ANNA UNIVERSITY, CHENNAI

B.E.(PART TIME) PROGRAMMES OFFERED IN THE AFFILIATED INSTITUTIONS

CURRICULUM AND SYLLABI FOR I - VII SEMESTERS

REGULATIONS – 2009

S.NO	NAME OF THE PROGRAMME
FACULTY OF CIVIL ENGINEERING	
1.	B.E. Civil Engineering
FACULTY OF MECHANICAL ENGINEERING	
2.	B.E. Mechanical Engineering
3.	B.E. Manufacturing Engineering
4.	B.E. Production Engineering
FACULTY OF ELECTRICAL ENGINEERING	
5.	B.E. Electrical and Electronics Engineering
6.	B.E. Electronics and Instrumentation Engineering
FACULTY OF INFORMATION AND COMMUNICATION ENGINEERING	
7.	B.E. Computer Science and Engineering
8.	B.E. Electronics Communication and Engineering

ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R – 2009

B.E. PRODUCTION ENGINEERING (PART – TIME)
I – VII SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA2111	Applied Mathematics	3	1	0	4
2.	PTPH2111	Applied Physics	3	0	0	3
3.	PTCY2111	Applied Chemistry	3	0	0	3
4.	PTGE2112	Fundamental of Computing and Programming	3	0	0	3
5.	PTGE2151	Basic Electrical & Electronics Engineering	4	0	0	4
		TOTAL CREDITS	**16**	**1**	**0**	**17**

SEMESTER II

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA2266	Statistics and Numerical Methods	3	1	0	4
2.	PTME2151	Engineering Mechanics	3	0	0	3
3.	PTPR2203	Engineering Metallurgy	3	0	0	3
4.	PTPR2305	Foundry and Welding Technology	3	0	0	3
PRACTICALS						
5.	PTPR2254	Metallurgy Lab	0	0	3	2
		TOTAL CREDITS	**12**	**1**	**3**	**15**

SEMESTER III

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTPR2252	Theory of Machines	3	1	0	4
2.	PTPR2202	Basics of Thermodynamics and Thermal Engineering	3	1	0	4
3.	PTME2254	Strength of Materials	3	0	0	3
4.	PTPR2253	Fluid Power Drives and Controls	3	0	0	3
PRACTICALS						
5.	PTME2208	Fluid Machines and Machinery Lab	0	0	3	2
		TOTAL PERIODS	**12**	**2**	**3**	**16**

SEMESTER IV

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTPR2304	Machine Elements Design	3	1	0	4
2.	PTME2027	Process Planning and Cost Estimation	3	0	0	3
3.	PTPR2302	Metal Forming Technology	3	0	0	3
4.	PTME2304	Engineering Metrology and Measurements	3	1	0	4
PRACTICALS						
5.	PTPR2356	Metrology and Inspection Lab	0	0	3	2
		TOTAL PERIODS	**12**	**2**	**3**	**16**

SEMESTER V

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTPR2251	Advance Machining Process	3	1	0	4
2.	PTMG2451	Engineering Economics and Cost Analysis	3	0	0	3
3.	PTPR2354	Design of Jigs, Fixture Press Tools & Drawings	3	0	0	3
4.	PTPR2303	Engineering Statistic and Quality Control	3	1	0	4
PRACTICALS						
5.	PTPR2306	CNC Machine Lab	0	0	3	2
		TOTAL PERIODS	**12**	**2**	**3**	**20**

SEMESTER VI

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTPR2353	Automated Production and Computer Integrated Manufacturing	3	1	0	4
2.	PTME2028	Robotics	3	0	0	3
3.	PTPR2351	Finite Element Analysis in Manufacturing Engineering	3	0	0	3
4.	E1*	Elective - I	3	0	0	3
5.	PTME2404	Computer Aided Simulation and Analysis Laboratory	0	0	3	2
		TOTAL PERIODS	**12**	**1**	**3**	**18**

SEMESTER VII

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTPR2352	Computer Aided and Product Design	3	1	0	4
2.	PTME2401	Mechatronics	3	0	0	3
3.	E2**	Elective -II	3	0	0	3
4.	E3***	Elective - III	3	0	0	3
5.	PTPR2452	Project work	0	0	12	6
		TOTAL PERIODS	**12**	**1**	**12**	**19**

ELECTIVES

SL.NO.	CODE NO.	COURSE TITLE	L	T	P	C
1.	PTME 2026	Unconventional Machining Processes	3	0	0	3
2.	PTPR 2021	Precision Engineering	3	0	0	3
3.	PTPR 2024	Surface Engineering	3	0	0	3
4.	PTMG 2021	Marketing Management	3	0	0	3
5.	PTME 2021	Quality Control & Reliability Engineering	3	0	0	3
6.	PTPR 2022	Fuzzy Logic and ANN	3	0	0	3
7.	PTPR 2023	Instrumentation and Control	3	0	0	3
8.	PTPR 2025	Design of Machine Tool Structure	3	0	0	3
9.	PTPR 2030	Composite Materials	3	0	0	3
10.	PTPR 2028	Processing of Polymer and Composites	3	0	0	3
11.	PTPR 2031	Non Destructive Testing Methods	3	0	0	3
12.	PTPR 2032	Simulation of Manufacturing Systems	3	0	0	3
13.	PTPR 2026	Production Management	3	0	0	3
14.	PTPR 2027	Ergonomics	3	0	0	3
15.	PTPR 2029	Engineering Economics and Financial Management	3	0	0	3
16.	PTPR 2030	Purchasing and Material Management	3	0	0	3
17.	PTME 2038	Operations Research	3	0	0	3
18.	PTPR 2033	Reliability Engineering	3	0	0	3
19.	PTPR 2034	Machine Tool Control and Condition Monitoring	3	0	0	3
20.	PTPR 2035	Mini Project	0	0	6	3
21.	PTGE 2025	Professional Ethics in Engineering	3	0	0	3
22.	PTME 2035	Entrepreneurship Development	3	0	0	3
23	PTPR 2036	Machine Vision	3	0	0	3
24.	PTPR 2037	Advances in Operation Research	3	0	0	3
25.	PTGE 2023	Fundamentals of Nanoscience	3	0	0	3
26.	PTME 2036	Production Planning & Control	3	0	0	3
27.	PTME 2037	Maintenance Engineering	3	0	0	3

PTMA2111 APPLIED MATHEMATICS L T P C
3 1 0 4

UNIT I MATRICES 12

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor's expansion – Maxima and Minima – Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Third edition, Laxmi Publications(p) Ltd.,(2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007)

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, (2007).
3. Jain R.K and Iyengar S.R.K," Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

PTPH2111 APPLIED PHYSICS L T P C
3 0 0 3

UNIT I ULTRASONICS 9

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

UNIT II LASERS 9

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

UNIT III FIBER OPTICS & APPLICATIONS 9

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

UNIT IV QUANTUM PHYSICS 9

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

UNIT V CRYSTAL PHYSICS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications, New Delhi(2003)
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi, 2005.

REFERENCES:

1. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6th

Edition, Thomson Brooks/Cole, Indian reprint (2007)
2. Rajendran, V and Marikani A, 'Engineering Physics' Tata McGraw Hill Publications Ltd, III Edition, New Delhi, (2004).
3. Palanisamy, P.K., 'Engineering Physics' Scitech publications, Chennai, (2007).
4. Jayakumar. S, 'Engineering Physics', R.K. Publishers, Coimbatore, (2003).
5. Chitra Shadrach and Sivakumar Vadivelu, 'Engineering Physics', Pearson Education, New Delhi, (2007).

PTCY2111 APPLIED CHEMISTRY L T P C
3 0 0 3

AIM

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES

- The student should be conversant with the principles water characterization and treatment of potable and industrial purposes.
- Principles of polymer chemistry and engineering applications of polymers
- Industrial applications of surface chemistry
- Conventional and non-conventional energy sources and energy storage devices and Chemistry of engineering materials

UNIT I WATER TECHNOLOGY 9

Characteristics – alkalinity – types of alkalinity and determination – hardness – types and estimation by EDTA method (problems); Domestic water treatment – disinfection methods (Chlorination, ozonation. UV treatment) – Boiler feed water – requirements – disadvantages of using hard water in boilers – internal conditioning (phosphate, calgon and carbonate conditioning methods) – external conditioning – demineralization process – desalination and reverse osmosis.

UNIT II POLYMERS AND COMPOSITES 9

Polymers-definition – polymerization – types – addition and condensation polymerization – free radical polymerization mechanism – Plastics, classification – preparation, properties and uses of PVC, Teflon, polycarbonate, polyurethane, nylon-6,6, PET-Rubber -vulcanization of rubber, synthetic rubbers – buty1 rubber, SBR, Composites – definition, types polymer matrix composites – FRP only.

UNIT III SURFACE CHEMISTRY 9

Adsorption – types – adsorption of gases on solids – adsorption isotherms – Frendlich and Langmuir isotherms – adsorption of solutes from solution – role of adsorbents in catalysis, ion-exchange adsorption and pollution abatement.

UNIT IV NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear energy – fission and fusion reactions and light water nuclear reactor for power generation (block diagram only) – breeder reactor – solar energy conversion – solar cells

– wind energy – fuel cells – hydrogen – oxygen fuel cell – batteries – alkaline batteries – lead–acid, nickel–cadmium and lithium batteries.

UNIT V ENGINEERING MATERIALS 9

Refractories – classification – acidic, basic and neutral refractories – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) – manufacture of alumina, magnesite and zirconia bricks, Abrasives – natural and synthetic abrasives – quartz, corundum, emery, garnet, diamond, silicon carbide and boron carbide. Lubricants – mechanism of lubrication, liquid lubricants, - properties – viscosity index, flash and fire points, cloud and pour points, oilyness) – solid lubricants – graphite and molybdenum sulphide. Nanomaterials – introduction to nanochemistry – carbon nanotubes and their applications

TOTAL: 45 PERIODS

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara "A text book of engineering chemistry" S.Chand & Co.Ltd., New Delhi (2006).

REFERENCES:

1. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

PTGE2112 FUNDAMENTALS OF COMPUTING AND PROGRAMMING L T P C 3 0 0 3

AIM :

To provide an awareness to Computing and Programming

OBJECTIVES :

- To enable the student to learn the major components of a computer system
- To know the correct and efficient ways of solving problems
- To learn to use office automation tools
- To learn to program in C

UNIT I INTRODUCTION TO COMPUTERS 9

Introduction – Characteristics of Computers – Evolution of Computers - Computer Generations – Classification of Computers – Basic Computer organization – Number Systems

UNIT II COMPUTER SOFTWARE 9

Computer Software –Types of Software – Software Development Steps – Internet Evolution - Basic Internet Terminology – Getting connected to Internet Applications.

UNIT III PROBLEM SOLVING AND OFFICE APPLICATION SOFTWARE 9

Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode - Application Software Packages- Introduction to Office Packages (not detailed commands for examination).

UNIT IV INTRODUCTION TO C 9

Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making - Branching and Looping.

UNIT V FUNCTIONS AND POINTERS 9

Handling of Character Strings – User-defined Functions – Definitions – Declarations - Call by reference – Call by value – Structures and Unions – Pointers – Arrays – The Preprocessor – Developing a C Program : Some Guidelines

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ashok.N.Kamthane,“ Computer Programming”, Pearson Education (India) (2008).
2. Behrouz A.Forouzan and Richard.F.Gilberg, “A Structured Programming Approach Using C”, II Edition, Brooks-Cole Thomson Learning Publications, (2007).

REFERENCES:

1. Pradip Dey, Manas Ghoush, “Programming in C”, Oxford University Press. (2007).
2. Byron Gottfried, “Programming with C”, 2nd Edition, (Indian Adapted Edition), TMH publications, (2006).
3. Stephen G.Kochan, “Programming in C”, Third Edition, Pearson Education India, (2005).
4. Brian W.Kernighan and Dennis M.Ritchie, “The C Programming Language”, Pearson Education Inc., (2005).
5. E.Balagurusamy, “Computing fundamentals and C Programming”, Tata McGraw-Hill Publishing Company Limited, (2008).
6. S.Thamarai Selvi and R.Murugan, “C for All”, Anuradha Publishers, (2008).

PTGE2151 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C

(Common to branches under Civil, Mechanical and Technology faculty**) 4 0 0 4**

UNIT I ELECTRICAL CIRCUITS & MEASURMENTS 12

Ohm’s Law – Kirchoff’s Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS 12

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS 12

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 12

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS

TEXT BOOKS:

1. V.N. Mittle “Basic Electrical Engineering”,Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, “Applied Electronics” S. Chand & Co., 2006.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”,Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press (2005).
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, (2002).
5. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, (2003).

PTMA 2266 STATISTICS AND NUMERICAL METHODS L T P C

(Common to Mechanical, Automobile & Production) **3 1 0 4**

UNIT I TESTING OF HYPOTHESIS 9 + 3

Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9 + 3

Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9 +3

Newton-Raphson method- 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 .

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9 + 3

Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Milne's predictor-corrector methods for solving first order equations - Finite difference methods for solving second order equation.

L = 45 T = 15 TOTAL :60 PERIODS

TEXT BOOKS:

1. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, 2007 (For units 3, 4 and 5).
2. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.

REFERENCES:

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th edition, 2007.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.
3. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
4. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.

PTME2151 ENGINEERING MECHANICS L T P C

3 1 0 4

OBJECTIVE

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the

effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I BASICS & STATICS OF PARTICLES 12

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

UNIT II EQUILIBRIUM OF RIGID BODIES 12

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

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

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

UNIT IV DYNAMICS OF PARTICLES 12

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

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction.

Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TOTAL: 60 PERIODS

TEXT BOOK:

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES:

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).

2. Hibbeller, R.C., “Engineering Mechanics”, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., “Engineering Mechanics – Statics & Dynamics”, Tata McGraw-Hill, (2001).
4. Irving H. Shames, “Engineering Mechanics – Statics and Dynamics”, IV Edition – Pearson Education Asia Pvt. Ltd., (2003).
5. Ashok Gupta, “Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)”, Pearson Education Asia Pvt., Ltd., (2002).

PTPR 2203 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 – Charbide & Iron Graphite equilibrium diagram. Classification of steel and cast iron - microstructures of Steels & Cast irons - properties and application.

UNIT II HEAT TREATMENT 10

Defintion – Full annealing, stress relief, recrystallisation and spheroidizing – normalizing, hardening and tempering of steel, Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR – Hardenability, Jominy end quench test – Austempering martempering – case hardening, carburizing, nitriding cyaniding, carbonitriding – Flame, Induction Laser and Electron beam and plasma phase hardening – Special and Duplex surface hardening processes.

UNIT III FERROUS AND NON FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) – stainless and tool steels – HSLA – maraging steels – Gray, white, malleable spheroidal, graphite, alloy cast irons Copper and Copper alloys, Brass, Bronze and Cupronickel – Aluminium and 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.

PTPR 2305 FOUNDRY AND WELDING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE:

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

UNIT I CASTING PROCESS 10

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

UNIT II WELDING PROCESSES 9

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

UNIT III SPECIAL CASTING PROCESSES 8

Pressure die casting – Centrifugal – continuous – investment – shell moulding – squeeze – electro slag casting – CO_2 moulding – Plaster mould castings – Antioch process – Slush casting.

UNIT IV SPECIAL WELDING PROCESSES 9

Atomic H_2 arc welding – Shielded gas arc welding GMAW & GTAW – Submerged arc welding – Electro slag welding – friction welding – explosive welding – Underwater

welding – Diffusion bonding – EBW – LBW – PAW – Stud welding – welding of dissimilar materials – Friction stir welding.

UNIT V TESTING OF CASTINGS & WELDMENTS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES

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

PTPR 2254 METALLURGY LABORATORY L T P C
0 0 3 2

OBJECTIVES:

To train the students in observation and interpretation of Microstructure of Engineering materials.

To train students in Heat treatment, hardenability 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 s(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 tes

TOTAL: 45 PERIODS

PTPR 2252 THEORY OF MACHINES L T P C
3 1 0 4

OBJECTIVE:
To understand the basic concepts of mechanisms and machinery

UNIT I MECHANISMS 14
Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint & motion – Degrees of freedom - Slider crank – single and double – Crank rocker mechanisms – Inversions, applications – Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II FRICTION 12
Types of friction – friction in screw and nut – screw jack – pivot, collar and thrust bearings – plate and cone clutch – belt (flat & vee) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.

UNIT III GEARING AND CAMS 12
Gear – Types and profile – nomenclature of spur & helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and reverted gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.

UNIT IV BALANCING 11
Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi cylinder engines – Governors and Gyroscopic effects.

UNIT V VIBRATION 11
Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

TOTAL: 60 PERIODS

TEXT BOOKS

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

REFERENCES

1. Rao J.S.and 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.

PTPR2202 BASICS OF THERMODYNAMICS AND THERMAL ENGINEERING **L T P C 3 1 0 4**

OBJECTIVE

To introduce fundamental concepts in thermodynamics, heat tramsfer, 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.

L = 45, T = 15, 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.

PTME 2254	**STRENGTH OF MATERIALS**	**L T P C**
	(Common to Mechanical, Automobile & Production)	**3 1 0 4**

OBJECTIVES

To gain knowledge of simple stresses, strains and deformation in components due to external loads.

To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.

Effect of component dimensions and shape on stresses and deformations are to be understood.

The study would provide knowledge for use in the design courses

UNIT I STRESS STRAIN DEFORMATION OF SOLIDS 9

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNITII BEAMS - LOADS AND STRESSES 9

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow

UNIT III TORSION 9

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

UNIT IV BEAMDEFLECTION 9

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method –Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS 9

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TUTORIALS 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997
2. Beer F. P. and Johnston R," Mechanics of Materials", McGraw-Hill Book Co, Third Edition, 2002.

REFERENCES:

1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
2. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 1981.
3. Ryder G.H, "Strength of Materials, Macmillan India Ltd"., Third Edition, 2002
4. Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books, 2004.
5. Singh D.K "Mechanics of Solids" Pearson Education 2002.
6. Timoshenko S.P, "Elements of Strength of Materials", Tata McGraw-Hill, New Delhi, 1997.

PTPR 2253 FLUID POWER DRIVES AND CONTROL L T P C
3 1 0 4

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 12

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 12

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 12

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 12

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 12

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: 60 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTME2208 FLUID MECHANICS AND MACHINERY LAB L T P C

(Common to Mechanical & Production) **0 0 3 2**

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump / submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.

9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

LIST OF EQUIPMENT

(for a batch of 30 students)

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup
10. Kaplan turbine setup

Quantity: one each.

TOTAL: 45 PERIODS

PTPR2304	**MACHINE ELEMENTS 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

TEXTBOOKS:

1. Joseph Edward Shigley, Charles R. Mischke " Mechanical Engineering Design", McGraw Hill, International Edition, 1992
2. C.S.Sharma and Kamlesh Purohit, " Design of Machine Elements", Prentice Hall of India Private Limited, 2003

REFERENCES:

1. V.B.Bhandari, "Design of Machine Elements", Tata McGraw-Hill Publishing Company Limited, 2003.
2. Robert L.Norton, "Machin Design – An Integrated Approach", Prentice Hall International Edition, 2000.

PTME 2027 PROCESS PLANNING AND COST ESTIMATION L T P C
(Common to Production and Mechanical) 3 0 0 3

OBJECTIVE

To introduce the process planning concepts

To make cost estimation for various products after process planning

UNIT I WORK STUDY AND ERGONOMICS 10

Method study – Definition – Objectives-Motion economy- Principles – Tools and Techniques-Applications – Work measurements- purpose – use – procedure – tools and techniques- Standard time –Ergonomics – principles – applications.

UNIT II PROCESS PLANNING 10

Definition – Objective – Scope – approaches to process planning- Process planning activities – Finished part requirements - operating sequences - machine selection – material selection parameters- Set of documents for process planning - Developing manufacturing logic and knowledge- production time calculation – selection of cost optimal processes.

UNIT III INTRODUCTION TO COST ESTIMATION 7

Objective of cost estimation- costing – cost accounting- classification of cost- Elements of cost.

UNIT IV COST ESTIMATION 8

Types of estimates – methods of estimates – data requirements and sources- collection of cost- allowances in estimation.

UNIT V PRODUCTION COST ESTIMATION 10

Estimation of material cost, labour cost and over heads, allocation of overheads – Estimation for different types of jobs.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Banga and Shama, Cost estimation, Sinha.B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co., 1995

REFERENCES

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

PTPR2302 METAL FORMING TECHNOLOGY L T P C
3 1 0 4

OBJECTIVES:

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

UNIT I FUNDAMENTALS OF METAL FORMING 15

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 15

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 – mannessmann process of seamless pipe manufacturing – Tube bending.

UNIT IV SHEET METAL FORMING PROCESSES 10

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

UNIT V RECENT ADVANCES 10

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: 60 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTME 2304 ENGINEERING METROLOGY AND MEASUREMENTS L T P C
(Common to Mechanical, Production and Automobile) **3 0 0 3**

OBJECTIVE

To understand the basic principles of measurements

To learn the various linear and angular measuring equipments, their principle of operation and applications

To learn about various methods of measuring Mechanical parameters

UNIT I CONCEPT OF MEASUREMENT 10

General concept – Generalised measurement system-Units and standards-measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration - Introduction to Dimensional and Geometric Toleranceing - interchangeability,

UNIT II LINEAR AND ANGULAR MEASUREMENT 12

Definition of metrology-Linear measuring instruments: Vernier, micrometer, Slip gauges and classification, - Tool Makers Microscope - interferometery, optical flats, - Comparators: limit gauges Mechanical, pneumatic and electrical comparators, applications. Angular measurements: -Sine bar, Sine center, bevel protractor and angle Decker..

UNIT III FORM MEASUREMENT 12

Measurement of screw threads: Thread gauges, floating carriage micrometer-measurement of gear tooth thickness: constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.

UNIT IV LASER AND ADVANCES IN METROLOGY 12

Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications.- computer aided inspection.

UNIT V MEASUREMENT OF MECHANICAL PARAMETERS 14

Force, torque, power:-mechanical, pneumatic, hydraulic and electrical type-Pressure measurement - Flow: Venturi, orifice, rotameter, pitot tube –Temperature: bimetallic strip, thermocouples, pyrometer, electrical resistance thermistor

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TOTAL: 60 PERIODS

TEXT BOOKS:

1. Jain R.K., “Engineering Metrology”, Khanna Publishers, 2005
2. Alan S. Morris, “The Essence of Measurement”, Prentice Hall of India, 1997

REFERENCES:

1. Gupta S.C, “Engineering Metrology”, Dhanpat rai Publications, 2005
2. Jayal A.K, “Instrumentation and Mechanical Measurements”, Galgotia Publications 2000
3. Beckwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education, 2006.
4. Donald Deckman, “Industrial Instrumentation”, Wiley Eastern, 1985.

PTPR2356 METROLOGY AND INSPECTION LAB L T P C
0 0 3 2

LIST OF EXPERIMENTS

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

TOTAL : 45PERIODS

PTPR 2251 ADVANCED MACHINING PROCESS L T P C
3 0 0 3

OBJECTIVES:

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

UNIT IV CNC MACHINES 9

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

UNIT V CNC PROGRAMMING 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Hazlehurst M, “Manufacturing Technology”, - 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

PTMG2451 ENGINEERING ECONOMICS AND COST ANALYSIS L T P C
(Common to Mechanical, Production, Automobile) 3 0 0 3

OBJECTIVES:

To learn about the basics of economics and cost analysis related to engineering so as to take economically sound decisions.

UNIT I INTRODUCTION TO ECONOMICS 8

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING 10

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW 9

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION 9

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001.
2. Suma Damodaran, “ Managerial economics”, Oxford university press 2006.

REFERENCES:

1. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of

India, 2002.
2. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2002
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 1984
4. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, “Principles of Engineering Economy”, Ronald Press, New York,1976.
5. Smith, G.W., “Engineering Economy”, Lowa State Press, Iowa, 1973.
6. Truett & Truett, “ Managerial economics- Analysis, problems & cases “ Wiley India 8th edition 2004.
7. Luke M Froeb / Brian T Mccann, “ Managerial Economics – A problem solving approach” Thomson learning 2007.

PTPR2354 DESIGN OF JIGS, FIXTURE AND PRESS TOOLS & DRAWING

L	T	P	C
3	1	0	4

OBJECTIVE:

To introduce the concepts of various types of jigs, fixtures and dies

To design and draw jig / fixture/ die for a given component

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

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

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

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

UNIT III PRESS WORKING OPERATION AND FORMING DIES **9+3**

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

UNIT IV ELEMENTS OF DIE **9+3**

Design concepts of the following elements of progressive, compound and

Combination dies – Die block – Die shoe – Bolster plate – punch – punch plate – punch holder – guide pins and guide bushes – strippers – knockouts – stops - pilots – selection of standard die sets – strip layout and development.

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

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

TOTAL: 60 PERIODS

TEXT BOOKS:

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

2. Kempster M.H.A., Introduction to Jigs and Fixtures, ELBS Edition, 1976

REFERENCES:

1. Handbook of metal forming, Kurt Lunge, McGraw Hill, Pub.Co. 1985.
2. Paquin, Die Design Fundamentals, Industrial Press Inc, New York, 1979
3. ASTME, Fundamentals of Tool design, Prentice Hall 1974

PTPR2303 ENGINEERING STATISTICS AND QUALITY CONTRO L T P C
3 1 0 4

OBJECTIVES:

To provide an introduction to fundamental concepts of statistical Process control
Enhance the student understanding of the complexities of Statistical Analysis and control chart interpretation
To understand the concept of reliability and it's improving techniques and design of experiments

UNIT I SAMPLING THEORY AND TESTING OF HYPOTHESIS 11

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

UNIT II STATISTICAL PROCESS CONTROL 15

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

UNIT III ACCEPTANCE SAMPLING 15

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

UNIT IV RELIABILITY AND QUALITY 10

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

UNIT V EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

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

TOTAL: 60 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTPR 2306 CNC MACHINE LAB 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

(Requirement for a batch of 30 Students)

S. No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
.	CNC Trainer Lathe	2 No.		
.	CNC Trainer milling machine	2 No.		
.	Any standard CAM software (Examples : PRO-E, Master CAM, SMART CAM, etc.,)	10 users		
.	CNC wire cut EDM	1		
.	Computers (Pentium 4, 128 RAM, 20 GB HDD, 17” Color Monitor)	5		

PTPR 2353 AUTOMATED PRODUCTION & COMPUTER INTEGRATED MANUFACTURING **L T P C 3 1 0 4**

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 **12**

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 **12**

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 **12**

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 12

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 12

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: 60 PERIODS

TEXT BOOKS:

1. Mikell P.Groover, “Automation, Production Systems and Computer-integrated Manufacturing”, Prentice Hall of India Private Limited, 2003
2. Radhakrishnan.P, Subramanyan.S and Raju.V, “CAD/CAM/CIM”, New Age\ International Publishers, 2000

REFERENCES:

1. James A.Retrg and Henry W. Kraebher, “Computer Integrated Manufacturing”, Pearson Education, Asia, 2001
2. Viswamathan.N and Narahari.Y, “Performance modelling of automated manufacturing system”, Prentice Hall of India Private Limited, 1994.

PTME2028	ROBOTICS	L	T	P	C
	(Common to Production and VII Semester Elective for Mechanica	3	0	0	3

OBJECTIVES

To introduce the basic concepts, parts of robots and types of robots

To make the student familiar with the various drive systems for robot, sensors and their applications in robots, programming of robots

To discuss about the various applications of robots, justification, implementation and safety of robot

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

UNIT III SENSORS AND MACHINE VISION 10

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors

Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction, Edge detection, Segmentation Feature Extraction, Object Recognition, Other Algorithms. Applications – Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 10

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 8

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M.P.Groover, “Industrial Robotics – Technology, Programming and Applications”, McGraw-Hill, 2001
2. Yoram Koren, “Robotics for Engineers”, McGraw-Hill Book Co., 1992

REFERENCES:

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw-Hill Book Co., 1987
2. Janakiraman.P.A., “Robotics and Image Processing”, Tata McGraw-Hill, 1995

PTPR 2351 FINITE ELEMENT ANALYSIS IN MANUFACTURING ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

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

UNIT I INTRODUCTION **9**

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

UNIT II GENERAL PROCEDURE OF FET **9**

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

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

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

UNIT IV ISO-PARAMETRIC ELEMENTS **9**

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

UNIT V APPLICATION OF FINITE ELEMENT ANALYSIS **8**

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTME2404	COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY	L T P C 0 0 3 2

LIST OF EXPERIMENTS

A. Simulation **8**

Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using C /MAT Lab.
Simulation of Hydraulic / Pneumatic cylinder using C / MAT Lab.
Simulation of cam and follower mechanism using C / MAT Lab.

B. Analysis (Simple Treatment only) **37**

Stress analysis of a plate with a circular hole.
Stress analysis of rectangular L bracket
Stress analysis of an axi-symmetric component
Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
Mode frequency analysis of a 2 D component
Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
Harmonic analysis of a 2D component
Thermal stress analysis of a 2D component
Conductive heat transfer analysis of a 2D component
Convective heat transfer analysis of a 2D component

TOTAL: 45 PERIODS

PTPR2352 COMPUTER AIDED PRODUCT DESIGN L T P C
3 1 0 4

OBJECTIVE:

To introduce the concepts and applications of CAD

To introduce the various concepts and techniques used for Product design and to develop product design skills.

UNIT I INTRODUCTION TO COMPUTER AIDED DESIGN 12

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

UNIT II COMPUTER GRAPHICS FUNDAMENTALS 12

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

UNIT III GEOMETRIC MODELING 12

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

UNIT IV PRODUCT DESIGN CONCEPTS 12

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

UNIT V PRODUCT DATA MANAGEMENT 12

Product Data Management – concepts – Collaborative product design and commerce – Information Acquisition – Sourcing factor – manufacturing planning factor – Customization factor – Product life cycle management.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Kevin Otto, Kristin Wood, "Product Design", Pearson Education, 2000
2. Ibrahim Zeid, "CAD/CAM theory and Practice", Tata McGraw Hill, 1991.

REFERENCES:

1. Biren Prasad, "Concurrent Engineering Fundamentals Vol.11", Prentice Hall, 1997.
2. James G.Bralla, "Handbook of Product Design for Manufacturing", McGraw Hill, 1994
3. David F.Rogers.J, Alan Adams, "Mathematical Elements for Computer Graphics", McGraw Hill, 1990

PTME2401 MECHATRONICS L T P C
(Common to Mechanical and Production) 3 0 0 3

OBJECTIVE

To understand the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems.

UNIT I MECHATRONICS, SENSORS AND TRANSDUCERS 9

Introduction to Mechatronics Systems – Measurement Systems – Control Systems – Microprocessor based Controllers. Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature,Light Sensors – Selection of Sensors

UNIT II ACTUATION SYSTEMS 9

Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives – Bearings. Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – Construction and working principle of DC and AC Motors – speed control of AC and DC drives, Stepper Motors-switching circuitries for stepper motor – AC & DC Servo motors

UNIT III SYSTEM MODELS AND CONTROLLERS 9

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Transnational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems. Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.

UNIT IV PROGRAMMING LOGIC CONTROLLERS 9

Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC.

UNIT V DESIGN OF MECHATRONICS SYSTEM 9

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design - Possible Design Solutions. Case studies of Mechatronics systems- Pick and place Robot- Autonomous mobile robot-Wireless suriviellance balloon- Engine Management system- Automatic car park barrier.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Bolton,W, “Mechatronics” , Pearson education, second edition, fifth Indian Reprint, 2003
2. Smaili.A and Mrad.F , "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008

REFERENCES:

1. Rajput. R.K, A textbook of mechatronics, S. Chand & Co, 2007

2. Michael B. Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2000.
3. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
4. Dan Necsulesu, “Mechatronics”, Pearson Education Asia, 2002 (Indian Reprint). Lawrence J. Kamm, “Understanding Electro – Mechanical Engineering”, An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.
5. Nitaigour Premchand Mahadik, “Mechatronics”, Tata McGraw-Hill publishing Company Ltd, 2003

PTPR2452 PROJECT WORK L T P C
0 0 12 6

OBJECTIVE

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

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.

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

The continuous assessment shall be made as prescribed in the regulations (vide clause 10.3 of Regulations 2004 for B.E., B.Tech. programmes)

PTME2026 UNCONVENTIONAL MACHINING PROCESSES L T P C
(Common to Mechanical and Production) 3 0 0 3

OBJECTIVE:

To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

UNIT I INTRODUCTION 5

Unconventional machining Process – Need – classification – Brief overview .

UNIT II MECHANICAL ENERGY BASED PROCESSES 10

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

UNIT III ELECTRICAL ENERGY BASED PROCESSES 8

Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 12

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

UNIT V THERMAL ENERGY BASED PROCESSES 10

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi (2007).

REFERENCES:

1. Benedict. G.F. “Nontraditional Manufacturing Processes” Marcel Dekker Inc., New York (1987).
2. Mc Geough, “Advanced Methods of Machining” Chapman and Hall, London (1998).
3. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., New Delhi ,8th Edition,2001.

PTPR2021 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 CONCEPTS OF ACCURACY AND MACHINE TOOLS 9

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

UNIT II STIFFNESS, THERMAL EFFECTS AND FINISH MACHINING 12

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

UNIT III DIMENSIONING 6

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

UNIT IV MICRO-MACHINING MICRO FABRICATION 9

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

UNIT V SMART STRUCTURES, MATERIALS AND MICRO ACTUATORS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTPR2024 SURFACE ENGINEERING L T 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 process – alkaline cleaning – emulsion cleaning- ultrasonic cleaning – acid and pickling salt bath descaling – abrasive bath cleaning – polishing and short peening – classification of surface engineering processes.

UNIT II THERMAL SPRAYING PROCESSES AND ELECTRODEPOSITED COATINGS 10

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

UNIT III HOT DIP COATING AND DIFFUSION COATINGS 10

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

UNIT IV NON-METALLIC COATING OXIDE AND COVENSION COATINGS 9

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

UNIT V QUALITY ASSURANCE, TESTING AND SELECTION OF COATINGS 8

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. STAND GRAINGER engineering coatings – design and application jaico publishing House, 1994

REFERENCES:

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

PTMG 2021 MARKETING MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

To understand the various processes involved in Marketing and its Philosophy.
To learn the Psychology of consumers.
To formulate strategies for advertising, pricing and selling

UNIT I MARKETING PROCESS 9

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic -Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Govindarajan. M, “Marketing management – concepts, cases, challenges and trends”, Prentice hall of India, second edition 2007.
2. Philip Kolter,Koshy Jha “Marketing Management”, Pearson Education ,Indian adapted edition.2007

REFERENCES:

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

PTME2021 QUALITY CONTROL AND RELIABILITY ENGINEERING L T P C
(Common to Mechanical, Automobile and Production) 3 0 0 3

OBJECTIVE:

To introduce the concept of SQC

To understand process control and acceptance sampling procedure and their application.

To learn the concept of reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 10

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance,Quality control: Quality cost-Variation in process-causesof variation –Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and chart -process capability – process capability studies and simple problems.Six sigma concepts.

UNIT II PROCESS CONTROL FOR ATTRIBUTES 8

Control chart for attributes –control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III ACCEPTANCE SAMPLING 9

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING - RELIABILITY 9

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

UNIT V QUALITY AND RELIABLITY 9

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

TOTAL: 45 PERIODS

Note: Use of approved statistical table permitted in the examination.

TEXT BOOKS:

1. Douglas.C.Montgomery, " Introduction to Statistical quality control" John wiley 4th edition2001.
2. L.S.Srinath, "Reliability Engineering", Affiliated East west press, 1991.

REFERENCES:

1. John.S. Oakland. Statistical process control", Elsevier, 5th edition, 2005

2. Connor, P.D.T.O., " Practical Reliability Engineering", John Wiley, 1993
3. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996
4. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001.
5. R.C.Gupta, "Statistical Quality control", Khanna Publishers, 1997.
6. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
7. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.
8. Danny Samson, "Manufacturing & Operations Strategy", Prentice Hall, 1991

PTPR2022 FUZZY LOGIC AND ANN 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 – Multiobjective decision making – fuzzy classification – means clustering – fuzzy pattern recognition – image processing applications – systactic recognition – fuzzy optimization – various

UNIT III INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 9

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

Applications of back propagation algorithms.

UNIT IV OTHER ANN ARCHITECTURES 9

Associative memory – exponential BAM – Associative memory for real coded pattern pairs – Applications adaptive reasonance 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 BOOKS:

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

REFERENCES:

1. Klir.G, Yuan B.B. “Fuzzy sets and fuzzy logic prentice Hall of India private limited, 1997.
2. Laurance Fausett, “Fundamentals of neural networks”, Prentice hall, 1992
3. Gen, M. and R. Cheng “Genetic algorithm and engineering design”, john wiley 1997

PTPR2023 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 and zero of a system, realization of transfer functions.

UNIT V STABILITY ANALYSIS 9

Stability criteria bode plots, routh and Nyquist criteria.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

1. C.S.Rangan, G.R.Sarma, VSV Mani, Instrumentation devices and systems”, Tata McGraw Hill, 2000
2. A.K. Sowhney, “electricaland electronic measurement and instrumentation, “Dhanpat rai & Cu, 2003.
3. Benjamin C.Kuo, “Automatic control system”, prentice hall of India pvt ltd.,2002

4. Ernest O.Doeblin, “measurement systems applications and design”, McGraw Hill International editions, 1990
5. S.Renganathan, “transducer engineering”, Allied publishers, 1990.

PTPR2025 DESIGN OF MACHINE TOOL STRUCTURE

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 regangular and box sections – methods of increasing rigidities.

UNIT III SLIDEWAYS **9**

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

UNIT IV SPINDLES AND SPINDLE SUPPORTS **8**

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

UNIT V MACHINE TOOL DYNAMICS **9**

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. G.C. Sen and A.Battacharya, “Principles of machine tools”, New central book agency, 1999
2. N.K.Metha, “Machine Tool Design and Numerical control”, Tata McGraw Hill publishing company, 1996

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

PTME2030 COMPOSITE MATERIALS L T P C
3 0 0 3

OBJECTIVES:

To understand the fundamentals of composite material strength and its mechanical behavior Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.

Thermo-mechanical behavior and study of residual stresses in Laminates during processing. Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 12

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

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 10

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

UNIT III LAMINA STRENGTH ANALYSIS 5

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

UNIT IV THERMAL ANALYSIS 8

Assumption of Constant C.T.E’s. Modification of Hooke’s Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E’s. C.T.E’s for special Laminate

Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

UNIT V ANALYSIS OF LAMINATED FLAT PLATES 10

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTPR2028 PROCESSING OF POLYMER AND COMPOSITES L T P C
3 0 0 3

UNIT I INTRODUCTION 8

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

UNIT II POLYMER MATRIX COMPOSITES 12

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

UNIT III METAL MATRIX COMPOSITES 9

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

UNIT IV CERAMICS MATRIX COMPOSITES 9

Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics – Need for CMC – Ceramic matrix – various types of ceramic matrix composites – oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles – fibres – whiskers. Sintering- Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

UNIT V ADVANCES IN POLYMERS & COMPOSITES 7

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTPR2031 NON-DESTRUCTIVE TESTING METHODS L T P C
3 0 0 3

AIM:

To impart knowledge on Non Destructive Testing procedures.

OBJECTIVES :

To understand principle behind various NDT techniques.
To study about NDT equipments and accessories.

To learn working procedures of various NDT techniques.

PRE-REQUISITES*: Basic knowledge on various process defects*

UNIT I NON-DESTRUCTIVE TESTING: AN INTRODUCTION 6

Introduction to various non-destructive methods- Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.

UNIT II LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING 10

Physical principles, procedure for penetrant testing, Penetrant testing materials, Penetrant testing methods – Applications

Principle of MPT, Magnetising technical and procedure used for testing a component , Equipment used for MPT , Applications

UNIT III EDDY CURRENT TESTING AND ACOUSTIC EMISSION TESTING 10

Principles, Instrumentation for ECT, Various Techniques – High sensitivity Techniques, Single, Multi and high frequency ECT, Applications

Principle of AET,AE signal parameters, Applications.

UNIT IV ULTRASONIC TESTING 10

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

UNIT V RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTPR2032 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 9
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 BOOK:

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.

PTPR2026 PRODUCTION MANAGEMENT L T P C
3 0 0 3

UNIT I PRINCIPLES OF MANAGEMENT AND PERSONNEL MANAGEMENT 7

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

UNIT II INVENTORY MANAGEMENT 11

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

UNIT III OPERATIONS MANAGEMENT 10

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

UNIT IV FINANCIAL MANAGEMENT 10

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

UNIT V MARKETING MANAGEMENT 7

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTPR2027 ERGONOMICS L T P C
3 0 0 3

OBJECTIVES:
To introduce the concepts of man machine systems and techniques of providing human comfort in man-making work systems.

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 seatedworkers – Arrangements of components within a physical space – Interpersonal aspect of workplace design.

UNIT III DESIGN OF EQUIPMENT 9
Programme 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 Ergonomcis 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. Micormic, J. Human factors in Engineering and Design, McGraw Hill, 1992.
3. Wilson,J.R.Corlect EN, Evaluation of Human work, A. practical Ergonomcis
4. methodology, Taylor and Frances, 1990.
5. Shackel, B.Richardson S, Human Factors for Inforamtion usability, Cambridge University, Cambridge University Press, 1991.

PTPR2029 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT L T P C
3 0 0 3

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

UNIT II PROFIT VALUE ANALYSIS 10

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

UNIT III WORKING CAPITAL MANAGEMENT 8

Current assets and liability decisions – estimation of working capital requirements – Management of accounts receivable – Inventory – cash – inventory valuation methods.

UNIT IV CAPITAL BUDGETING 7

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

UNIT V ENGINEERING ECONOMICS 7

Economics – Engineering economics – Demand analysis Laws of demand – Production and cost – Pricing methods

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. Kesavan, C.Elanchezhian and T.Sundar Selwyn – Engineering Economics and Financial Accounting, Laxmi Publications 2005
2. S.N.Maheswaran, Management Accounting and Financial Control, Sultan Chand, 1992.

REFERENCES:

1. C.James, Vanhorn, Fundamentals of Financial management PHI 1996
2. Charles T.Homgren, Cost Accounting, PHI 1985

PTPR2030 PURCHASING AND MATERIALS MANAGEMENT L T P C
3 0 0 3

UNIT I FUNCTIONS OF MATERIALS MANAGEMENT 6

Introduction to materials management – objectives – Organization – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II PURCHASING MANAGEMENT 8

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

UNIT III STORES MANAGEMENT 8

Store function – Location – Layout – Stock taking – Materials handling – codification – Inventory pricing – MIS for stores management

UNIT IV MATERIALS PLANNING 12

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

UNIT V INVENTORY MANAGEMENT 11

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

TOTAL: 45 PERIODS

TEXT BOOK:

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

REFERENCES:

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

PTME2038 OPERATIONS RESEARCH L T P C
(Common to Mechanical, Automobile) 3 0 0 3

OBJECTIVES:

To create awareness about optimization in utilization of resources.
To understand and apply operations research techniques to industrial operations.

UNIT I LINEAR MODEL 10

The phases of OR study – formation of an L.P model- graphical solution – simplex algorithm – artificial variables technique– Big M method, two phase method, Duality in LPP. Transportation problems- VAM – MODI technique, Assignment problems.

UNIT II NETWORK MODELS 8

Shortest route – minimal spanning tree - maximum flow models – project network- CPM and PERT network-critical path scheduling.

UNIT II INVENTORY MODEL 9

Types of Inventory- EOQ –ERL- Deterministic inventory problems – Price breaks - Stochastic inventory problems- selective inventory control techniques.

UNIT II REPLACEMENT MODELS 9

Replacement of items that deteriorate with time – value of money changing with time – not charging with time – optimum replacement policy – individual and group

replacement. Sequencing problem: models with n jobs with 2 machines – problem with n jobs with m machines.

UNIT III QUEUING THEORY 9

Queuing models – queuing systems and structures – notation –parameter – single server and multiserver models – Poisson input – exponential service – constant rate service – infinite population.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Wayne.L.Winston, Operations research applications and algorithms, Thomson learning,4th edition 2007.
2. Taha H.A, "Operation Research", Pearson Education sixth edition, 2003

REFERENCES:

1. Frederick.S.Hiller and Gerald.J.Lieberman, "Operations research concepts and cases", TMH (SIE) 8th edition.
2. J.K.Sharma, "Operations research theory and applications", Macmillan India .3rd edition 2007,
3. Hira and Gupta " Problems in Operations Research", S.Chand and Co,2002.
4. Panneerselvam, "Operations Research" Prentice Hall of India, 2003.
5. G Srinivasan, "Operations research principles and applications", PHI (EEE) 2007.
6. Wagner, "Operations Research", Prentice Hall of India, 2000.

PTPR2033 RELIABILITY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

To stress the importance of reliability in Engineering and products also the concept of maintability, failure modes and testing methods.

UNIT I CONCEPTS OF RELIABILITY, SYSTEM AND MODELS 12

Definition of reliability – reliability Vs quality-reliability function-MTTF – hazard rate function- bathtub curve – derivation of the reliability function-constant failure rate model – time dependent failure models. Weibull distribution – normal distribution – the lognormal distribution.Serial configuration – parallel configuration – combined series parallel systems – system structure function, minimal cuts and minimal paths – Markov analysis – load sharing systems, standby system, degraded systems, three state devices – covariate models, static models, dynamic models, physics of failure models

UNIT II DESIGN FOR RELIABILITY AND MAINTAINABILITY 12

Reliability design process – system effectiveness – economic analysis and life cycle cost – reliability allocation – optimal, Arinc, Agree, - Design methods – parts and material selection, derating, stress-strength analysis – failure analysis – identification of failure mode – determination of causes – assessment of effects – classification of seventy – computation of critically index – corrective action – system safety and FTA. Analysis of downtime – the repair time distribution – stochastic point processes – system repair time

– reliability under preventive maintenance – state dependent systems with repair – MTTR-mean system downtime – MTR – MH/OH – cost model – fault isolation and self diagnostics – repair Vs replacement – replacement model – proactive, preventive, predictive maintenance – maintenance and spares provisioning – maintainability prediction and demonstration – concepts and definition of availability.

UNIT III OPTIMIZATION OF SYSTEM RELIABILITY 7

Optimization techniques for system reliability with redundancy – heuristic methods applied to optimal system reliability- redundancy allocation by dynamic programming – reliability optimization by non linear programming.

UNIT IV THE ANALYSIS OF FAILURE DATA AND RELIABILITY TESTING 7

Data collection – empirical methods – ungrouped and grouped complete, censored data – static life estimation – test time calculation – burn in testing, acceptance, sequential, binomial testing – accelerated life testing – ther acceleration models – experimental design – reliability growth process – idealized growth curve – various growth models – identifying failure and repair distributions.

UNIT V PACKAGING AND TRANSPORTATION FOR RELIABILITY *7*

Objectives – preservation-packaging – transportation and subsequent storage – reliability and the customer - Purchase of equipment – installation – commissioning a new system – reliability prediction and control – reliability management – the people concerned with reliability, coordination, training

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Charles E. Ebling, “An introduction to Reliability and Maintainability Engg”, Tata McGraw-Hill, 2000.

REFERENCES:

1. Patrick D T o’connor, “Practical Reliability Engineringt”, John-Wiley and Sons inc, 2002.
2. David J Smith, “Reliability, Maintainability and Risk: Practical Methods for Engineers”, Butterworth, 2002
3. Way kuo, Rajendra Prasad V, Frank A and Tillman, ching- lai Hwang “Optimal Reliability Design and Applciations”, Cambridge University Press P ltd., 2001.
4. Srinath I.S, Engineering Design and Reliability, ISTE, 1999.
5. Oleg Vinogradov, “Introduction to Mechanical Reliability: A Designers Approach, Hemisphere Publications, 1991.

PTPR2034 MACHINE TOOL CONTROL & CONDITION MONITORING L T P C
3 0 0 3

OBJECTIVES:

To understand the control system of machine tools and its applications
To understand the objectives, aims and methodology of machine tool condition onitoring and diagnostics.

UNIT I OVERVIEW OF AUTOMATIC CONTROLS IN MACHINE TOOLS 6

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

UNIT II COMPUTER CONTROL SYSTEM 15

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

UNIT III DRIVE SYSTEMS IN MACHINE TOOLS 8

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

UNIT IV CONDITION MONITORING 8

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

UNIT V MACHINE TOOL DIAGNOSTICS 8

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

TOTAL: 45 PERIODS

REFERENCES:

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

PTPR 2035 MINI PROJECT L T P C
0 0 6 3

OBJECTIVES:

1. The students in batches (not exceeding three in a batch) have to take up a project in the area of manufacturing engineering.
2. Each batch is guided by a faculty member. The students have to select a suitable problems, design, prepare the drawings, produce the components, assemble and commission the project.

3. The students have to prepare and present a detailed project report at the end of the VIII semester.
4. The evaluation will ne made for the continuous internal assessment for the Project by a committee nominated by the Head of the Department.

PTGE2025 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

UNIT I ENGINEERING ETHICS 9

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

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

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

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

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

UNIT IV RESPONSIBILITIES AND RIGHTS 9

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

UNIT V GLOBAL ISSUES 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001)

4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, (2003)

PTME2035 ENTREPRENEURSHIP DEVELOPMENT L T P C
(Common to Mechanical, Production & Automobile) 3 0 0 3

OBJECTIVE:

Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurical Growth.

UNIT II MOTIVATION 9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9

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

UNIT IV FINANCING AND ACCOUNTING 9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

2. Kuratko & Hodgetts, “Enterprenuership – Theory, process and practices”, Thomson learning 6th edition.

REFERENCES:

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

PTPR2036 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.

UNIT III 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.

PTPR 2037 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

PTGE2023 FUNDAMENTALS OF NANOSCIENCE L T P C
3 0 0 3

UNIT I INTRODUCTION 10

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

UNIT II PREPARATION METHODS 10

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

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 5

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

UNIT IV PREPARATION ENVIRONMENTS 10

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

UNIT V CHARECTERISATION TECHNIQUES 10

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

PTME2036 PRODUCTION PLANNING AND CONTROL L T P C
3 0 0 3

OBJECTIVES:

To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.

To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION 9

Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect-aesthetic aspect. Profit consideration-Standardization, Simplification & specialization-Break even analysis-Economics of a new design.

UNIT II WORK STUDY 9

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study - work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING 9

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING 9

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance - Flow production scheduling-Batch production scheduling-Product sequencing - Production Control systems-Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Martand Telsang, “Industrial Engineering and Production Management”, S. Chand and Company, First edition, 2000.

2. James.B.Dilworth,"Operations management – Design, Planning and Control for manufacturing and services" Mcgraw Hill International edition1992.

REFERENCES:

1. Samson Eilon, "Elements of production planning and control", Universal Book Corpn.1984
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Ed. John Wiley and Sons, 2000.
3. Kanishka Bedi, " Production and Operations management", Oxford university press, 2nd Edition 2007.
4. Melynk, Denzler, " Operations management – A value driven approach" Irwin Mcgrawhill.
5. Norman Gaither, G. Frazier, " operations management" Thomson learning 9th edition IE, 2007
6. K.C.Jain & L.N. Aggarwal, "Production Planning Control and Industrial Management", Khanna Publishers, 1990.
7. S.N.Chary, "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.
8. Upendra Kachru, " Production and operations management – Text and cases" Excel books 1st edition 2007.

PTME 2037	MAINTENANCE ENGINEERING (Common to Mechanical and Production)	L T P C 3 0 0 3

OBJECTIVES:

To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.

To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.

To illustrate some of the simple instruments used for condition monitoring in industry.

UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 10

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

UNIT II MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE 9

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.

UNIT III CONDITION MONITORING 9

Condition Monitoring – Cost comparison with and without CM – On-load testing and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis

UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 10

Repair methods for beds, slideways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 7

Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Srivastava S.K., “Industrial Maintenance Management”, - S. Chand and Co., 1981
2. Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995

REFERENCES:

1. White E.N., “Maintenance Planning”, I Documentation, Gower Press, 1979.
2. Garg M.R., “Industrial Maintenance”, S. Chand & Co., 1986.
3. Higgins L.R., “Maintenance Engineering Hand book”, McGraw Hill, 5th Edition, 1988.
4. Armstrong, “Condition Monitoring”, BSIRSA, 1988.
5. Davies, “Handbook of Condition Monitoring”, Chapman &Hall, 1996.
6. “Advances in Plant Engineering and Management”, Seminar Proceedings - IIPE, 1996.

ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R - 2009

B.E. (PART TIME) ELECTRONICS AND INSTRUMENTATION ENGINEERING

I - VII SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA2112	Applied Mathematics	3	1	0	4
2.	PTPH2111	Applied Physics	3	0	0	3
3.	PTCY2112	Applied Chemistry	3	1	0	4
4.	PTEE2151	Electric Circuit Analysis	3	0	0	3
PRACTICAL						
5.	PTGE2114	Computer Practice	0	0	3	2
		TOTAL	**16**	**2**	**0**	**18**

SEMESTER II

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA2211	Transforms and Partial Differential Equations	3	1	0	4
2.	PTEI2203	Electronic Devices and Circuits	3	0	0	3
3.	PTEI2253	Digital logic Circuits	3	1	0	4
4.	PTEI2201	Electrical Machines	3	1	0	4
5.	PTGE2021	Environmental Science and Engineering	3	0	0	3
		TOTAL	**15**	**3**	**0**	**18**

SEMESTER III

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTEI 2252	Transducer Engineering	3	0	0	3
2.	PTEE 2254	Linear Integrated Circuits and Applications	3	0	0	3
3.	PTEC2315	Communication Engineering	3	0	0	3
4.	PTCS2311	Object Oriented Programming	3	0	0	3
PRACTICAL						
1.	PTEI 2257	Transducers and Measurements Laboratory	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

Multi wavelength analysis:

This mode is similar to single wave length except that it takes readings at more than one wavelength. With this mode, readings can be taken at minimum 2 discrete readings and maximum 8 discrete wavelength. Any 8 wavelength can be selected in the range 200nm to 1000nm.Note the maximum wavelength of absorption .

EQUIPMENT

1. IR spectrophotometer sl-117
2. cuvette
3. Solution
4. Printer

9. Ph – Meter Measurement of p^h - value of Test Solutions

AIM

To measure the P_H values of the test solutions using pH-meter.

EXERCISE

Find the pH values of the test solutions.

PROCEDURE

1. Switch on the P_H meter
2. Connect the glass electrode to the P_H-meter
3. Take distilled water in a beaker and insert electrode in the beaker
4. The P_H meter should show approximately test solutions. If Acidic than the P_H is < 7 and if alkaline than the P_H >7

EQUIPMENT

1. pH meter – 1 No.
2. Test solutions – few types
3. Beaker – 2 Nos.
4. Stand – 1 No.

10. MEASUREMENTS OF CONDUCTIVITY OF TEST SOLUTIONS.

AIM

To measure the conductivity of the given solution.

EXERCISE

(i) Solution under test is taken in a beaker.
(ii) Electrode is immersed into the solution
(iii) The electrode terminal is connected to display unit.
(iv) Digital display shows the conductivity of the given solution in mho
(v) Repeat the procedure fro different samples.
(vi) Switch on the supply.

EQUIPMENT

(i) Solution under test.
(ii) Conductivity electrode
(iii) Conductivity meter setup with display.

PTEI2402 LOGIC AND DISTRIBUTED CONTROL SYSTEM L T P C
3 0 0 3

AIM

To illustrate the concept of programmable logic controllers and distributed control system.

OBJECTIVES

To give an introductory knowledge about PLC and the programming languages.
To give adequate knowledge about of application of PLC.
To give basic knowledge in the architecture and local control unit of distributed control system.
To give adequate information in the interfaces used in DCS.
To give basic knowledge about Computer Controlled Systems.

UNIT I PROGRAMMABLE LOGIC CONTROLLER 9

Evolution of PLC's – Components of PLC – Advantages over relay logic – Architecture of PLC– Programming devices - Discrete and Analog I/O modules – Programming languages –– Ladder diagram – Programming timers and counters – Design of PLC.

UNIT II APPLICATIONS OF PLC 9

Instructions in PLC – Program control instructions, math instructions, sequencer instructions – Use of PC as PLC – Application of PLC – Case study of bottle filling system.

UNIT III COMPUTER CONTROLLED SYSTEMS 9

Basic building blocks of Computer controlled systems – SCADA – data Acquisition System – supervisory Control – Direct digital Control .

UNIT IV DISTRIBUTED CONTROL SYSTEM 9

DCS - Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities.

UNIT V INTERFACES IN DCS 9

Operator interfaces - Low level and high level operator interfaces – Operator displays - Engineering interfaces – Low level and high level engineering interfaces – General purpose computers in DCS.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Petruzella, 'Industrial Electronics', McGraw Hill, Second edition, 1997.
2. Michael P. Lukas, 'Distributed Control System', Van Nostrand Reinhold Co., Canada, 1986.
3. John. W. Webb Ronald A Reis - Programmable Logic Controllers - Principles and Applications, Fourth edition, Prentice Hall Inc., New Jersey, 1998.

REFERENCES

1. T. Hughes, 'Programmable Logic Controllers', ISA press,2007.
2. Krishna Kant – Computer based Industrial Control, Prentice Hall, New Delhi, 1997.

PTEI2353 **DIGITAL SYSTEM DESIGN** **L T P C**
3 0 0 3

AIM

The course is designed to introduce the fundamental concepts and design of digital system.

OBJECTIVES

To introduce the most common digital logic families.
To provide introduction to programmable logic devices such as PLA, PAL, FPGA, CPLD etc.
To provide introduction to Digital Memories. Such as ROM, RAM, SRAM, etc.
To discuss case studies on Digital System design.

UNIT I DIGITAL LOGIC FAMILIES 9

TTL, CMOS, NMOS, Dynamic MOS , ECL, I^2L, Operating conditions, Parameters, Interpreting data sheets. Power supply grounding considerations for digital ICs, TTL – to – CMOS Interface, CMOS – to – TTL interface.

UNIT II PROGRAMMABLE LOGIC DEVICES 9

Programmable logic Arrays, Programmable array logic, Realizing logic function using Multiplexers, Decoders, ROM, PLA, PAL. Design of sequential Networks using PAL, PLA – Programmable Gate arrays – FPGA – CPLD.

UNIT III DIGITAL MEMORIES 9

The role of Memory in a system – memory types and terminology – ROM – types of ROM – RAM – SRAM – DRAM – Expanding word size and capacity – Applications.

UNIT IV DIGITAL SYSTEM DESIGN CASE STUDIES 9

Multiplexing displays – Frequency counters – Time measurement – Digital voltmeter – PRBS generator – Interfacing with flash memory.

UNIT V DESIGN FOR TESTABILITY 9

Teatability – Ad hoc design for testing techniques – controllability and observability by means of scan registers – Generic scan based designa – Board level and system level DFT approaches.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Charles H.Roth, 'Fundamentals Logic Design', Jaico Publishing, IV edition, 2002.
2. Donald. P. Leach, Albert paul Malvino, Goutam Suha,'Digital Principles and Applications' Tata McGraw – Hill , Sixth edition .
3. Miron Abramonici, Melvin. A. Rrewer, Arthur.D. Friedman,Digital system testing and testable design, Jaico publishing house.

REFERENCES

1. Theodore. F. Bogart,' Introduction to Digital Circuits', McGraw – Hill International edn.1992
2. Ronald J.Tocci, Neal .S. Widmer,'Digital System Principles and Applications', Pearson Education, 8th edition, Asia, 2002.
3. On demand public key management for wireless Ad Hoc networks.
4. Efficient hybrid security mechanisms for heterogeneous sensor networks.
5. Performance analysis of Handoff techniques based on Mobile Ip, TCP – migrate and SIP.

PTEI2302 ANALYTICAL INSTRUMENTS LT P C
3 0 0 3

AIM

The course is designed to equip the students with an adequate knowledge of a number of analytical tools which are useful for clinical analysis in hospitals, drugs and pharmaceutical laboratories and above all for environmental Pollution Monitoring.

OBJECTIVES

To provide various techniques and methods of analysis which occur in the various regions of the spectrum. These are the powerful tools used in Clinical and Research laboratories.

To give unique methods of separation of closely similar materials, the most powerful being gas chromatography.

To study important methods of analysis of industrial gases. Awareness and control of pollution in the environment is of vital importance.

To bring out the latest ideas on ion-selective electrodes as well as biosensors which have potential applications in medical field, food and beverage industries.

To provide the important electromagnetic resonance and microscopic methods of analysis. Further they are both sensitive and specific and often are characterized by good accuracy. NMR & ESR and microscopic techniques are useful in structure determination.

UNIT I COLORIMETRY AND SPECTROPHOTOMETRY 9

Special methods of analysis – Beer-Lambert law – Colorimeters – UV-Visible spectrophotometers – Single and double beam instruments – Sources and detectors – IR Spectrophotometers – Types – Attenuated total reflectance flame photometers – Atomic absorption spectrophotometers – Sources and detectors – FTIR spectrophotometers – Flame emission photometers – Fluorescence spectrophotometer

UNIT II CHROMATOGRAPHY 9

Different techniques – Gas chromatography – Detectors – Liquid chromatographs – Applications – High-pressure liquid chromatographs – Applications.

UNIT III INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS 9

Types of gas analyzers – Oxygen, NO_2 and H_2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements.

UNIT IV pH METERS AND DISSOLVED COMPONENT ANALYZERS 9

Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, cyclic voltametry, biosensors, dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer.

UNIT V ELECTRO MAGNETIC RESONANCE AND MICROSCOPIC TECHNIQUES 9

NMR – Basic principles – NMR spectrometer - Applications. Electron spin Resonance spectroscopy – Basic principles, Instrumentation and applications. Scanning Electron Microscope (SEM), - Basic principles, Instrumentation and applications. Transmission Electron Microscope (TEM) – Basic principles – Instrumentation and applications. Mass spectrometers – Different types – Applications.

TOTAL : 45 PERIODS

TEXT BOOKS

1. G.W. Ewing, 'Instrumental Methods of Analysis', McGraw Hill, 1992.
2. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999
3. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, 'Instrumental Methods of Analysis', CBS publishing & distribution, 1995.

REFERENCES

1. Robert D. Braun, 'Introduction to Instrumental Analysis', McGraw Hill, Singapore, 1987.
2. R.S. Khandpur, 'Handbook of Analytical Instruments', Tata McGraw Hill publishing Co. Ltd., 2003.
3. Liptak, B.G, Process Measurement and Analysis, Chilton Book Company, 1995

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PTEI2351 MODERN ELECTRONIC INSTRUMENTATION L T P C
3 0 0 3

AIM

To provide adequate knowkedge in digital instruments, display devices and virtual instrumentation.

OBJECTIVES

To make the students to gain a clear knowledge of the basics of digital instruments and measurement techniques.
To have an adequate knowledge in various display and recording devices.
To have an elaborate study of communication standards
To have a detailed study of virtual instrumentation and its applications.

UNIT I DIGITAL INSTRUMENTS 9

Digital voltmeters and multimeters –Microprocessor based DMM with auto ranging and self diagnostic features – Digital IC tester –Frequeny, period, time interval and pulse width measurement.

UNIT II DISPLAY AND RECORDING DEVICES 9

Cathode ray oscilloscope – General purpose and advanced types – Sampling and storage scopes – Wave analyzers – Signal and function generators – Distortion factor meter – Q meter – Seven segment and dot matrix display – X-Y recorders – Magnetic tape recorders – Digital recording and data loggers.

UNIT III RS 232 AND RS 485 9

Modern instrumentation and control systems – OSI model – EIA 232 Interface standard - EIA 485 Interface standard - EIA 422 Interface standard – 20 mA current loop – Serial Interface converters.

UNIT IV VIRTUAL INSTRUMENTATION 9

Virtual instrumentation – Definition, flexibility – Block diagram and architecture of virtual instruments – Virtual instruments versus traditional instruments – Review of software in virtual instrumentation - VI programming techniques – VI , sub VI,loops and charts ,arrays, clusters and graphs, case and sequence structures, formula nodes, string and file input / output.

UNIT V DATA ACQUISITION CARDS 9

DAQ cards for VI applications – Requirements – DAQ modules with serial communication – Design of digital voltmeters with transducer input – Design of ON/OFF controller for temperature control applications.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Chris Nadovich, 'Synthetic Instruments Concepts and Applications', Elsevier, 2005.
2. Rick Bitter, Taqi Mohiuddin and Matt Nawrocki, 'Labview Advanced Programming Techniques', CRC Press, Second Edition, 2007.
3. S. Gupta and J.P. Gupta, 'PC interfacing for data acquisition and process Control', second Edition, Instrument Society of America, 1994.
4. Kalsi H.S., "Electronic Instrumentation", Second Edition, Tata Mc Graw Hill Company, New Delhi, 2004.
5. Sawhney A.K., "A course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai and sons, New Delhi, 2003.

REFERENCES

1. Rahman Jamal and Herbert Picklik, LabVIEW – Applications and Solutions, National Instruments Release ISBN 0130964239.Rah
2. William Buchanan 'Computer Busses', CRC Press, 2000.
3. Rangan C.S., Sharma G.R., Mani V.S.V., "Instrumentation devices and Systems", Tata Mc Graw Hill Company, New Delhi,.2002.
4. Joseph J Carr, "Elements of Electronic Instrumentation and Measurement", Third Edition, Pearson Education, 2003.
5. David A. Bell, "Electronic Instrumentation and measurements", Second Edition, Prentice Hall of India, New Delhi, 2003.
6. Gupta J.B., "A course in Electrical and Electronic Measurement and Instrumentation", 12th Edition, Katson Publishing House, 2003.

PTEI2403 VLSI DESIGN L T P C
3 0 0 3

AIM

To introduce the technology and concepts of VLSI.

OBJECTIVES

To introduce MOS theory / Manufacturing Technology.
To study inverter / counter logic / stick / machine diagram / sequential circuits.
To study address / memory / arithmetic circuits.
To introduce FPGA architecture / principles / system design.
To get familiarised with VHDL programming behavioural/Structural/concurrent/ process.

UNIT I BASIC MOS TRANSISTOR 9

Enhancement mode and Depletion mode – Fabrication (NMOS, PMOS, CMOS, BiCMOS) Technology – NMOS transistor current equation – Second order effects – MOS Transistor Model.

UNIT II NMOS AND CMOS INVERTER AND GATES 9

NMOS and CMOS inverter – Determination of pull up / pull down ratios – Stick diagram – lambda based rules – Super buffers – BiCMOS & steering logic.

UNIT III SUB-SYSTEM DESIGN AND LAYOUT 9

Structured design of combinational circuits – Dynamic CMOS & clocking – Tally circuits – (NAND-NAND, NOR-NOR and AOI logic) – EXOR structure – Multiplexer structures – Barrel shifter, high speed adder and multiplier circuits.

UNIT IV DESIGN OF COMBINATIONAL ELEMENTS AND REGULAR ARRAY LOGIC 9

NMOS PLA – Programmable Logic Devices - Finite State Machine PLA – Introduction to FPGA.

UNIT V VHDL PROGRAMMING 9

RTL Design – simulation and synthesis - Combinational logic – Types – Operators – Packages – Sequential circuit – Sub-programs – Test benches. (Examples: adders, counters, flipflops, FSM, Multiplexers / Demultiplexers).

TOTAL : 45 PERIODS

TEXT BOOKS

1. D.A.Pucknell, K.Eshraghian, 'Basic VLSI Design', 3rd Edition, Prentice Hall of India, New Delhi, 2003.
2. Rabey, J.M., Digital Integrated Circuits: A Design Perspective, Prentice Hall, 1955
3. Bhasker, J., VHDL Primer, Prentice Hall 1995

REFERENCES

1. Eugene D.Fabricius, 'Introduction to VLSI Design', Tata McGraw Hill, 1990.
2. N.H.Weste, 'Principles of CMOS VLSI Design', Pearson Eduction, India, 2002.
3. Zainalatsedin Navabi, 'VHDL Analysis and Modelling of Digital Systems', 2nd Edition, Tata McGraw Hill, 1998.
4. Douglas Perry, 'VHDL Programming by example', Tata McGraw Hill, 3rd Edition, 2003

PTEI2404 FIBRE OPTICS AND LASER INSTRUMENTS L T P C
3 0 0 3

AIM

To contribute to the knowledge of Fibre optics and Laser Instrumentation and its Industrial and Medical Application.

OBJECTIVES

To expose the students to the basic concepts of optical fibres and their properties.
To provide adequate knowledge about the Industrial applications of optical fibres.
To expose the students to the Laser fundamentals.
To provide adequate knowledge about Industrial application of lasers.
To provide adequate knowledge about holography and Medical applications of Lasers.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splicers – Fibre termination – Optical sources – Optical detectors.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors – Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

TOTAL : 45 PERIODS

TEXT BOOKS

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India, 1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.

REFERENCES

1. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3. John F. Read, 'Industrial Applications of Lasers', Academic Press, 1978.
4. Monte Ross, 'Laser Applications', McGraw Hill, 1968

PTCS2351 ARTIFICIAL INTELLIGENCE L T P C
3 0 0 3

UNIT I PROBLEM SOLVING 9

Introduction – Agents – Problem formulation – uninformed search strategies – heuristics – informed search strategies – constraint satisfaction

UNIT II KNOWLEDGE AND REASON 9

Logical agents – propositional logic – inferences – first-order logic – inference in first-order logic – forward chaining – backward chaining – resolution

UNIT III PLANNING 9

Planning with state-space search – partial-order planning – planning graphs – planning and acting in the real world

UNIT IV UNCERTAIN KNOWLEDGE AND REASONING 9

Uncertainty – review of probability - probabilistic Reasoning – Bayesian networks – inferences in Bayesian networks – Temporal models – Hidden Markov models

UNIT V LEARNING 9

Learning from observation - Inductive learning – Decision trees – Explanation based learning – Statistical Learning methods - Reinforcement Learning

TOTAL : 45 PERIODS

TEXT BOOK

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education, 2003.

REFERENCES

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press, 1998.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education, 2002.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers, 1998.

PTCS2071 COMPUTER ARCHITECTURE L T P C
3 0 0 3

UNIT I INSTRUCTION SET ARCHITECTURE 9

Introduction to computer architecture - Review of digital design – Instructions and addressing – procedures and data – assembly language programs – instruction set variations

UNIT II ARITHMETIC/LOGIC UNIT 9

Number representation – design of adders – design of simple ALUs – design of Multipliers and dividers – design of floating point arithmetic unit

UNIT III DATA PATH AND CONTROL 9

Instruction execution steps – control unit synthesis – microprogramming – pipelining – pipeline performance

UNIT IV MEMORY SYSTEM 9

Main Memory concepts – types of memory – cache memory organization – secondary storage – virtual memory – paging

UNIT V I/O AND INTERFACES 9

I/O devices – I/O programming – polling – interrupts – DMA – buses – links – interfacing – context switching – threads and multithreading

TOTAL : 45 PERIODS

TEXT BOOKS

1. B. Parhami, “Computer Architecture”, Oxford University Press, 2005.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, Tata McGraw Hill, 2002

REFERENCES

1. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software interface”, Third Edition, Elsevier, 2004.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Seventh Edition, Pearson Education, 2006.
3. Miles Murdocca “Computers Architecture and Organization An Integrated approach”, Wiley India pvt Ltd, 2007
4. John D. Carpinelli, “Computer systems organization and Architecture”, Pearson Education, 2001.

PTCS2411 OPERATING SYSTEMS L T P C
3 0 0 3

AIM

To learn the various aspects of operating systems such as process management, memory management, file systems, and I/O management

UNIT I PROCESSES AND THREADS 9

Introduction to operating systems – review of computer organization – operating system structures – system calls – system programs – system structure – virtual machines. Processes: Process concept – Process scheduling – Operations on processes – Cooperating processes – Interprocess communication – Communication in client-server systems. Case study: IPC in Linux. Threads: Multi-threading models – Threading issues. Case Study: Pthreads library

UNIT II PROCESS SCHEDULING AND SYNCHRONIZATION 9

CPU Scheduling: Scheduling criteria – Scheduling algorithms – Multiple-processor scheduling – Real time scheduling – Algorithm Evaluation. Case study: Process scheduling in Linux. Process Synchronization: The critical-section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – critical regions – Monitors. Deadlock: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock.

UNIT III STORAGE MANAGEMENT 9

Memory Management: Background – Swapping – Contiguous memory allocation –Paging – Segmentation – Segmentation with paging. Virtual Memory: Background – Demand paging – Process creation – Page replacement – Allocation of frames – Thrashing. Case Study: Memory management in Linux

UNIT IV FILE SYSTEMS 9

File-System Interface: File concept – Access methods – Directory structure – File -system mounting – Protection. File-System Implementation : Directory implementation – Allocation methods – Free-space management – efficiency and performance – recovery – log-structured file systems. Case studies: File system in Linux – file system in Windows XP

UNIT V I/O SYSTEMS 9

I/O Systems – I/O Hardware – Application I/O interface – kernel I/O subsystem – Streams – performance. Mass-Storage Structure: Disk scheduling – Disk management – Swap-space management – RAID – disk attachment – stable storage – tertiary storage. Case study: I/O in Linux

TOTAL : 45 PERIODS

TEXT BOOKS

1. Silberschatz, Galvin, and Gagne, "Operating System Concepts", Sixth Edition, Wiley India Pvt Ltd, 2003.
2. D. M. Dhamdhere, "Operating Systems: A concepts based approach", Second Edition, Tata McGraw-Hill Publishing Company Ltd., 2006.

REFERENCES

1. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education/PHI, 2001.
2. Harvey M. Deital, "Operating Systems", Third Edition, Pearson Education, 2004.

PTCS2070 VISUAL LANGUAGES AND APPLICATIONS L T P C
3 0 0 3

AIM

To study the principles and techniques of windows programming using MFC, procedures, resources, controls and database programming through the visual languages, Visual C++ and Visual Basic.

OBJECTIVES

To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.

To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.

To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.

To study about the integrated development programming event driven programming, variables, constants, procedures and basic ActiveX controls in visual basic.

To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB.

UNIT I FUNDAMENTALS OF WINDOWS AND MFC 9

Messages - Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective.The benefits of C++ and MFC - MFC design philosophy - Document/View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map.

Drawing the lines – Curves – Ellipse – Polygons and other shapes. GDI pens – Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard: Input focus - Keystroke messages - Virtual key codes - Character & dead key messages.

UNIT II RESOURCES AND CONTROLS 9

Creating a menu – Loading and displaying a menu – Responding to menu commands – Command ranges - Updating the items in menu, update ranges – Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus – Cascading menus - Context menus.

The C button class – C list box class – C static class - The font view application – C edit class – C combo box class – C scrollbar class. Model dialog boxes – Modeless dialog boxes.

UNIT III DOCUMENT / VIEW ARCHITECTURE 9

The inexistence function revisited – Document object – View object – Frame window object – Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document – Mid squares application – Supporting multiple document types – Alternatives to MDI. Splitter Windows: Dynamic splitter window – Static splitter windows.

Creating & initializing a toolbar - Controlling the toolbar's visibility – Creating & initializing a status bar - Creating custom status bar panes – Status bar support in appwizard. Opening, closing and creating the files - Reading & Writing – C file derivatives – Serialization basics - Writing serializable classes.

UNIT IV FUNDAMENTALS OF VISUAL BASIC 10

Menu bar – Tool bar – Project explorer – Toolbox – Properties window – Form designer – Form layout – Intermediate window. Designing the user interface: Aligning the controls – Running the application – Visual development and event driven programming.

Variables: Declaration – Types – Converting variable types – User defined data types - Lifetime of a variable. Constants - Arrays – Types of arrays. Procedures: Subroutines – Functions – Calling procedures. Text box controls – List box & Combo box controls – Scroll bar and slider controls – File controls.

UNIT V DATABASE PROGRAMMING WITH VB 8

Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager – Entering data with the visual data manager. Data bound list control – Data bound combo box – Data bound grid control. Mapping databases: Database object – Table def object, Query def object.

Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Jeff Prosise, 'Programming Windows With MFC', Second Edition, WP Publishers & Distributors [P] Ltd, Reprinted 2002.
2. Evangelos Petroutsos, 'Mastering Visual Basic 6.0', BPB Publications, 2002.

REFERENCES

1. Herbert Schildt, 'MFC Programming From the Ground Up', Second Edition, Tata McGraw Hill, reprinted 2002.
2. John Paul Muller, 'Visual C++ 6 From the Ground Up Second Edition', Tata McGraw Hill, Reprinted 2002.
3. Curtis Smith & Micheal Amundsen, 'Teach Yourself Database Programming with Visual Basic 6 in 21 days', Techmedia Pub, 1999.

PTEI2021 POWER PLANT INSTRUMENTATION L T P C
3 0 0 3

AIM

The course is designed to familiarize the student with the functions and instrumentation available in a modern power generation plant.

OBJECTIVES

To provide an overview of different methods of power generation with a particular stress on thermal power generation.

To bring out the various measurements involved in power generation plants.

To provide knowledge about the different types of devices used for analysis.

To inpart knowledge about the different types of controls and control loops.

To familiarize the student with the methods of monitoring different parameters like speed, vibration of turbines and their control

UNIT I OVERVIEW OF POWER GENERATION 9

Brief survey of methods of power generation – hydro, thermal, nuclear, solar and wind power – importance of instrumentation in power generation – thermal power plants – building blocks – details of boiler processes UP&I diagram of boiler – cogeneration.

UNIT II MEASUREMENTS IN POWER PLANTS 9

Electrical measurements – current, voltage, power, frequency, power – factor etc. – non electrical parameters – flow of feed water, fuel, air and steam with correction factor for temperature – steam pressure and steam temperature – drum level measurement – radiation detector – smoke density measurement – dust monitor.

UNIT III ANALYZERS IN POWER PLANTS 9

Flue gas oxygen analyser – analysis of impurities in feed water and steam – dissolved oxygen analyser – chromatography – PH meter – fuel analyser – pollution monitoring instruments.

UNIT IV CONTROL LOOPS IN BOILER 9

Combustion control – air/fuel ratio control – furnace draft control – drum level control – main stem and reheat steam temperature control – superheater control – attemperator – deaerator control – distributed control system in power plants – interlocks in boiler operation.

UNIT V TURBINE – MONITORING AND CONTROL 9

Speed, vibration, shell temperature monitoring and control – steam pressure control – lubricant oil temperature control – cooling system

TOTAL : 45 PERIODS

TEXT BOOKS

1. Sam G. Dukelow, The control of Boilers, instrument Society of America, 1991.
2. Modern Power Station Practice, Vol.6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971.

REFERENCES

1. Elonka,S.M.and Kohal A.L.Standard Boiler Operations, McGraw-Hill, New Delhi, 1994.
2. R.K.Jain, Mechanical and industrial Measurements, Khanna Publishers, New Delhi, 1995.

PTEI2022 INSTRUMENTATION IN PETROCHEMICAL INDUSTRIES L T P C
3 0 0 3

AIM

To expose the students to the Instrumentation applied in petrochemical industries.

OBJECTIVES

To expose the students to the basic processing in petroleum industry.

To provide adequate knowledge about the unit operations.

To impart knowledge pertaining to the petroleum products and the chemicals obtained from them.

To provide adequate knowledge about the measurement of various parameters in petrochemical industry.

To expose the students to the various control loops in Petrochemical Industry.

UNIT I PETROLEUM PROCESSING 9

Petroleum exploration – Recovery techniques – Oil – Gas separation - Processing wet gases – Refining of crude oil.

UNIT II OPERATIONS IN PETROLEUM INDUSTRY 9

Thermal cracking – Catalytic cracking – Catalytic reforming – Polymerisation – Alkylation – Isomerization – Production of ethylene, acetylene and propylene from petroleum.

UNIT III CHEMICALS FROM PETROLEUM PRODUCTS 9

Chemicals from petroleum – Methane derivatives – Acetylene derivatives – Ethylene derivatives – Propylene derivatives – Other products.

UNIT III MEASUREMENTS IN PETROCHEMICAL INDUSTRY 9

Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments – Intrinsic safety of Instruments.

UNIT IV CONTROL LOOPS IN PETROCHEMICAL INDUSTRY 9

Process control in refinery and petrochemical industry – Control of distillation column – Control of catalytic crackers and pyrolysis unit – Automatic control of polyethylene production – Control of vinyl chloride and PVC production.

TOTAL : 45 PERIODS

TEXT BOOKS

1. A.L. Waddams, ‘Chemicals from Petroleum’, Butter and Janner Ltd., 1968.
2. J.G. Balchan. and K.I. Mumme, ‘Process Control Structures and Applications’, Van Nostrand Reinhold Company, New York, 1988.

REFERENCES

1. Austin G.T. Shreeves, ‘Chemical Process Industries’, McGraw Hill International Student edition, Singapore, 1985.
2. B.G Liptak, ‘Instrumentation in Process Industries’, Chilton Book Company, 1994.

PTEI2023 MICRO ELECTRO MECHANICAL SYSTEMS L T P C
3 0 0 3

AIM

The course is designed to familiarize the student with the functions and applications of MEMS.

OBJECTIVES

To study about MEMS and parts of MEMS
To study the design methodalogy of MEMS for various mechanics.
To study about actuators in MEMS.
To study about MEMS based circuits.
To study about optical and RF based MEMS.

UNIT I INTRODUCTION TO MEMS 9

MEMS and Microsystems, Miniaturization, Typical products, Micro Sensors,Micro actuation, MEMS with micro actuators, Microaccelorometers and Micro fluidics, MEMS materials, Micro Fabrication

UNIT II MECHANICS FOR MEMS DESIGN 9

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics, material, physical vapor deposition (PVD), chemical mechanical polishing (CMP)

UNIT III ELECTRO STATIC DESIGN 9

Electrostatics: basic theory, electro static instability, Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators, bistable actuators.

UNIT IV CIRCUIT AND SYSTEM ISSUES 9

Electronic interfaces, Feed back systems, Noise, Circuit and system issues, Case studies –Capacitive accelerometer, Peizo electric pressure sensor, Thermal sensors, radiation sensors, mechanical sensors, bio-chemical sensors Modeling of MEMS systems, CAD for MEMS.

UNIT V INTRODUCTION TO OPTICAL AND RF MEMS 9

Optical MEMS, system design basics – Gaussian optics, matrix operations, Resolution, Case studies, MEMS scanners and retinal scanning, display, Digital Micro mirror devices, RF Memes – design basics, case study – Capacitive RF MEMS switch, Performance issues.

TOTAL : 45 PERIODS

TEXT BOOK

1. Stephen Santeria, “Microsystems Design “, Kluwer publishers, 2000.

REFERENCES

1. Nadim Maluf, “ An introduction to Micro electro mechanical system design”, Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, “ The MEMS Handbook”, CRC press Baco Raton, 2000
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.
4. Julian w. Gardner, Vijay k. varadan, Osama O.Awadelkarim,micro sensors mems and smart devices, John Wiley & son LTD,2002
5. James J.Allen, micro electro mechanical system design, CRC Press published in 2005

PTGE2023 FUNDAMENTALS OF NANOSCIENCE L T P C
3 0 0 3

UNIT I INTRODUCTION 10

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

UNIT II PREPARATION METHODS 10

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

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 5

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

UNIT IV PREPARATION ENVIRONMENTS 10

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

UNIT V CHARECTERISATION TECHNIQUES 10

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., Nanomaterials: Synthesis, Properties and Applications, (Institute of Physics Publishing, Bristol and Philadelphia, 1996)
2. N John Dinardo, Nanoscale charecterisation of surfaces & Interfaces, Second 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.

PTEC2055 DIGITAL IMAGE PROCESSING L T P C
3 0 0 3

AIM

To introduce the concept of analyzing the digital image fundamentals and digital image processing.

OBJECTIVES

To study the digital image fundamentals and its applications.
To study various filters used in digital image processing.
To study about the segmentation & representation schemes.
To study about recognition & interpretation methods.
To study about imagecompression.

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Elements of visual perception, psycho visual model, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals -RGB,HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical formulation.

UNIT II IMAGE TRANSFORMS 9

1D DFT, 2D transforms – DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, Wavelet Transform.

UNIT III IMAGE ENHANCEMENT AND RESTORATION 9

Histogram modification and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median and filters, Homomorphic filtering, Color image enhancement. Image Restoration – degradation model, Inverse filtering – removal of blur, Wiener filtering, Geometric transformations – spatial transformations, Gray-Level interpolation,

UNIT IV IMAGE SEGMENTATION AND RECOGNITION 9

Edge detection. Image segmentation by region growing, region splitting and merging, edge linking.. Image Recognition – Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation, Image classification using neural network.

UNIT V IMAGE COMPRESSION 9

Need for data compression, Huffman,. Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Block Truncation Coding. Transform Coding – DCT and Wavelet. JPEG, MPEG. Standards, principles of Context based Compression.

TOTAL : 45 PERIODS

TEXT BOOKS

1. William K.Pratt, ' Digital Image Processing', John Wiley, NewYork,2002.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Prentice Hall of India, 2002.

REFERENCES

1. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001
2. Rafael C. Gonzalez, Richard E.Woods, Steven Eddins, ' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.
3. Rafael C. Gonzalez, Richard E.Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2004
4. Milman Sonka, Vaclav Hlavac, Roger Boyle, 'Image Processing, Analysis, and Machine Vision', Brooks/Cole, Vikas Publishing House, II ed., 1999.
5. Sid Ahmed, M.A., 'Image Processing Theory, Algorithms and Architectures', McGraw-Hill, 1995.

PTEC2056 ADVANCED COMMUNICATION ENGINEERING L T P C
3 0 0 3

AIM

To understand the advanved communication engineering concepts.

OBJECTIVES

To have a detailed knowledge of various spread spectrum techniques.

To understand the basic principles of mobile communication and bluetooth technology.

To have an exposure towards the high performance communication networks – ATM and ISDN

To understand the operation of Radar and Navigationational aids.

UNIT I SPREAD SPECTRUM COMMUNICATION 9

Spread spectrum techniques-spreading techniques-PN sequences-DSSS, RHSS-use of spread spectrum with CDMA

UNIT II MOBILE COMMUNICATION 9

Basic cellular system-performance criteria-operation of cellular system-cell splitting-interference GSM, GPRS, Blue tooth-the link controller, the link manager, the host controller interface, LLCAP, WLL, Multiple access techniques

UNIT III ATM 9

ATM's position in OSL model-B-ISDN protocol reference model-ATM functions and layers-ATM signaling principles, TM operation and maintenance-ATM protocol stack: lower layers, fibre based networks and its advantages-ATM physical layer media

UNIT IV ISDN 9

ISDN standards, ISDN interface and functions-UNI-ISDN proctol architecture, ISDN physical layer, ISDN dataline layer-Network interface

UNIT V RADAR AND NAVIGATIONAL AIDS 9

Radar block diagram and operation-Radar range equation-Prediction of range performance-Minimum detectable signal-Pulse repetition frequency and range ambiguities-CW and FM CW radar-Synthetic aperature and air surveillance radar-ECCM and bistatic radar

TOTAL : 45 PERIODS

TEXT BOOKS

1. M.I. SKOLNIK, Introduction to Radar-Mc Graw Hill and Edition
2. William C.Y.Lee, Mobile Cellular Telecommunications system-Mc Graw Hill International Ed. 1990
3. Simon Haykin, 'Digital communications', John Wiley and Sons, 1988
4. William Stallings,'ISDN and BISDN' Macmillan Publishers, 1995

REFERENCES

1. Jennifer Bray and Charles F. Sturman, 'Bluetooth', Pearson Education Asia, 2001.

PTEC2057 ADVANCED DIGITAL SIGNAL PROCESSING L T P C
3 0 0 3

[Review of discrete-time signals and systems- DFT and FFT, Z-Transform, Digital Filters is recommended]

AIM

To provide adequate knowledge in Random signal processing.

OBJECTIVES

Detail study of time averaging , ensamble averaging & study of power spectral density.
Detail study of parametric & non – parametric estimation
Detail study of adaptive filters & its applications
Introduction study of multivariable digital signal processing.

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9

Discrete Random Processes- Ensemble averages, stationary processes, Autocorrelation and Auto covariance matrices. Parseval's Theorem, Wiener-Khintchine Relation- Power Spectral Density-Periodogram Spectral Factorization, Filtering random processes. Low Pass Filtering of White Noise. Parameter estimation: Bias and consistency.

UNIT II SPECTRUM ESTIMATION 9

Estimation of spectra from finite duration signals, Non-Parametric Methods-Correlation Method , Periodogram Estimator, Performance Analysis of Estimators -Unbiased, Consistent Estimators- Modified periodogram, Bartlett and Welch methods, Blackman – Tukey method. Parametric Methods - AR, MA, ARMA model based spectral estimation. Parameter Estimation -Yule-Walker equations, solutions using Durbin's algorithm

UNIT III LINEAR ESTIMATION AND PREDICTION 9

Linear prediction- Forward and backward predictions, Solutions of the Normal equations- Levinson-Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction , FIR Wiener filter and Wiener IIR filters.

UNIT IV ADAPTIVE FILTERS 9

FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMS adaptive algorithm, Normalized LMS. Adaptive channel equalization-Adaptive echo cancellation-Adaptive noise cancellation- Adaptive recursive filters (IIR).

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9

Mathematical description of change of sampling rate - Interpolation and Decimation , Decimation by an integer factor - Interpolation by an integer factor, Sampling rate conversion by a rational factor, Filter implementation for sampling rate conversion- direct form FIR structures, Polyphase filter structures, time-variant structures. Multistage implementation of multirate system.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc., Singapore, 2002.
2. John G. Proakis, Dimitris G.Manolakis, Digital Signal Processing Pearson Education, 2002.

REFERENCES
1. John G. Proakis et.al.'Algorithms for Statistical Signal Processing', Pearson Education, 2002.
2. Dimitris G.Manolakis et.al.' Statistical and adaptive signal Processing', McGraw Hill, New York, 2000.
3. Rafael C. Gonzalez, Richard E.Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2004.(For Wavelet Transform Topic)

PTEE 2023 ROBOTICS AND AUTOMATION L T P C
3 0 0 3

AIM
To provide comprehensive knowledge of robotics in the design, analysis and control point of view.

OBJECTIVES
To study the various parts of robots and fields of robotics.
To study the various kinematics and inverse kinematics of robots.
To study the Euler, Lagrangian formulation of Robot dynamics.
To study the trajectory planning for robot.
To study the control of robots for some specific applications.

UNIT I BASIC CONCEPTS 9
Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov's laws of robotics – dynamic stabilization of robots.

UNIT II POWER SOURCES AND SENSORS 9
Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

UNIT III MANIPULATORS, ACTUATORS AND GRIPPERS 9
Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

UNIT IV KINEMATICS AND PATH PLANNING 9
Solution of inverse kinematics problem – multiple solution jacobian work envelop – hill climbing techniques – robot programming languages

UNIT V CASE STUDIES 9
Mutiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

REFERENCES

1. Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 1992.
2. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.
3. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.
4. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA, 1991.
5. Issac Asimov I Robot, Ballantine Books, New York, 1986.

PTGE2022 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

UNIT I INTRODUCTION 9

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

UNIT II TQM PRINCIPLES 9

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

UNIT III TQM TOOLS & TECHNIQUES I 9

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

UNIT IV TQM TOOLS & TECHNIQUES II 9

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

UNIT V QUALITY SYSTEMS 9

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

TOTAL : 45 PERIODS

TEXT BOOK

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

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

PTGE2025 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

UNIT I ENGINEERING ETHICS 9

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

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

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

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

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

UNIT IV RESPONSIBILITIES AND RIGHTS 9

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

UNIT V GLOBAL ISSUES 9

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

TOTAL : 45 PERIODS

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

REFERENCES

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

PTIC2401 DIGITAL CONTROL SYSTEM L T P C
3 0 0 3

AIM

To provide sound knowledge on the principles of discrete data control system

OBJECTIVES

To study the importance of sample data control system.
To give adequate knowledge about signal processing in digital control.
To study the importance of modeling of discrete systems and stability analysis of discrete data system.
To study the importance of state space representation for discrete data system.
To introduce the design concept for digital controllers.

UNIT I COMPUTER CONTROLLED SYSTEM 9

Configuration of the basic digital control scheme – general sampled data system variables – signal classifications – why use digital control system – Advantages – disadvantages – examples of discrete data and digital control systems.

UNIT II SIGNAL PROCESSING IN DIGITAL CONTROL 9

Sampling process – Frequency domain analysis – ideal samples – Shanon’s sampling theorem – generation and solution of process – linear difference equations – data reconstruction process – frequency domain characteristics.

UNIT III DISCRETE SYSTEM MODELLING 9

Determination of the – transform – mapping between s and – domains - – transform of system equations – open loop Hybrid sampled Data Control Systems – open loop discrete Input Data Control System – closed loop sampled data control system – modified – transform method – response between sampling instants – stability on the – -plane and jury’s stability test – steady state error analysis for stable systems.

UNIT IV STATE VARIABLE ANALYSIS OF DIGITAL CONTROL SYSTEMS 9

State descriptions of digital processors – conversion of state variable models to transfer functions – conversion of transfer functions to canonical state variable models – first comparison form – second companion form – Jordon Canonical form – state description of sampled continuous time plants – solution of state difference equations – closed form solution – state transition matrix – Caley Hamilton Technique – concept of controllability and absorbability – loss of controllability and absorbability due to sampling.

UNIT V DESIGN OF DIGITAL CONTROL 9

Digital PI, PD and PID Controller – Position and velocity forms – state regulator design – design of state observers – dead beat control by state feed back and dead beat observers.

TOTAL : 45 PERIODS

TEXT BOOKS

1. C.M. Houpis, G.B. Lamount, 'Digital Control Systems-Theory, Hardware, Software', International Student Edition, McGraw Hill Book Co., 1985.
2. M.Gopal, 'Digital Control and State Variables Methods', Tata McGraw HILL, 2nd Edition, 2003.

REFERENCES

1. B.C. Kuo, "Digital control systems", Second Edition, Oxford University press, 1992.
2. P.B. Deshpande and R.H. Ash, 'Computer Process Control', ISA Publication, USA, 1995.

PTCS2461 APPLIED SOFT COMPUTING L T P C
3 0 0 3

AIM

To cater the knowledge of Neural Networks, Fuzzy Logic Control, Genetic Algorithm and Evolutionary Programming and their applications for controlling real time systems.

OBJECTIVES

To expose the concepts of feed forward neural networks.
To provide adequate knowledge about feed back neural networks.
To teach about the concept of fuzziness involved in various systems.
To provide adequate knowledge about fuzzy set theory.
To expose the ideas of GA and EP in optimization and control.

UNIT I ANN - INTRODUCTION 9

Introduction – Biological neuron – Artificial neuron – Neuron modeling – Learning rules – Single layer – Multi layer feed forward network – Back propagation – Learning factors.

UNIT II ANN - ARCHITECTURE AND APPLICATIONS 9

Feedback networks – Discrete time Hopfield networks – Transient response of continuous time networks – Process modeling using ANN- Neuro controller for inverted pendulum.

UNIT III FUZZY SYSTEMS 9

Classical sets – Fuzzy sets – Fuzzy relations **–** Fuzzification - Membership functions – Defuzzification – Methods of defuzzification – Fuzzy rules.

UNIT IV FUZZY LOGIC CONTROL 9

Membership function – Knowledge base – Decision-making logic – Optimisation of membership function using neural networks – Adaptive fuzzy system.- FLC for inverted pendulum- Home heating system- Introduction to Neuro-fuzzy systems.

UNIT V OPTIMIZATION TECHNIQUES 9

Gradient Search – Non-gradient search – Genetic Algorithms: Operators, search algorithm, penalty – Evolutionary Programming: Operators, Search Algorithms

TOTAL : 45 PERIODS

TEXT BOOKS

1. Laurance Fausett, 'Fundamentals of Neural Networks', Pearson Education, 2004.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', McGraw Hill, 1997.
3. David Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning', Pearson Education, 2007.

REFERENCES

1. J.S.R.Jang, C.T.Sun and E.Mizutani, ' Neuro- Fuzzy and Soft Computing' Pearson Education, New Delhi, 2004
2. Jacek M. Zurada, 'Introduction to Artificial Neural Systems', Jaico Publishing home, 2002.
3. John Yen and Reza Langari, 'Fuzzy Logic – Intelligence, Control and Information', Pearson Education, New Delhi, 2003.
4. Robert J.Schalkoff, ' A rtifical Neural Networks', McGraw Hill, 1997.