ANNA UNIVERSITY, CHENNAI – 600 025

UNIVERSITY DEPARTMENTS

R 2013

B.E. PRODUCTION ENGINEERING (PART TIME)

I- VII SEMESTER CURRICULA AND SYLLABI

SEMESTER I

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

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTPR8201	Electrical, Electronics & Control Systems	3	0	0	3
2	PTPR8202	Foundry and Welding Technology	3	0	0	3
3	PTPR8203	Metal Cutting and CNC Machines	3	0	0	3
4	PTPR8204	Metallurgy and Materials Testing	3	0	0	3
PRACTICAL						
5	PTPR8211	Metal Cutting and CNC Lab	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTPR8301	Fluid Power Drives and Control	3	0	0	3
2	PTPR8302	Metal Forming Processes	3	0	0	3
3	PTPR8303	Quantitative Techniques in Management	3	0	0	3
4	PTPR8351	Kinematics & Dynamics of Machines	3	0	0	4
PRACTICAL						
5	PTPR8311	Fluid power Lab	0	0	3	2
		TOTAL	**12**	**0**	**3**	**15**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTPR8401	Computer Aided Product Design	3	0	0	3
2	PTPR8402	Engineering Metrology	3	0	0	3
3	PTPR8403	Jigs, Fixtures and Press Tools	3	0	0	3
4	PTPR8404	Machine Components Design	3	0	0	3
PRACTICAL						
5	PTPR8411	Metrology Lab	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTPR8501	FEA and System Simulation	3	0	0	3
2	PTPR8502	Modern Manufacturing Processes	3	0	0	3
3	PTPR8503	Quality Control and Reliability	3	0	0	3
4	PTPR8551	Production of Automotive Components	3	0	0	3
PRACTICAL						
5	PTPR8511	Analysis and Simulation Lab	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTPR8601	Mechatronics for Automation	3	0	0	3
2	PTPR8602	Operation Planning and Cost Estimation	3	0	0	3
3	PTPR8603	Robotic Engineering	3	0	0	3
4		Elective I	3	0	0	3
PRACTICAL						
5	PTPR8611	Mechatronics and Robotics Lab	0	0	3	2
		TOTAL	**12**	**0**	**3**	**14**

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTPR8701	Computer Integrated Manufacturing	3	0	0	3
2	PTPR8702	Manufacturing Management	3	0	0	3
3		Elective II	3	0	0	3
PRACTICAL						
5	PTPR8711	Project Work	0	0	9	6
		TOTAL	**9**	**0**	**9**	**15**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 101
(15+14+15+14+14+14+15)

ELECTIVES FOR B.E. PRODUCTION ENGINEERING – PART TIME (R-2013)

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1	PTGE8251	Environmental Science & Engineering	3	0	0	3
2	PTMG8651	Total Quality Management	3	0	0	3
3	PTPR8001	Advances in Operations Research	3	0	0	3
4	PTPR8002	Applied Probability and Statistics	3	0	0	3
5	PTPR8003	Micro Electro Mechanical Systems and Nano Technology	3	0	0	3
6	PTPR8004	Micromachining and Fabrication	3	0	0	3
7	PTPR8005	Non Destructive Testing Methods	3	0	0	3
8	PTPR8006	Plant Layout and Material Handling Systems	3	0	0	3
9	PTPR8007	Processing of polymers and composites	3	0	0	3
10	PTPR8008	Purchasing and Materials Management	3	0	0	3
11	PTPR8009	Selection of Materials	3	0	0	3
12	PTPR8071	Engineering Economics and Financial Management	3	0	0	3
13	PTPR8072	Surface Engineering	3	0	0	3
14	PTGE8071	Disaster Management	3	0	0	3
15	PTGE8072	Human Rights	3	0	0	3

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

OBJECTIVES

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

UNIT I MATRICES 9

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

UNIT II FUNCTIONS OF SEVERAL VARIABLES 9

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

UNIT III ANALYTIC FUNCTION 9

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

UNIT IV COMPLEX INTEGRATION 9

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

UNIT V LAPLACE TRANSFORMS 9

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

TOTAL: 45 PERIODS

OUTCOMES

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

BOOKS FOR STUDY

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

REFERENCES

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

PTPH8151 ENGINEERING PHYSICS L T P C
3 0 0 3

OBJECTIVE:

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

UNIT I PROPERTIES OF MATTER 9

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

UNIT II ACOUSTICS AND ULTRASONICS 9

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

UNIT III THERMAL PHYSICS 9

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

UNIT IV APPLIED OPTICS 9

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its application - Lasers - Einstein's coefficients - CO_2, Nd:YAG and semiconductor lasers - homo junction and hetro junction - construction and working - applications - Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V SOLID STATE PHYSICS 9

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

TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

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

REFERENCES:

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

PTCY8152 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I CHEMICAL THERMODYNAMICS 9

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

UNIT II POLYMER CHEMISTRY 9

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

UNIT III KINETICS AND CATALYSIS 9

Introduction-reaction velocity, factors affecting reaction velocity, rate constant, order of reaction, molecularity, pseudo molecular reactions, zero, first, second, and third order reactions, reactions of fractional orders, determination of order of reactions. Catalysis: Auto catalysis -

Enzyme Catalysis: Michaelis-Menton equation; factors affecting enzyme catalysis. Heterogeneous Catalysis: Types of adsorption isotherms: Langmuir–Hinselwood and Rideal–Eley Mechanism.

UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Photoprocesses - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitisation. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram) and applications.

UNIT V NANOCHEMISTRY 9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

PTGE8151 COMPUTING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

The students should be made to:

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

UNIT I INTRODUCTION 9

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

UNIT II C PROGRAMMING BASICS 9

Problem formulation – Problem Solving - Introduction to ' C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS 9

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

UNIT IV FUNCTIONS AND POINTERS 9

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

UNIT V STRUCTURES AND UNIONS 9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

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

TEXTBOOKS:

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

REFERENCES:

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

PTGE8153 ENGINEERING MECHANICS L T P C
3 0 0 3

OBJECTIVE

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

UNIT I BASICS AND STATICS OF PARTICLES 9

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

UNIT II EQUILIBRIUM OF RIGID BODIES 9

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

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 9

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

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

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

REFERENCES:

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

PTPR8201 ELECTRICAL, ELECTRONICS AND CONTROL SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- To study about the electrical components, electronics devices, various types of motors, Control Systems and Measuring Systems.

UNIT I BASIC ELECTRICAL COMPONENTS. 9

Ohm's law, Kirchhoff's laws ,Faradays law, Lenz 's law, Transformers-principle , operation, properties, and characteristics , Motors- D.C , A.C, Servo, and Stepper-principles, operation, properties and characteristics .

UNIT II BASIC ELECTRONIC DEVICES: 9

R, L, C components- properties and types, Semiconductor devices – Diodes , BJT , FET, UJT, SCR, Displays -- operating principles, characteristics . and applications. Rectifier and power supply circuits.

UNIT III ANALOG AND DIGITAL CIRCUITS 9

Operational Amplifiers – properties and application as -amplifier , differentiator, integrator, summer, Comparator etc , Basics of Boolean Logic – Logic Gates, Flip-Flops, Shift-Registers, Counters, Timers, A/D and D/A Converters.

UNIT IV BASICS OF CONTROL SYSTEM 9

Introduction to control systems – open loop and closed loop, Test signals, Block diagram and signal flow graph representation, concept of pole -zero of system, realization of transfer functions. Time and Frequency response of dynamic systems, Stability analysis of control systems.

UNIT V MEASURING SYSTEMS 9

Measurements of Electrical quantities – voltmeter, ammeter, watt- meter, Digital Multi Meters, Cathode Ray Oscilloscopes, -frequency, phase, amplitude measurements. Recorders- tape recorder , X-Y recorders , UV recorders, Printers, Data loggers. Virtual instruments.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to construct analog and digital circuits with electrical and electronics component. They will be familier with the use of electrical and electronic measuring systems

TEXT BOOKS:

1. Millman.J. and Halkias.C., “Integrated Electronics”, Tata McGraw Hill, 2004.
2. J.J.Nagrath and Gopal, “control system engineering”, New age international (p) ltd., 2000.

REFERENCES:

1. Donald P Leach, Albert Paul Malvino and Goutam Saha,” Digital Principles & Applications”,6E, Tata McGraw Hill, 2006.
2. Helfrick.A.D., and Cooper.W.D., “‘Electronic Instrumentation and Measurement techniques”, Prentice Hall of India, 1998.
3. R.K .Rajput, Text book of Electrical Engineering, Firewell Media Publications, 2004.

PTPR8202 FOUNDRY AND WELDING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To understand the principle, procedure and applications of Foundry and Welding Processes.
- Class supported by video film shows on the various 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 & chills chaplets..

UNIT II WELDING PROCESSES 9

Introduction to soldering, brazing and welding Types of joints – plane of welding – edge preparation – filler material – flux – shielding gases – fusion welding – gas welding – 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- Counter gravity low pressure casting electro-magnetic casting.

UNIT IV SPECIAL WELDING PROCESSES 9

Shielded Metal Arc welding, Gas Metal Arc Welding-Gas Tungsten Arc Welding – Submerged arc welding – Flux Cored 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 – High frequency induction welding.

UNIT V TESTING OF CASTINGS & WELDMENTS 9

Causes and remedies for casting defects – welding defects – Destructive testing – NDT methods– Dye penetrant – magnetic particle – X-ray/Radiography -ultrasonic testing- Case studies in testing of welded joints & castings.

TOTAL: 45 PERIODS

OUTCOMES:

- Gives a comprehensive idea about the two different methods of production process.
- Student can select the appropriate process to make a part by the right method

TEXT BOOK:

1. P.L.Jain, Principle of Foundry Technology – Tata McGraw Hill – 2003.
2. R.S.Parmer Welding Engineering & Technology – Khanna Publishers – 2002.
3. Principle of metal casting, Heime, Looper and Rosenthal – Tata McGraw Hill – 2001.
4. Welding Technology, Little, Tata McGraw Hill – 2000.

REFERENCES:

1. Modern Welding Technology – B.Curry – Prentice Hall – 2002.
2. Welding Principle & applications – Larry Jeff in Delmar – 1997.
3. Foundry Engineering – Taylor HF Fleming, M.C. & Wiley Eastern Ltd., 1993.

PTPR8203 METAL CUTTING AND CNC MACHINES 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 TOOL MATERIAL, TOOL WEAR AND TOOL LIFE 9

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

UNIT II MECHANICS OF METAL CUTTING 9

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

UNIT III GEAR MANUFACTURE 8

Different methods of gear manufacture –— gear generation – different methods - gear hobbing , gear shaping, gear planning and bevel gear generation. gear broaching – gear finishing methods - shaving – grinding , lapping and gear honing

UNIT IV CNC MACHINES 9

NC, CNC & DNC – types of CNC – constructional features of CNC machines - feed back devices – preset & qualified tools – Machining center – Turning center – CNC wire cut EDM.

UNIT V CNC PROGRAMMING 10

Manual part programming – steps involved – sample programs in lathe & milling– canned cycles – Computer aided part programming – APT program.

TOTAL: 45 PERIODS

OUTCOME

- Acquired knowledge will equip the candidate in selection of proper tools of required nomenclature and materials and also the replacement of tools with respect to quality requirement.

TEXT BOOKS:

1. B.L.Juneja, G.S. Sekhon, Niting Seth, “Fundamentals of Metal Cutting and Machine Tools, New Age International Publishers, 2005.
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
5. Geoffrey Boothroyd, Winston A. Knight , "Fundamental sof Machining and Machine Tools"

PTPR8204 METALLURGY AND MATERIALS TESTING L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.
- To study the theoretical foundations of metallography, X- ray diffraction, electron diffraction, scanning electron microscopy, chemical and thermal analysis.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

ASTM grain size number. Constitution of alloys – phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide and Iron – Carbide & Iron Graphite equilibrium diagram. Classification of steel and cast iron - microstructures of Steels & Cast irons - properties and application- Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR.

UNIT II HEAT TREATMENT AND STRENGTHENING 9

Defintion – Full annealing, stress relief, recrystallisation and spheroidizing – normalizing, hardening and tempering of steel, – 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 – Strengthening methods.

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 steels – 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

Elastic, anelastic and viscoelastic behaviour - 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, ductile-brittle transition - fatigue and creep mechanisms – types of wear – preventions.

UNIT V CHARACTERISATION OF MATERIALS 10

Metallographic techniques – specimen preparation – resolution – phase contrast – quantitative techniques. X – Ray diffraction techniques – stereograhic projection - determination of crystal structure, lattice parameter, phase diagram and residual stress – quantitative phase estimation - application of Scanning electron microscope, EDX. Electron probe micro analysis, scanning Tunneling Microscope (STM) and Atomic Force Microscope – Thermo gravimetric Analysis.

TOTAL: 45 PERIODS

OUTCOME

- Students could understand the correlation between the structure and mechanical properties of engineering materials.
- Students could select or suggest a suitable material for any engineering application.
- Students could understand and the need, principle, procedure, applications and limitations of various characterisation techniques.

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. Culity B.D., Stock S.R. & Stock S. ‘Elements of X-ray diffraction’, PHI, 2005
5. Goldsten I.J., Dale E., Echin N.P & Joy D.C., ‘Scanning Electron Microscopy and X-ray micro analysis, ISBN-0306441756, Plenum Publishing Co., 2000.

PTPR8211 METAL CUTTING AND CNC LAB L T P C

0 0 3 2

OBJECTIVE:

- To expose the students to write, simulate and Machine the various operations in CNC machines with metal cutting concept.

LIST OF EXPERIMENTS

1. Tool life study on a single point turning tool.
2. Measurement of cutting forces in turning using lathe tool dynamometer.
3. Measurement of shear plane angle using chip-thickness ratio criteria.
4. Acceptance test on RAM type milling machine as per ISI test chart & Measurement of single point tool angles.
5. Spur Gear milling in gear shaper.
6. Gear hobbing - (i) Spur Gear / Helical Gear.
7. Programming and machining of step turning and taper turning operation in CNC Lathe.
8. Programming and machining of thread cutting and grooving operation in CNC Lathe.
9. Programming and simulation for canned cycle in CNC lathe.
   (i) Stock removing in facing cycle.
   (ii) Stock removing in turning cycle.

(iii) Grooving cycle.
(iv) Thread cutting cycle.

10. Programming for milling operations in a CNC milling simulation.
11. Programming for mirroring / scaling function / Pocket milling and drilling cycle in a CNC milling.
12. Programming for spur gear cutting operation and Programming for hexagonal cutting operation.
13. Programming and Simulation in CNC Router.
14. Virtual CNC Programming & Study And Operation Of Machining / Turning Centre.

TOTAL: 45 PERIODS

OUTCOME

- Trained students will be able to understand the working of CNC machines and mechanisms of metal cutting. Acquire knowledge to in proper selection of tools.

PTPR8301 FLUID POWER DRIVES AND CONTROLS L T P C
3 0 0 3

OBJECTIVES:

- To understand the working principle of hydraulic and pneumatic components and its selection.
- To design hydraulic and pneumatic circuits for different applications.

UNIT I INTRODUCTION TO FLUID POWER & HYDRAULICS PRINCIPLE 8

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

UNIT II FLUID POWER DRIVES 10

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

UNIT III FLUID POWER ELEMENTS 10

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

UNIT IV HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN 10

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

UNIT V ELECTRO PNEUMATICS AND PLC CIRCUITS 7

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

TOTAL: 45 PERIODS

OUTCOME:

- Gives confidence to design any fluid power circuit.
- Acts as a ball to integrate various activities in a manufacturing activity.

TEXT BOOKS:

1. S.Ilango, V.Soundarajan, “Introduction to Hydraulics and Pneumatics”, PHI Learning Pvt. Ltd, 2011.
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.
4. Anthony Esposito “Fluid power with applications”, 5th editor, Pearson education 2003.

PTPR8302 METAL FORMING PROCESSES L T P C
3 0 0 3

OBJECTIVE:

- To understand the principle, procedure and application of Bulk Metal Forming and Sheet Metal Forming.

UNIT I FUNDAMENTALS OF METAL FORMING 9

State of stress – Components of stress, symmetry of stress tensor, principle 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 9

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 9

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 9

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 – Explosive forming, electro hydraulic forming, Magnetic pulse forming and Super plastic forming.

UNIT V POWDER FORGING AND RECENT ADVANCES 9

Powdered metals and fabrication procedures, Applications, Preparation of powders, Compacting and sintering, Yield criteria and flow rules, Hot and cold pressing (HIP, CIP) –P/M forming – Electro forming – fine blanking – Hydro forming – Peen forming – Laser Forming – Micro forming – Isothermal forging – high speed for forging and extrusion near net shape forming – Ultra fine grained materials by severe plastic deformation CAD and CAM in forming.

TOTAL: 45 PERIODS

OUTCOMES

- The students can understand load requirements for various bulk metal forming with or without addition of heat. The students can understand tooling and press capacity for making sheet metal components.

TEXT BOOKS:

1. Dieter G.E., "Mechanical Metallurgy", McGraw Hill, Co., S.I. Edition, 2005
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

PTPR8303 QUANTITATIVE TECHNIQUES IN MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

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

UNIT I LINEAR PROGRAMMING 10

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

UNIT II REPLACEMENT MODELS AND GAME THEORY 8

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

UNIT III QUEUING MODELS AND SIMULATION 9

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

UNIT IV FORECASTING AND SEQUENCING 9

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

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

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

TOTAL: 45 PERIODS

OUTCOME

The students will be able to

(i) Formulate the given problem into a suitable model

(ii) Apply the appropriate optimisation technique

TEXT BOOKS:

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

REFERENCES:

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

PTPR8351 KINEMATICS AND DYNAMICS OF MACHINES L T P C
(Common to Production and Automobile) 3 0 0 4

OBJECTIVES:

- To understand the basic concepts of mechanisms and machinery.

UNITI MECHANISMS 9

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 9

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 9

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 9

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 9

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: 45 PERIODS

OUTCOME

- Students will be able to understand the concepts of mechanisms and machines
- Students can fabricate the mechanisms for their final year project work.

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.

PTPR8311 FLUID POWER LAB L T P C
0 0 3 2

OBJECTIVE:

- To study the functional aspects of different pneumatic and hydraulic Components and its use in circuits.
- To train the student in designing different pneumatic and hydraulic circuits for different applications.

LIST OF EXPERIMENTS

1. Study and use of pneumatic and hydraulic elements.
2. Simulation of speed control circuits in a hydraulic trainer.
3. Simulation of hydraulic circuits in a hydraulic trainer.
4. Simulation of single and double acting cylinder circuits using different directional control values.
5. One shot and regenerative pneumatic circuits.
6. Sequencing of pneumatic circuits.
7. Simulation of Electro-pneumatic circuits.
8. Simulation of Logic pneumatic circuits.
9. Simulation of electro pneumatic sequencing circuits.
10. Simulation of PLC based electro pneumatic sequencing circuits.
11. Simulation of pneumatic circuits using PLC.
12. To design and connect the circuits for the given problem (case study).
13. To compare the ladder diagram for electrical and PLC control for the given sequence.
14. Simulation of circuit for the given sequence using software.

TOTAL: 45 PERIODS

OUTCOME

- Will be able to automate stage by stage in present set up.
- Will be able to select the proper component for automation

PTPR8401 COMPUTER AIDED PRODUCT DESIGN L T P C
3 0 0 3

OBJECTIVES:

- 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 6

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 9

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

UNIT III GEOMETRIC MODELING 10

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 Ergonomics - Design for environment; Bench marking – FMEA – QFD – DOE – Taguchi method of DOE – Quality loss functions – Design for product life cycle.

UNIT V PRODUCT DATA MANAGEMENT 8

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

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply geometric modeling principles to design a component and also able to manage the product data and apply product life cycle management to industrial components.

TEXT BOOK:

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

REFERENCES:

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

PTPR8402 ENGINEERING METROLOGY L T P C
3 0 0 3

OBJECTIVES:

- To understand the concept of Engineering metrology.
- To learn about metrology instruments and application for various measurements.
- To introduce the concepts of computer applications in metrology.

UNIT I FUNDAMENTALS OF MEASUREMENT 8

Definition of Engineering metrology – Line, end and wave length standards of measurement – Errors in measurements – Limits, fits, tolerance and guage design – Inter changeability and selective assembly – Accuracy, precision and Calibration of instruments – Light interference and interferometry – Measurement of absolute length using interferometers.

UNIT II LINEAR AND ANGULAR MEASURING SYSTEMS 10

Linear and Angular measuring systems. Slip gauges, micrometers, verniers, dial gauges and surface plates – Concept of comparators mechanical, electrical, optical and pneumatic comparators – Angular measuring systems – angle gauges – Sine bar – Precision spirit level, Auto collimators – Angle dekkor – Clinometers – Straightness and flatness measurement using precision level and auto collimators.

UNIT III MEASUREMENT OF SURFACE TEXTURE AND MEASURING MACHINES 9

Surface texture – Definitions – types of surface texture – surface texture measurement methods Comparison – Profilometer – Surface texture measuring instruments – Measurement of run-out and concentricity straightness, flatness and alignment errors – Tool makers microscope – Optical and Laser Alignment telescope – Metroscope.

UNIT IV METROLOGY OF SCREW THREADS & GEARS 9

Metrology of screw threads & gears Internal and external screw threads – terminology - measurement of various elements of screw threads – thread micrometer two wire and three wire - methods, gear terminology measurement of various elements of gears pitch circle method, constant chord method, base tangent method – plug method – Rolling gear tester.

UNIT V LASER METROLOGY AND COMPUTER AIDED METROLOGY 9

Co-ordinate measuring machines – Probe sensors – Errors – Environmental factors – Laser micrometer Laser interferometer – Testing of geometric features of machine tools using laser interferometer – non contact and in-process inspection using laser – machine tool metrology – vision systems – Automic force microscope scanning tunneling microscope.

TOTAL: 45 PERIODS

OUTCOME

- Knowledge acquired will equip the students to produce quality parts by implementing the usage of right (appropriate) measuring system.

TEXT BOOKS:

1. Jain.R.K. “Engineering Metrology” Khanna Publishers, 2002

REFERENCES:

1. Gupta.I.C. “A text book of Engineering Metrology” Dhanpat Rai & Sons, 1996
2. Galyer G.N. and Shotbolt C.R. “Metrology for Engineers” ELBS 1990
3. “ASTE Hand book of Industrial Metrology” Prentice Hall of India Limited 1992
4. Rajput R.K. Engineering Metrology and Instrumentation” Kataria & Sons Publishers, 2001.

PTPR8403 JIGS, FIXTURES AND PRESS TOOLS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the concepts of various types of jigs, fixtures and dies.
- To design jig / fixture/ die for a given component.

UNIT I LOCATION AND CLAMPING DEVICES IN JIGS AND FIXUTRES 8

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 10

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 OPERATIONS AND FORMING DIES 8

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

UNIT IV ELEMENTS OF DIE 9

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 OF DIES, JIGS AND FIXTURES 10

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

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

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

REFERENCES:

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

PTPR8404 MACHINE COMPONENTS DESIGN L T P C
3 0 0 3

OBJECTIVE:

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

UNIT I INTRODUCTION 9

Fundamentals of Machine Design-Engineering Design, Phases of Design, Design Consideration - Standards and Codes - Selection of Materials –Design against Static and Dynamic Load –

Modes of Failure, Factor of Safety, Principal Stresses, Theories of Failure-Stress Concentration, Stress Concentration Factors, Variable Stress, Fatigue Failure, Endurance Limit, Design for Finite and Infinite Life, Soderberg and Goodman Criteria.

UNIT II DETACHABLE AND PERMANENT JOINTS 9

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

UNIT III SHAFTS, COUPLING AND BRAKES 9

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

UNIT IV GEARS AND BELT DRIVES 9

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

UNIT V SPRINGS AND BEARINGS 9

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: 45 PERIODS

OUTCOME

- Students can design any machine components while developing and fabricating the mechanisms considering the load conditions.
- They will be fit to become a design engineer.

TEXTBOOK:

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

REFERENCES:

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

PTPR8411 METROLOGY LAB

L	T	P	C
0	0	3	2

OBJECTIVE:

- To practice in the various measurement methods.

LIST OF EXPERIMENTS

1. Measurement of Angle using Sine bar/bevel protractor.
2. Inspection of Internal and External taper angle.
3. Measurement of Bore Diameter using different instruments.
4. Calibration of a dial gauge.
5. Measurement of Roundness.
6. Inspection of screw thread parameters using three wire method.

7. Measurement of surface texture.
8. Tool makers microscope- critical parameter measurement.
9. Measurement of tool angle by profile projector.
10. Inspection using vision measuring system.
11. Measurements using CMM.
12. Straightness measurement using Autocollimator.
13. Measurements using profile projector.
14. Measurement of dimensions using LASER.

TOTAL: 45 PERIODS

OUTCOME

- They will have the knowledge of selecting the proper instruments and measuring techniques for the measurement of various quality parameters of the components.

PTPR8501 FEA AND SYSTEM SIMULATION 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-Solution of Eigen value problems-Transient vibration analysis-Thermal transients.

UNIT V APPLICATION OF FINITE ELEMENT ANALYSIS 8

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

TOTAL: 45 PERIODS

OUTCOME

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

TEXT BOOKS:

1. Chandraputla T.R., and Belegundu A.D., "Introduction of Finite Element in Engineering", Prentice Hall of India, Third Edition, 2002.
2. Reddy. J.N., "An Introduction to Finite Element Method" McGraw Hill, Third Edition, 2005.

REFERENCES:

1. Rao.S.S., "The Finite Element Method in Engineering", Butterworth-Heinemann, fourth edition, 2004.
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.

PTPR8502 MODERN MANUFACTURING PROCESSES L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge to the students about various non traditional machining processes and the principles of rapid prototyping.

UNIT I MECHANICAL ENERGY BASED PROCESSES 8

Abrasive Jet Machining – Water Jet machining – Ultrasonic machining, (AJM, WJM and USM). Working Principle – equipments used – Process parameters – MRR – Variation in techniques used – Applications.

UNIT II CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES 10

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

UNIT III ELECTRICAL ENERGY BASED PROCESSES 8

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

UNIT IV THERMAL ENERGY BASED PROCESSES 10

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

UNIT V RAPID PROTOTYPING AND RAPID TOOLING 9

Introduction-Stereo Lithography-Fused Deposition Moulding-Selective Laser Sintering Laminated Object Manufacturing-Solid base curing-direct Manufacturing and Rapid Tooling.

TOTAL: 45 PERIODS

OUTCOME

- The students will be in a position to select and employ a particular non traditional machining process as well as a rapid prototyping technique based upon the application in industries.

TEXT BOOKS:

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

REFERENCES:

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

PTPR8503 QUALITY CONTROL AND RELIABILITY L T P C
3 0 0 3

OBJECTIVES:

- To impart the knowledge of the quality control, control charts and application and construction of various quality control charts and the selection.
- To study the significance of design of experiments and its application.
- To train the students in the field of reliability and its estimation.

UNIT I STATISTICAL PROCESS CONTROL 9

Quality control – Defenition – Quality Assurance Variation in process – Factors – control charts – variables X_R and X_σ, - Attributes P, C and U-Chart Estblishing and interpreting control charts process capability – Quality rating – Short run SPC.

UNIT II ACCEPTANCE SAMPLING 9

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 and LTPD – Use of standard sampling plans – Sequential sampling plan.

UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

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

UNIT IV RELIABILITY AND ITS PREDICTION 9

Life testing – Failure characteristics – Meantime to failure – maintainability and availability – reliability – system reliability – OC curves – reliability improvement techniques – Reliability testing techniques – Pareto analysis. MTBF MTTF – System reliability – OC curve Availability and Maintainability – Reliability Improvement techniques.

UNIT V FAILURE DATA ANALYSIS 9

Real time distribution, exponential, normal, log normal, gamma and weibull – reliability data requirements – Graphical evaluation.

TOTAL: 45 PERIODS

OUTCOME

- The students will be able to solve engineering problems in 1D, 2D problems by various methods like classical method and nodal approximation method.

TEXT BOOKS:

1. Amita Mitra "Fundamentals of Quality Control and Improvement" Pearson Education, 2002
2. Modares: Reliability & Risk Analysis Marcel Decker Inc. 1993.

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.

PTPR8551 PRODUCTION OF AUTOMOTIVE COMPONENTS L T P C
(Common to Production and Manufacturing) 3 0 0 3

OBJECTIVES:

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

UNIT I ENGINE 9

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

UNIT II ENGINE PARTS 8

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

UNIT III FUEL AND TRANSMISSION SYSTEM 10

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

UNIT IV CHASSIS AND SUSPENSION SYSTEM 8

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

UNIT V RECENT ADVANCES 10

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

TOTAL: 45 PERIODS

OUTCOME

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

TEXT BOOKS:

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

REFERENCES:

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

PTPR8511 ANALYSIS AND SIMULATION LAB L T P C
0 0 3 2

OBJECTIVE:

- To train the students to make use of software for simulation and analysis for various applications in the field of manufacturing engineering.

LIST OF EXPERIMENTS

1. One Dimensional FEA Problem.
   a. Truss structure analysis.
   b. Cantilever beam analysis.
   c. Temperature distribution problem.
2. Two Dimensional FEA Problem.
   a. Plane stress analysis.
   b. Axisymmetric analysis.
   c. Vibration Analysis.
3. Three Dimensional FEA Problem.
   a. 3D Shell Analysis.
   b. 3D Contact Analysis.
4. FEA Application in metal forming, Metal cutting, Casting process etc.
5. Preparation of Process Planning Sheet.
6. Simulation of simple mechanism using solid modeling software.
7. Routing & flow process chart.

TOTAL: 45 PERIODS

OUTCOME

- Students will be able to solve some engineering problems with the help of FEA simulation problems etc.

PTPR8601 MECHATRONICS FOR AUTOMATION L T P C
3 0 0 3

OBJECTIVE:

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

UNIT I MECHATRONICS SYSTEMS ANS SENSORS 9

Introduction to Mechatronics Systems, key elements, ways of integration – hardware and software. sensors – Characteristics –static and dynamic , types - linear , rotational, velocity

acceleration , force, torque , flow , temperature , proximity , optical , Micro and Nano sensors, selection of sensors

UNIT II ACTUATORS 9

Electrical actuators - switches – mechanical , solid state , solenoids, relays , Motors –Types and characteristics Micro and Nano actuators, Drive circuits for various actuators. Selection of actuators.

UNIT III SYSTEM MODELS AND SIMULATION 9

Building Models for Mechanical, Electrical, Fluid and Thermal Systems, Rotational - Transnational Systems, Electro mechanical Systems , Hydraulic – Mechanical Systems. Models Simulation using SIMULINK Packages.

UNIT IV MICROCONTROLLER AND APPLICATIONS 9

8051 processors – Architecture , ,Address modes, Instruction sets , simple programming exercises - Memories – different types , 8255 Programmable Peripherals interfacing – Different I/O devices , Stepper motor interface , A/D and D/A interface.

UNIT V MECHATRONICS SYSTEM DESIGN 9

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design – Optimization techniques in system design, Study of virtual instrumentation and its applications , Case studies in manufacturing.

TOTAL: 45 PERIODS

OUTCOME

- The students will learn various components of Mechatronics system and will be able to automate the systems in Mechatronics approach.

TEXT BOOKS:

1. W.Bolton, “MECHATRONICS” Pearson Education Limited, 2004.

REFERENCES:

1. R.K.Rajput.A Text Book of Mechatronics, Chand &Co, 2007.
2. Devadas shetty, Richard A. Kolk, “Mechatronics System Design”, PWS Publishing Company, 2001.
3. Dan Necsulescu. Mechatronics, Pearson Education, Inc.2002.
4. M.A Mazidi & M.J. Mazidi, Microcontroller and Embedded systems. PWS Publishing Company, 2001.

PTPR8602 OPERATIONS PLANNING AND COST ESTIMATION L T P C
3 0 0 3

OBJECTIVES:

- To develop a good process planning capabilities.
- To impart the knowledge on cost estimation of a given product.

UNIT I PROCESS PLANNING 7

Definition – Information required and advantages – process planning activities and chart selection of machining process, machine tools, grouping of jobs. Primary process selection – Manual process planning – case studies short comings of Manual process planning.

UNIT II ESTIMATION, COSTING AND ELEMENTS OF COST 9

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

UNIT III ANALYSIS OF OVERHEAD EXPENSES & METHODS OF DEPRECIATION 10

Overhead expenses – Factory expenses – Administrative expenses – selling and distributing expenses – Allocation of over head expenses – Depreciation – causes of depreciation – methods of depreciation.

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

Estimation of forging cost – Forging process – Forging operations – Losses in forging operations – Calculating forging cost – illustrative examples – estimation in Foundry shop – Estimation of pattern cost – Foundry losses – Steps for calculating casting costs – illustrative examples. Estimating welding costs – Introduction – Arc welding costs – Basic costing procedure (Arc welding) – Gas welding – Basic costing procedure (Gas welding) – illustrative examples.

UNIT V ESTIMATION OF MACHINING TIME

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

TOTAL: 45 PERIODS

OUTCOME

- The student will be in a position to develop process planning sheets for manufacturing various components and decide a selection of machines, equipment etc.

TEXT BOOKS:

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

REFERENCES:

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

PTPR8603 ROBOTIC ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To study the kinematics, drive systems and programming of robots.

UNIT I FUNDAMENTALS OF ROBOT 7

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 10

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, two fingered and three fingered grippers, internal grippers and external grippers, selection and design considerations of a gripper - gripper force calculation and analysis.

UNIT III SENSORS IN ROBOTICS 8

Force sensing, touch and tactile sensors, proximity sensors, non contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism. Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis – data reduction, segmentation, feature extraction, object recognition, other algorithms, applications – Inspection, identification, visual servoing and navigation.

UNIT IV ROBOT KINEMATICS AND PROGRAMMING 12

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

UNIT V APPLICATIONS OF ROBOT 8

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

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

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

REFERENCES:

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

PTPR8611 MECHATRONICS AND ROBOTICS LAB L T P C
0 0 3 2

OBJECTIVE:

- To understand the various concepts of sensors and robots.

- To impart practical knowledge in Robotic equipment, Simulation softwares and Microcontroller programming.

LIST OF EXPERIMENTS:

1. Study of characteristics of optical and temperature transducers
2. I/O port programming of an 8051 microcontroller.
3. Applications of ideal operational amplifiers.
4. Characterisation of DC brush servo motor.
5. PC parallel port and microcontroller interfacing of a unipolar stepper motor.
6. Servo Motor Control in a linear slide base.
7. Modelling and Simulation of mechanisms using ADAMS.
8. Kinematic analysis and verification of 2 DOF RR Configuration robot.
9. Analysis and synthesis of two degree of freedom planar robot.
10. Robot control with stepper motor interfacing.
11. Experimental verification of Frankenstein equation for 1 DOF robot.
12. Experiments on LVDT.
13. AC & DC power control.
14. Distance measurement using Acoustic techniques.

TOTAL: 45 PERIODS

OUTCOME

- Help them to design mechatronic system.
- To appreciate the design of proper robotic type

PTPR8701 COMPUTER INTEGRATED MANUFACTURING L T P C
3 0 0 3

OBJECTIVE:

- 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.

UNIT I INTRODUCTION TO CIM AND AUTOMATED PRODUCTION SYSTEMS 8

Product design & CAD, CAM, CAD/CAM and CIM – CIM Hardware and software – three step process for implementation of CIM – production concepts– Automation – Reasons for Automation and Automation strategies – The future automated factory. 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.

UNIT II MATERIAL HANDLING AND STORAGE SYSTEM 10

Factors influencing material handling system – 10 principles of Material handling – Material transport system – Industrial Trucks, Mono-rails and other rail-guided vehicles, conveyors, cranes & Hoists – Automated guided vehicle system – Types. Guidance technology, vehicle management, despatch rules and safety.Storage systems – Performance, storage location strategies, conventional methods – Automated Storage and Retrieval systems – carousel storage systems.

UNIT III GROUP TECHNOLOGY AND CELLULAR MANUFACTURING 9

Part families – visual – parts classification and coding – case studies in coding – Production flow analysis – benefits of G.T. – Application of G.T.Cellular Manufacturing – Composite part concept – Machine cell design – Key machine concept - quantitative analysis in cellular manufacturing – Rank order clustering technique – Arranging machines in G.T. Cell – Hollier method 1 and 2.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM 9

FMS - Definition and Types – 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.

UNIT V AUTOMATED ASSEMBLY AND SHOP FLOOR CONTROL 9

Automated assembly – Fundamental – system configuration, part delivery at work station – Design for automated assembly.Shop floor control – Three phases – Factory data collection – manual method – Automated and semi automated data collection (ADC) – Bar code technologies and other ADC Technologies.

TOTAL: 45 PERIODS

OUTCOME

- The students will be in a position to apply computers to the various manufacturing activities in industries.

TEXT BOOK:

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

REFERENCES:

1. Radhakrishnan.P, Subramanyan.S and Raju.V, “CAD/CAM/CIM”, New Age International Publishers, 2000.
2. James A.Retrg and Henry W. Kraebher, “Computer Integrated Manufacturing”, Pearson Education, Asia, 2001.
3. Viswamathan.N and Narahari.Y, “Performance modelling of automated manufacturing system”, Prentice Hall of India Private Limited, 1994.
4. Kant Vajpayee.S, “Principles of Computer-Integrated Manufacturing “, Prentice Hall of India Private Limited, 2006.

PTPR 8702 MANUFACTURING MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To train production engineer to manage Industrial scenario.

UNIT I PRINCIPLES OF MANAGEMENT AND PERSONNEL MANAGEMENT 7

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

UNIT II INVENTORY MANAGEMENT 11

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

UNIT III OPERATIONS MANAGEMENT 10

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

UNIT IV FINANCIAL MANAGEMENT 10

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

UNIT V MARKETING MANAGEMENT 7

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

TOTAL: 45 PERIODS

OUTCOMES

- The students after successful completion of the course will be in a position to manage manufacturing and manufacturing related activities in industries and will be coordinate better with other department in industries.

TEXT BOOKS:

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

REFERENCES:

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

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

OBJECTIVES

To the study of nature and the facts about environment.

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

- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

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

Field study of common plants, insects, birds

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

UNIT II ENVIRONMENTAL POLLUTION 8

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

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

UNIT III NATURAL RESOURCES 10

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

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

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

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

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

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

TOTAL : 45 PERIODS

OUTCOMES:

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

PTMG8651 TOTAL QUALITY MANAGEMENT L T P C

(Common to Manufacturing, Mechanical, Printing, Production, CSE, Industrial, ECE, IT,EEE, Industrial, Leather, Automobile) 3 0 0 3

AIM

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

OBJECTIVES

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

UNIT I INTRODUCTION 9

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

UNIT II TQM PRINCIPLES 9

Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

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

UNIT IV TQM TOOLS & TECHNIQUES II 9

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

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits –Quality Council – Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXT BOOK:

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

REFERENCE BOOKS:

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

PTPR8001 ADVANCES IN OPERATIONS 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 – Sensitivity Analysis - 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

OUTCOMES

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

TEXT BOOKS:

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

PTPR8002 APPLIED PROBABILITY AND STATISTICS L T P C
3 0 0 3

OBJECTIVE:

- To train the students so that students will be able to design experimental designs and use these concepts for research design.

UNIT I PROBABILITY THEORY 14

Random variables – probability density and distribution functions-moment generating and characteristic functions – Binomial, Poisson, Normal distributions and their applications.

UNIT II SAMPLING THEORY 13

Sampling distributions – Standard error – t, F, Chi square distributions – applications.

UNIT III ESTIMATION THEORY 5

Interval estimation for population mean, standard deviation, difference in means, ratio of standard deviations – point estimation.

UNIT IV TESTING OF HYPOTHESIS 8

Hypothesis testing – Small samples – Tests concerning proportion, means, Standard deviations – Tests based on chi square

UNIT V ANOVA **5**

One, two factor models – Design of experiments.

TOTAL: 45 PERIODS

OUTCOME

- The student will be in a position to make statistical analysis or experimental results of project work.

TEXT BOOK:

1. Levin and Rubin, Statistics for Management, Prentice Hall of India, 2001.

REFERENCES:

1. Hooda, Statistics for business and economics, Macmillan India, 2001.
2. John.E.Freunds, "Mathematical statistics with applications", Pierson Education, 2004.
3. Gupta and Kapoor, Fundamentals of Mathematical Satistics, Sultanchand, 2002.

PTPR8003 MICRO ELECTRO MECHANICAL SYSTEMS AND NANO TECHNOLOGY **L T P C 3 0 0 3**

OBJECTIVE:

- To expose the students to the evolution of micro electromechanical systems, to the various fabrication techniques and to make students to be award of micro actuators.

UNIT I MATERIALS FOR MEMS AND MINIATURISATION **6**

Definition – historical development – fundamentals – Scaling laws in miniaturization – Rigid Body dynamics, Electrostatic Forces, Electromagnetic properties, Electricity, diffusion property, optical property and Heat Transfer, Materials for MEMS and Microsystems – Si,Si compounds, Si Piezoressistors, GaAs, Quartz, Piezoelectric Crystals and Polymers – Doping of semiconductors – diffusion process.

UNIT II FABRICATION PROCESSES **10**

Photolithography – photo resist applications, light sources and postbaking – Ion implantation – diffusion process – oxidation – thermal oxidation, silicon dioxide, oxidation rate, oxide thickness by colour – chemical vapour deposition – enhanced CVD – Physical vapour deposition – sputtering – deposition by epitaxy – etching – chemical and plasma etching. Bulk micromanufacturing – wet etching, dry etching and etch stop – surface micromachining – LIGA process – SLIGA process.

UNIT III MICROSYSTEM – WORKING PRINCIPLE AND PACKAGING **10**

Microsensors – Optical, Pressure, Acoustic wave and Thermal sensors – Microactuation – thermal forces, shape memory alloys, piezoelectric crystals and Electrostatic Forces – MEMS with microactuators – Microgripper, Micromotor, microvalves and micropumps – Microaccelerometers – Microfluidics – micromirror array for video projection – Microsystem packaging – die level, device level and system level – Interfaces – Die preparation – surface bonding- wire bonding – sealing – Assembly of Microsystems – selection of packaging materials – signal mapping and transduction – pressure sensors packaging.

UNIT IV MICROSYSTEMS DESIGN **10**

Static bending of thin plates – Mechanical Vibration – thin film mechanics – Design considerations – constraints, selection of materials, selection of Manufacturing processes, selection of signal transduction, electromechanical system and packaging – Process design – Mechanical Design Thermomechanical loading, Thermomechanical stress analysis, Dynamic

Analysis and Interfacial fracture Analysis – simulation of Microfabrication process – Design of a Si die for a micropressure sensor – Fluid resistance in Microchannels – capillary electrophoresis network systems – Design of MEMS cell gripper – MOEMS – CMOS.

UNIT V NANO TECHNOLOGY 9

Classification of nano structures – effect of the nanometer length scale effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems. Fabrication methods – Top down processes – bottom up process – nano positioning systems.

TOTAL: 45 PERIODS

OUT COME

- To understand basics concepts of Nano technology and MEMS. It helps to design micro level sensors, micro-grippers, and its supporting systems.

TEXT BOOKS:

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. Norio Taniguchi, Nano Technology Oxford University Press, New York, 2003

REFERENCES:

1. Mark Madou Fundamentals of Microfabrication, CRC Press, New York, 1997.
2. The MEMS Hand book, Mohammed Gad-el-Hak, CRC Press, New York
3. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
4. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.
5. Ananthasuresh G.K. Vinoy K.J. Gopalakrishnan S. Bhat K.N and Aatre V.K., Microand smart systems, Wiley India Pvt. Ltd., New Delhi, 2010
6. Akhlesh Lakhtakia (Editor), "The Hand Book of Nano Technology, Nanometer Structure", Theory, Modeling and Simulations", Prentice-Hall of India (P) Ltd., New Delhi, 2007.
7. Rai-choudhury, P, "MEMS and MOEMS Technology and Application, PHI, New Delhi, 2009.

PTPR8004 MICROMACHINING AND FABRICATION L T P C
3 0 0 3

OBJECTIVE:

- To introduce the various types of micromachining processes and their Applications.

UNIT I INTRODUCTION 9

Introduction to micromachining process – Classification of micromachining and nanomachining processes – Molecular dynamics, principle of molecular dynamics simulation potential energy function – Boundary condition – MD simulation procedure.

UNIT II MICROFABRICATION METHODS 9

Methods of microfabrication – Maleno deposition – Electro discharge depositant, Chemical vapour deposition physical vapour deposition – Electro Chemical spark deposition – LIGA.

UNIT III MECHANICAL MICROMACHINING 9

Ultrasonic machining – Abrasive jet machining – Abrasive water jet machining, water jet machining – Beam energy micromachining – Electron beam machining, electro discharge machining, ion beam machining, focused con beam machining.

UNIT IV MICROMACHINING AND NANO FUNCTIONING WITH ABRASIVE FLOW 9

Process principle and description – Process Technology Selection of machine Effect of process parameter on performance – Mechanism of materials removal Magneto Rhological Nanofunctioning Process. Nano functioning – Smart Rhological fluids – Magneto Rhological polishing fluid – Rhological character is of MRP fluid – MRF process – MRAFF Process – MRJF process.

UNIT V HYBRID MICRO MACHINING 9

Chemical Mechanical polishing – Electro chemical spark micro machining – Electro discharge grinding – Electro lytic in process dressing – Application.

TOTAL: 45 PERIODS

OUTCOME

- To understand various micromachining techniques and able to suggest suitable micromachining for industrial components

TEXT BOOKS:

1. V.K.Jain – Introduction to Micromachining – Narrosa Publishing house 2010.

REFERENCES:

1. Sami Franssito : Introduction to Micro fabrication – Johnwiley and sons.
2. Jain V.K. Advanced machining process, Allied Publisher, Delhi 2002.
3. Mohammed Gad-el-Hat: “The MEMS Hand book” CRC Press 2006.

PTPR8005 NON DESTRUCTIVE TESTING METHODS L T P C
3 0 0 3

OBJECTIVES:

- To understand principle behind various NDT techniques.
- To study about NDT equipments and accessories.
- To learn working procedures of various NDT techniques.

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, Pentrant 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 A-Scan, B-Scan , C-Scan – Applications.

UNIT V RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS 9

Basic principle, Effect of radiation of 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

OUTCOMES

- Ability to defect the flow and other defects using non destructive testing procedure for industrial component.

TEXT BOOKS:

1. Baldev raj, T Jeyakumar, M. Thavasimuthu "Practical Non-Destructive Tesitng" 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.

PTPR8006 PLANT LAYOUT AND MATERIAL HANDLING SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- To introduce the concepts of Plant Layout and Materials Handling Systems and their Applications in industry.

UNIT I INTRODUCTION 9

Faciities in the production system – Manufacturing systems – Production Quantity – Product variety – Fixed production layout – Process layout Batch Production Group technology – Cellular layout – Analysis of material transport systems.

UNIT II PLANT LAYOUT 9

Layout for mass production – types of facilities and layouts used for different levels of production quantity and product variety – Single model and mixed model production lines – Flow line production layouts Set up time – Change over times – Manufacturing Support Systems – Automation migration strategy composite part concept – machine cell design – Arranging machines in a G.T. Cell.

UNIT III MATERIAL HANDLING 9

Material handling equipments – Industrial trucks manual and powered – Automated guided vehicle systems – monirails and other Rail Guided vehicles – Powered conveyors – cranes & hoists – Vehicles – Guidance technology – Self Guided vehicles – material handling management and safety.

UNIT IV ANALYSIS OF MATERIAL TRANSPORT SYSTEMS 9

Charting techniques in material handling – Analysis of vehicle based systems – Conveyor analysis – Single direction conveyor – Recirculating conveyor analysis.

UNIT V STORAGE SYSTEMS 9

Storage system performance – Comparison of storage strategies – storage location strategies conventional and automated storage systems. Automated storage and retrieval systems – Engineering Analysis of storage systems.

TOTAL: 45 PERIODS

OUTCOME

- The student will be in a position to develop goo dplant layouts and material handling system.

TEXT BOOKS:

1. MICKELL.P GROOVER "Automation production systems and computer integrated manufacturing" Prentice-Hall of India Private Limited, New Delhi – 110 001, 2005.

REFERENCES:

1. EASTMAN R.M. - "Materials handling" Marcel Dekker.Inc New York 1987.
2. Mulcahy.D.E. "Materials Handling Hand book" McGrah Hill, New York 1999.
3. GROOVER M.P. "Plant Layout and automation" John Wiley & Sons Inc. New York 1994
4. BLACK J.T. The Design of the factory with a future" McGraw Hill Inc, New York 1991.

PTPR8007 PROCESSING OF POLYMERS AND COMPOSITES L T P C
3 0 0 3

OBJECTIVES:

- To study matrix material, particulates and fibres of polymer matrix composites, MMC and ceramic matrix composites.
- To develop knowledge on processing, interfacial properties and application of computers.

UNIT I INTRODUCTION TO POLYMERS 8

Chemistry and Classification of Polymers – Glass transition temperature, thermal expansion molecular weight, stress strain behaviour - Properties of Thermo plastics – Properties of Thermosetting Plastics – Properties and application of Epoxy, polyester, PMMA, PEEK, Poly propylene, polymide, phenolics, polyetherimide – Merits and Disadvantages.

UNIT II PROCESSIONG OF POLYMERS 9

Extrusion – Injection Moulding – Blow Moulding Compression and Transfer Moulding – Casting – Thermo Forming General Machining properties of Plastics – Machining Parameters and their effect – Joining of Plastics – Mechanical Fasteners – Thermal bonding – Press Fitting.

UNIT III INTRODUCTION TO FIBRES AND COMPOSITE MATERIALS 9

Fibres – Fabrication, Structure, properties and applications – Glass, Boron, carbon, polyethylene, Kevlar, Aramid, Alumina, SiC Si_3N_4, B_4 C, ceramic and metallic fibers whiskers – Matrix materials structure – Polymers – metals and ceramics – Physical and chemical properties.

UNIT IV PROCESSING OF POLYMER MATRIX COMPOSITES 9

Open mould process, bag moulding, compression moulding with BMC and SMC filament winding – pultrusion – centrifugal casting – injection moulding – structure, properties and application of PMC's – Carbon Matrix Composites – Interfaces – Properties – recycling of PMC.

UNIT V PROCESSING OF – METAL MATRIX COMPOSITES AND CERAMIC MATRIX COMPOSITES 10

Solid state fabrication techniques – diffusion bonding – powder metallurgy techniques plasma spray, chemical and physical vapour deposition of matrix on fibres chemical vapour infiltration – Sol gel – liquid state fabrication methods – infiltration - squeeze, casting – Rheo casting – compocasting – interfaces properties – application of MMC and ceramic matrix composites – Primary and secondary processing of composites.

TOTAL: 45 PERIODS

OUTCOMES

- Ability to select suitable matrix, reinforce materials for polymer matrix composites, metal matrix composites and ceramics matrix composites

TEXT BOOK:

1. Krishnan K Chawla, Composite Materials Science and Engineering, International Edition, Springer, 2006.

REFERENCES:

1. Harold Belofsky, Plastics, Product Design and Process Engineering, Hanser Publishers, 2002.
2. Bera.E and Moet.A, High performance polymers, Hanser Publishers, 2001.
3. Rauwendaal, C., Polymer extrusion, Hanser publishers, 2000.

PTPR8008 PURCHASING AND MATERIALS MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To introduce the various aspects of Purchasing And Materials Management

UNIT I FUNCTIONS OF MATERIALS MANAGEMENT 6

Introduction to materials management – objectives – organization – Functions operating cycle – value analysis – make or buy decisions.

UNIT II PURCHASING MANAGEMENT 8

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

UNIT III STORES MANAGEMENT 8

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

UNIT IV INVENTORY MANAGEMENT 12

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

UNIT V QUANTITATIVE TECHNIQUES IN MATERIAL MANAGEMENT 11

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

TOTAL: 45 PERIODS

OUTCOMES

- To explain the functions and structure of materials, purchase and store management
- To perform analysis on materials planning

- To perform calculation using different inventory models.

TEXT BOOKS:

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

REFERENCES:

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

PTPR8009 SELECTION OF MATERIALS L T P C
3 0 0 3

OBJECTIVE:

- By considering various constraints like material chart, process attributes, Material cost, recyclability, materials are selected for the engineering components.

UNIT I MATERIALS AND PROPERTIES 9

Classes of engineering materials - Evolution of Engineering Materials-Definition of materials properties- Displaying material properties using materials selection charts- Forces for change in materials selection and design, Materials and the environment.

UNIT II FACTORS IN SELECTION PROCESS 10

Design process - types of design, design requirements, function, Material attributes. Shape and Manufacturing processes - Materials processing and design processes and their influence on design, Process attributes, Systematic process selection, Process selection diagrams, Process cost, Energy consumption for production, Material costs, availability and recyclability, Environmental consideration.

UNIT III MATERIALS SELECTION PROCESS 10

Materials selection methods: Screening, Ranking - weighted ranking, Performance indices - Materials selection charts, Deriving property limits and material indices, Structural indices. Shape factors, Efficiency of standard sections, Material limits for shape factors, Material indices which include shape-microscopic or micro structural shape factor, Co-selecting material and shape.

UNIT IV CASE STUDIES ON APPLICATIONS 9

Automobile materials (Body and Crank shaft), Marine structural materials (Hull and Propeller), Aircraft structural materials (Wings and landing gears), Materials for space (Gas turbines and Nose), Materials for power generation machinery (Boilers and Pressure vessels), Materials for medical applications (Surgical knives and Bone replacements), Chemical and petrochemical industries (Acid storage tanks and Fuel carrying pipes).

UNIT V SUBSTITUTION OF MATERIALS & MINI PROJECT WORK 8

Environmental design, Economics and environmental impact of materials, Hybrid materials: composites, sandwich structure, lattices and segmented structure, case studies on hybrid materials, polymer foams, Natural Biomaterials and Implantable Biomaterials. Students will carry out a materials selection exercise for a hypothetical design project, identifying selection parameters and potential materials.

TOTAL: 45 PERIODS

OUTCOME

- It gives in sight of various metallurgical properties of materials and to suggest suitable material for real time application with considering design constraints.

TEXT BOOK:

1. M F Ashby, "Materials Selection in Mechanical Design", third edition, Butterworth-Heineman, New York, 2005.
2. J A Charles and F A A Crane., "Selection and Use of Engineering Materials", second edition, Butterworth-Heinemann Ltd., 1989.

REFERENCES:

1. G E Dieter, "Engineering Design: A Materials and Processing Approach", Third Edition, McGraw-Hill, 2000.
2. ASM Handbook, Volume 20: Materials Selection and Design, ASM International, 1997.
3. H Petroski, "Invention by Design", Harvard University Press, 1997.
4. K. G. Budinski, M. K. Budinski, Engineering Materials: Properties and Selection, 6th edition, Prentice Hall, 1999.
5. Mahmoud M.Farag, Materials and Process Selection for Engineering Design, second edition, CRC Press, New York, 2007.

PTPR8071 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT L T P C
(Common to Production, Leather and Manufacturing) 3 0 0 3

OBJECTIVE:

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

UNIT I FINANCIAL ACCOUNTING 12

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

UNIT II PROFIT VOLUME ANALYSIS 10

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

UNIT III WORKING CAPITAL MANAGEMENT 8

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

UNIT IV CAPITAL BUDGETING 7

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

UNIT V ENGINEERING ECONOMICS 8

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

TOTAL: 45 PERIODS

OUTCOME

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

TEXT BOOKS:

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

REFERENCES:

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

PTPR8072 SURFACE ENGINEERING L T P C
(Common to Production and Manufacturing) 3 0 0 3

OBJECTIVE:

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

UNIT I METAL CLEANING AND PREVIEW ON SURFACE ENGINEERING 8

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

UNIT II THERMAL SPRAYING PROCESSES AND ELECTRODEPOSITED COATINGS 10

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

UNIT III HOT DIP COATING AND DIFFUSION COATINGS 10

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

UNIT IV NON-METALLIC COATING OXIDE AND COVERSION COATINGS 9

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

UNIT V QUALITY ASSURANCE, TESTING AND SELECTION OF COATINGS 8

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

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

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

REFERENCES:

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

PTGE8071 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I INTRODUCTION TO DISASTERS 9

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

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

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

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

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

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

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

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

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

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

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

TEXTBOOK:

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

REFERENCES

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

PTGE8072 HUMAN RIGHTS L T P C
3 0 0 3

OBJECTIVES :

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

UNIT I 9

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

UNIT II **9**

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

UNIT III **9**

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

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

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

TOTAL : 45 PERIODS

OUTCOME :

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

REFERENCES:

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