ANNA UNIVERSITY : : CHENNAI 600 025

UNIVERSITY DEPARTMENTS

R - 2008

B.E. MANUFACTURING ENGINEERING

III TO VIII SEMESTERS CURRICULUM AND SYLLABI

SEMESTER – III

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA9211	Mathematics – III	3	1	0	4
ME9252	Engineering Materials and Metallurgy	3	0	0	3
EE9211	Electrical Drives and Control	3	0	0	3
CE9213	Strength of Materials	3	0	0	3
ME9211	Mechanics of Machines	3	1	0	4
MF9201	Manufacturing Processes – I	3	0	0	3
PRACTICAL					
CE9214	Strength of Materials Laboratory	0	0	3	2
EE9212	Electrical Engineering &Measurements Laboratory	0	0	3	2
ME9204	Manufacturing Technology Laboratory - I	0	0	3	2
MF9202	Metallurgy and Non Destructive Testing Laboratory	0	0	2	1
	TOTAL	**18**	**2**	**11**	**27**

SEMESTER IV

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA9261	Probability and Statistics	3	1	0	4
MF9251	Manufacturing Processes – II	3	0	0	3
CE9211	Fluid Mechanics and Machinery	3	1	0	4
ME9261	Machine Design	3	1	0	4
ME9215	Thermodynamics	4	0	0	4
MF9252	Engineering Metrology	3	0	0	3
PRACTICAL					
ME9256	Manufacturing Technology Laboratory - II	0	0	3	2
CE9212	Fluid Mechanics and Machinery Laboratory	0	0	3	2
ME9307	Dynamics Laboratory	0	0	3	2
ME9264	Machine Drawing	0	0	4	2
	TOTAL	**19**	**3**	**13**	**30**

SEMESTER V

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MF9301	Casting and Welding Technology	3	0	0	3
MF9302	Metal Forming Technology	3	0	0	3
MF9303	Precision Engineering	3	0	0	3
MF9304	Computer Aided Design	3	0	0	3
ME9303	Hydraulics and Pneumatics	3	0	0	3
MF9305	CNC Machining Technology	3	0	0	3
PRACTICAL					
MF9306	CAM Laboratory	0	0	4	2
MF9307	Metrology Laboratory	0	0	2	1
MF9308	CAD Laboratory	0	0	2	1
MF9309	Technical Seminar	0	0	2	1
	TOTAL	**18**	**0**	**10**	**23**

SEMESTER VI

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MG9362	Industrial Management	3	0	0	3
ME9301	Design of Jigs, Fixtures and Press Tools	3	0	0	3
MF9351	Computer Integrated Production Management System	3	0	0	3
ME9351	Finite Element Analysis	3	0	0	3
ME9352	Microprocessor and Micro controller	3	0	0	3
	Elective – 1	3	0	0	3
PRACTICAL					
ME9358	Microprocessor and Micro controller Laboratory	0	0	4	2
MF9352	Advanced Machine Tools Laboratory	0	0	4	2
GE9371	Communication Skills and Soft Skills Laboratory	0	0	2	1
	TOTAL	**18**	**0**	**10**	**23**

SEMESTER VII

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MF9401	Operations Research	3	0	0	3
ME9402	Mechatronics	3	0	0	3
GE9022	Total Quality Management	3	0	0	3
MF9402	Flexible Manufacturing systems	3	0	0	3
	Elective – II	3	0	0	3
	Elective – III	3	0	0	3
PRACTICAL					
MF9403	Design and Fabrication Project	0	0	6	3
ME9403	Computer Aided Simulation and Analysis Laboratory	0	0	3	2
ME9404	Mechatronics Laboratory	0	0	3	2
MF9404	Comprehension	0	0	2	1
	TOTAL	**18**	**0**	**14**	**26**

SEMESTER VIII

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
	Elective – IV	3	0	0	3
	Elective V	3	0	0	3
PRACTICAL					
MF9451	Project work	0	0	12	6
	TOTAL	**6**	**0**	**12**	**12**

LIST OF ELECTIVES FOR B.E.MANUFACTURING ENGINEERING

CODE NO	COURSE TITLE	L	T	P	C
MF9021	Product Design and Development	3	0	0	3
MF9022	Non Destructive Testing	3	0	0	3
MF9023	Rapid Prototyping	3	0	0	3
MF9024	Computer Simulation	3	0	0	3
MF9025	Quality Control and Reliability Engineering	3	0	0	3
MF9026	Processes Planning and Cost Estimation	3	0	0	3
MF9027	Processing of Plastics and Composite Materials	3	0	0	3
MF9028	Nuclear Engineering	3	0	0	3
MF9029	Total Productive Maintenance	3	0	0	3
MF9030	Micromachining Processes	3	0	0	3
MF9031	Robotics	3	0	0	3
MF9032	Artificial Intelligence	3	0	0	3
MF9033	Mechanical Vibration and noise	3	0	0	3
MF9034	Value Engineering and Reengineering	3	0	0	3
MF9035	Electronics Manufacturing Technology	3	0	0	3
ML9254	Powder Metallurgy	3	0	0	3
IE9035	Supply Chain Management	3	0	0	3
ME9022	New and Renewable Sources of Energy	3	0	0	3
ME9025	Design for Manufacturing	3	0	0	3
ME9032	Computational Fluid Dynamics	3	0	0	3
MA9262	Numerical Methods	3	1	0	4
GE9021	Professional Ethics in Engineering	3	0	0	3
GE9023	Fundamentals of Nanoscience	3	0	0	3
PT9071	Packaging Materials and Technology	3	0	0	3

MA9211 **MATHEMATICS III** **LT P C**
(Common to all branches of B.E. / B.Tech Programmes) **3 1 0 4**

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

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

UNIT I FOURIER SERIES 9+3
Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM 9+3
Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9+3
Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's Linear equation – Integral surface passing through a given curve – Solution of linear equations of higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3
Method of separation of Variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 9+3
Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value theorems – Formation of difference equation – Solution of difference equation using Z-transform.

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

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

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

ME9252 ENGINEERING MATERIALS AND METALLURGY L T P C
3 0 0 3

OBJECTIVE:
To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9
Constitution of alloys – Solid solutions, substitutional and interstitials – Phase diagrams and microstructure development: Isomorphous, eutectic, peritectic, eutectoid and peritectroid alloy systems. Iron-Iron carbide equilibrium diagram, Development of microstructures in Iron- carbon alloys.

UNIT II HEAT TREATMENT 9
Full annealing-stress relief, Recrystalisation- Spheroidizing, Normalising, Hardening and tempering of steel. Isothermal transformation diagrams- TTT– CCT cooling curves - Hardenability, Jominy end quench test – Austempering, martempering – case hardening, carburizing, nitriding, cyaniding, carbonotriding –flame and induction hardening – vacuum and plasma hardening – current trends- thermo-mechanical treatments- elementary ideas on sintering.

UNIT III FERROUS AND NON FERROUS METALS 9
Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W)- classification of steels (tool steel, stainless)– cast irons – alloy cast irons- Copper and Copper alloys – Aluminum and its alloys- Magnesium and its alloys– Titanium and its alloys- Nickel and Cobalt alloys, properties and applications of these materials.

UNIT IV NON-METALLIC MATERIALS 9
Types, properties and applications: Polymers, Ceramics and Composites– Super conductors- nanomaterials and their properties.

UNIT V MECHANICAL PROPERTIES AND TESTING 9
Crystal imperfections- Dislocations- Strengthening mechanisms- Elastic, anelastic and viscoelastic behaviour – modulus of elasticity- plastic deformation- Mechanical tests- tension, compression, impact, hardness- effect of temperature, grain size , solutes and precipitates on dislocation dynamics – Mechancism of Fracture - mechanism of creep- creep resistant materials- creep tests- fracture toughness- ductile-brittle transition – deformation mechanism maps- fatigue fracture-fatigue test.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Raghavan. V. Materials Science and Engineering", Prentice Hall of India Pvt.Ltd, 5th edition, 2007.
2. Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised Indian edition 2007.

REFERENCES

1. George E. Dieter, Mechanical Metallurgy, McGraw Hill, 2007.
2. Syndney H Avner, "Introduction to Physical Metallurgy", 2/E Tata McGraw Hill Book Company, 2007.
3. Kenneth G. Budinski and Michael K. Budinski "Engineering Materials", PHI / Pearson Educations, 8th Edition, 2007.
4. G.S. Upadhay and Anish Upadhay, "Materials Science and Engineering", Viva Books Pvt. Ltd, 2006.
5. James F. Shackelford and Madanpalli K. Muralidhara, Introduction to Materials Science for Engineers, Pearson Education, 6th edition, 2007.

EE9211 ELECTRICAL DRIVES AND CONTROL L T P C
3 0 0 3

AIM:
To provide knowledge in the area of electrical dives and their control techniques

PREREQUISTE:
Basic Electrical Engineering

OBJECTIVE:
To impart knowledge on
- Basics of electric drives
- Different speed control methods
- Various motor starters and controllers
- Applications

UNIT I INTROUDCTION 9
Fundamentals of electric drives – advances of electric drive-characteristics of loads – different types of mechanical loads – choice of an electric drive – control circuit components: Fuses, switches, circuit breakers, contactors. Relay – control transformers.

UNIT II SPEED CONTROL OF DC MACHINES 9
DC shunt motors – Speed Torque characteristics - Ward Leonard method, DC series motor – series parallel control – solid state DC drives – Thyristor bridge rectifier circuits-chopper circuits.

UNIT III SPEED CONTROL OF AC MACHINES 9
Induction motor – Speed torque Characteristics – pole changing, stator frequency variation - slip-ring induction motor – stator voltage variation - Rotor resistance variation, slip power recovery – basic inverter circuits- variable voltage frequency control.

UNIT IV MOTOR STARTERS AND CONTROLLERS 9
DC motor starters : using voltage sensing relays, current sensing relays and time delay relays - wound rotor induction motor starters – starters using frequency sensing relays - DOI -starter and auto transformers starter.

UNIT V HEATING AND POWER RATING OF DRIVE MOTORS 9
Load diagram, over load capacity, insulating materials, heating and cooling of motors, service condition of electric drive – continuous, intermittent and short time – industrial application.

TOTAL : 45 PERIODS

TEXT BOOKS

1. N.K De and P.K Sen ‘Electric Drives’ Prentice Hall of India Private Ltd,2002.
2. Vedam Subramaniam ‘Electric Drives’ Tata McGraw Hill ,New Delhi,2007
3. V.K Mehta and Rohit Mehta ‘ Principle of Electrical Engineering’ S Chand & Company,2008

REFERENCES

1. S.K Bhattacharya Brinjinder Singh ‘Control of Electrical Machines’ New Age International Publishers,2002.
2. John Bird ‘Electrical Circuit theory and technology’ Elsevier, First Indian Edition, 2006.

CE9213 STRENGTH OF MATERIALS L T P C
3 0 0 3

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 8

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

UNIT II TRANSEVERSE LOADING ON BEAMS AND STRESSES IN BEAMS 13

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending - bending formula – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 6

Stresses and deformation in circular and hollows shafts – Stepped shafts – Shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs.

UNIT IV DEFLECTION OF BEAMS 10

Double Integration method – Macaulay's method – Area moment theorems for computation of slopes and deflections in beams – Conjugate beam and energy method – Maxwell's reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses – deformation in thin cylinders –spherical shells subjected to internal pressure – deformations in spherical shells - Lame's theory – application of theories of failure

TOTAL : 45 PERIODS

TEXT BOOKS

1. Rajput.R.K. "Strength of Materials" S.Chand & co Ltd. New Delhi 1996
2. Jindal U.C. "Strength of Materials" Asian Books Pvt Ltd, New Delhi 2007

REFERENCES

1. Egor.P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi 1997
2. Subramanian R. "Strength of Materials" Oxford University Press,Oxford Higher Education series ,2007
3. Hibbeler , R.C, Mechanics of materials", Pearson Education, Low price Edition,2007

ME9211 MECHANICS OF MACHINES LT P C
3 1 0 4

OBJECTIVES:

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

UNIT I KINEMATIC OF MECHANICS 10

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

UNIT II GEARS AND GEAR TRAINS 9

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

UNIT III FRICTION 8

Sliding and Rolling Friction angle – friction in threads – Friction Drives – Friction clutches – Belt and rope drives – brakes – Tractive resistance.

UNIT IV FORCE ANALYSIS 9

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

UNIT V BALANCING AND VIBRATION 9

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

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

TEXT BOOKS

1. Ambekar A.G., "Mechanism and Machine Theory" Prentice Hall of India, New Delhi, 2007
2. Shigley J.E., Pennock G.R and Uicker J.J., "Theory of Machines and Mechanisms", Oxford University Press, 2003

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh.A, and A.K.Mallick, "Theory and Machine", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
3. Rao.J.S. and Dukkipatti R.V. "Mechanisms and Machines", Wiley-Eastern Ltd., New Delhi, 1992.
4. V.Ramamurthi, Mechanisms of Machine, Narosa Publishing House, 2002.
5. Robert L.Norton, Design of Machinery, McGraw-Hill, 2004.

STANDARDS

1. IS 2458:2001, Vocabulary of Gear Terms – Definitions related to Geometry.
2. IS 3756 : 2002, Method of Gear Correction – Addendum modification for External cylindrical gears with parallel axes.
3. IS 5267 : 2002 Vocabulary of Gear Terms – Definitions Related to Worm Gear Geometry.
4. IS 12328 : Part 1 : 1988 Bevel Gear Systems Part -1 Straight Bevel Gears.
5. IS12328 : 1988 Bevel Systems Part – 2 Spiral Bevel Gears.

MF9201 MANUFACTURING PROCESSES - I LT P C
3 0 0 3

AIM:
To provide the coverage of the breadth and depth of the field of manufacturing. So that students can become familiar with some of the basic metal cutting, and related machining process.

OBJECTIVES:
At the end of this course the student should be able to understand
- Methods to solve problems on cutting forces, tool life and analytical methods of estimating cutting temperature.
- Constructional features of lathe, drilling, shaper, planer, boring, broaching, and grinding machines, accessories and common operations performed on these machines.
- Machine tool structures, erection and testing of machine tools
- Concept of automation of machine tools.

UNIT I FUNDAMENTALS OF METAL CUTTING 9
Tool geometry- Mechanics of orthogonal and oblique cutting - mechanism of chip formation- Types of chips produced in cutting -Cutting forces - Merchant's circle diagram – simple problems -Cutting temperature-causes, effects, measurement, estimation and control-Tool failure modes-wear mechanisms – tool life - simple problems- Machinability -Surface finish and integrity of machined surfaces- Machining economics- cutting tool materials- Cutting tool reconditioning-Cutting fluids.

UNIT II BASIC MACHINING PROCESSES 12
Lathe: Kinematic arrangement -Specification - Types - Mechanisms - work holding devices- Operations - Drilling: Specification - Types - Mechanism - Operations - Drill tool nomenclature –-Boring: Specification - Types - Operations - Boring tool - Jig Boring machine – Reamer and tap Milling: Specification – Types - Cutter nomenclature – Types of cutter - mounting of cutters Operations - Indexing - Cam and thread milling- Shaper: Specification - Types – Mechanism- Planer: Specification - Types - Mechanism - Broaching: Specification - Types - Tool nomenclature - Broaching process.

UNIT III GRINDING AND FINISHING OPERATIONS 8
Grinding: Types of grinding machine - Designation and selection of grinding wheel - Abrasives- Bonds -bonded abrasives - Reconditioning of grinding wheel – grinding operations and machines wheel grinding -Design Considerations for grinding - economics of grinding- finishing operation. - deburring - lapping, honing, burnishing - super finishing operations.

UNIT IV GEAR CUTTING 8
Gear cutting methods-Kinematics of gear shaping and gear hobbing – template gear cutting methods-Gear generation principles specifications - Bevel gear generator – Gear finishing methods-gear grinding –lapping

UNIT V MACHINE TOOL STRUCTURE AND AUTOMATION 8
Classification Machine tool structures-Vibration and chatters in machining-erecting and testing of machine tools-Automation: Cam controlled automats, single spindle and multi spindle automats - Swiss type, automatic screw mechanism - Feeding mechanism Transfer mechanism, Tracer controller mechanism.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Geoffrey Boothroyd, Winston A. Knight, “Fundamentals of metal machining andmachine tools ”, CRC , 2nd edition, 1988.
2. P.C.PANDY,C.K.SINGH,”Production Engineering and Science”, Standard Publishers distributors, New Delgi, 2003.

REFERENCES

1. S.K. HAJRA CHOUDRY, S.K.BOSE, A.K. HAJRA CHOUDRY " Elements of Workshop Technology Vol II: Machine tools", Media promoters and Publishers Pvt Ltd, 2002
2. P.C.SHARMA, A Text book of Production Technology, S.Chand and Co., Ltd., 1999.
3. KRAR, OSWARD, Technology of Machine Tools, McGraw Hill International Editions,1991.
4. ROY A LINDBERG, Fourth Edition, Process and Materials of Manufacture, Prentice-Hall of India, 1994.
5. E.PAUL DeGARMA, J.T.BLACK and RONALD A.KOSHER, Eighth Edition, Materials and Processes in Manufacturing Prentice-Hall of India, 1997.

CE9214 STRENGTH OF MATERIALS LABORATORY L T P C
0 0 3 2

OBJECTIVE:

To study the properties of materials when subjected to different types of Loading.

LIST OF EXPERIMENTS

1. Tension test on mild steel rod.
2. Double shear test on metals.
3. Torsion test on mild steel rod.
4. Impact test on metal specimen.
5. Hardness test on metals.
6. Compression test on helical spring
7. Deflection test on carriage spring.

TOTAL : 45 PERIODS

EE9212 ELECTRICAL ENGINEERING &MEASUREMENTS LABORATORY L T P C
0 0 3 2

AIM

To provide the practical knowledge and control methods of electrical machines

OBJECTIVE

To impart practical knowledge on

- Characteristic of different machines
- Method of speed control of machines
- Measurement of various electrical parameters

LIST OF EXPERIMENTS

1. Study of DC & AC Starters
2. Study of Transducers
3. Wheatstone Bridge and Schering Bridge
4. ADC and DAC Converters
5. Speed Control of DC Shunt Motor
6. Load Test on DC Shunt Motor
7. OCC & Load Characteristics of DC Shunt Generator
8. Load Test on Single-Phase Transformer
9. Load Test on Three-Phase Induction Motor
10. Load Test on Single-Phase Induction Motor.

TOTAL : 45 PERIODS

ME9204 MANUFACTURING TECHNOLOGY LABORATORY - I LT P C
0 0 3 2

OBJECTIVE
Student should have knowledge on common basic machining operations

LIST OF EXPERIMENTS
Measurement of the Machined Components and Machining time estimation of:

1. Taper Turning
2. External thread cutting
3. Internal thread cutting
4. Eccentric Turning
5. Knurling
6. Square Head Shaping
7. Hexagonal Head Shaping
8. Drilling and Tapping
9. Determination of Cutting forces in Turning Operations.

TOTAL : 45 PERIODS

REFERENCES

1. Hajra Choudhury, S.K and Hajra Choudhury. A.K., " Elements of Workshop Technology', Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 1997.
2. Sharma, P.C.A Text book of Production Technology, S. Chand and Co. Ltd., 2004.
3. Roy. A. Lindberg, "Process and Materials of Manufacture", Pearson Education Fourth Edition 2006

MF9202 METALLURGY AND NON DESTRUCTIVE TESTING LABORATORY L T P C
0 0 2 1

OBJECTIVES
To gain practical knowledge in
- Microstructure analysis of various steels, Cast Iron and Non ferrous Materials.
- Heat Treatment of steels
- Creep and formability tests and
- Important Non Destructive Tests.

LIST OF EXPERIMENTS
1. Microstructure analysis of steel (Mild, Medium carbon, High carbon, Hardened & Spheroidised Steel), Cast iron
2. Sintering processes
3. Microstructure analysis of Non ferrous alloys
4. Heat treatment of steel
5. Creep test
6. Formability test
7. Cooling curve experiment
8. Liquid penetrant test
9. Ultrasonic flaw detection
10. Magnetic particle testing
11. Eddy current testing.

TOTAL : 30 PERIODS

MA 9261 PROBABILITY AND STATISTICS LT P C
3 1 0 4

AIM:
This course aims at providing the required skill to apply the statistical tools in engineering problems.

OBJECTIVES:
- The students will have a fundamental knowledge of the concepts of probability.
- Have knowledge of standard distributions which can describe real life phenomenon.
- Have the notion of sampling distributions and statistical techniques used in management problems.

UNIT I RANDOM VARIABLES 9 + 3
Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 9 + 3
Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 9 + 3
Sampling distributions - Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – χ^2-test for goodness of fit – Independence of attributes – Non-parametric tests: Test for Randomness and Rank-sum test (Wilcoxon test).

UNIT IV DESIGN OF EXPERIMENTS 9 + 3
Completely randomized design – Randomized block design – Latin square design - 22 - factorial design.

UNIT V STATISTICAL QUALITY CONTROL 9 + 3
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

T : 45 + 15 ,TOTAL : 60 PERIODS

TEXT BOOKS

1. Milton, J. S. and Arnold, J.C., “Introduction to Probability and Statistics”, Tata McGraw Hill, 4th edition, (2007).
2. Johnson, R.A. and Gupta, C.B., “Miller and Freund’s Probability and Statistics for Engineers”, Pearson Education, Asia, 7th edition, (2007).

REFERENCES

1. Devore, J.L., “Probability and Statistics for Engineering and the Sciences”, Thomson Brooks/Cole, International Student Edition, 7th edition, (2008).
2. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., “Probability and Statistics for Engineers and Scientists”, Pearson Education, Asia , 8th edition, (2007).
3. Ross, S.M., “Introduction to Probability and Statistics for Engineers and Scientists, 3rd edition, Elsevier, (2004).
4. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., “Schaum’s Outline of Theory and Problems of Probability and Statistics”, Tata McGraw Hill edition, (2004).

MF9251 MANUFACTURING PROCESSES – II LT P C
3 0 0 3

AIM:
To give the insight, principles of basic forming, casting and joining processes to the student. So that they will be able to analyze the merits and limitations of each processes while making process selection.

OBJECTIVE:
- At the end of this course the student should be able to understand
- The tools, equipment and principle of operation of primary and secondary manufacturing processes.
- Defects, causes and their remedies of welding, casting and metal forming operations.
- Processing of plastics and fabrication of various types composite material.
- Equipment, principle of operation of non traditional machining and forming processes.

UNIT I CASTING PROCESSES 9
Casting Terminology – Pattern – Types of Patterns – Pattern allowances – Moulds Moulding Tools – Machines and Materials – Core – Core Making – Sand Moulding methods – Melting furnaces – fluxing – Inoculation – Die-casting processes-Cleaning, Inspection and repairing of castings.

UNIT II METAL FORMING PROCESSES 9
Hot working & Cold working of metals – Forging Machines - Forging operations– Rolling Types of Rolling mills – Rolling operations – Extrusion – Extrusion processes– Rod, wire and tube drawing - Bending – Principle & types- Deep drawing – Principle & Types Sheet metal forming operations such as squeezing, spinning, peen ,stretch forming and super plastic forming.

UNIT III FABRICATIOIN PROCESSES 9
Welding – Classification of welding – Electric Arc Welding- Equipment – Consumables – processes – Gas Welding – Equipment – Processes – Resistance welding – Types of Resistance welding – Soldering & Brazing – Adhesive bonding – Welding Inspection – Defects, Causes & Remedies.

UNIT IV PROCESSING OF PLASTICS AND COMPOSITES 9
Types of plastics – Processing of thermo plastics – Extrusion, Inspection blow, Rotatromal moulding processes – Calendaring, Film blowing, Thermo forming Processing of thermosets - Compression, Transfer, Jet Moulding processes – Bonding of thermoplastics- Laminated plastic –– Composites- types- Fabrication Methods advantages ,limitations and applications.

UNIT V UNCONVENTIONAL METHODS OF MANUFACTURING 9
Introduction – Need –classification -Electro-Discharge Machining – Electro-Chemical Machining – Laser Beam Machining – Abrasive Jet Machining –Water jet Cutting Ultrasonic Machining –– High Velocity Forming of Metals – Explosive Fabrication – Hydro forming – Electro-hydraulic Forming – Magnetic pulse Forming – Electron Beam Machining.

TOTAL : 45 PERIODS

TEXT BOOKS

1. S.Gowri, P.Hariharan, A.Suresh Babu “Manufacturing Technology-I”,Pearson Education, 2008
2. P.C.SHARMA, A Text book of Production Technology, S.Chand and Co., Ltd., 1999.

REFERENCES

1. R.K.Rajput, "Manufacturing Technology (Manufacturing Processes), Latmi Publications Ltd., New Delhi,2007
2. D.K.Singh, "Fundamentals of Manufacturing Engineering", Ane Books India, New Delhi,2008
3. R.B.Gupta, "Foundry Engineering", Sataya Prakasham, New Delhi,2002
4. R.S.Parmar, "Welding Processes and Technology", Khanna Publishers, New Delhi,2003

CE9211 **FLUID MECHANICS AND MACHINERY** **LT P C**

(Common for Manufacturing, Mechanical, Mining and Industrial Engineering) **3 1 0 4**

AIM:

The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated under standing of the transport of mass, momentum and energy.

OBJECTIVES:

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

UNIT I INTRODUCTION 9 + 3

Units and dimensions, Properties of fluids – specific gravity, specific weight, viscosity, compressibility, vapor pressure and gas laws – Capillarity and surface tension – Flow characteristics: Concepts of system and control volume. Application of control volume to continuity equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9 + 3

Laminar flow through circular conduits and circular annuli. Boundary layer concepts. Boundary layer thickness. Hydraulic and energy gradient. Darey-Weisbach equation. Frictioon factor and Moody diagram. Commercial pipes. Minor losses. Flow through pipes in series and pipes in parallel.

UNIT III DIMENSIONAL ANALYSIS 7 + 2

Dimensions and units; Buckingham's Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

UNIT IV ROTODYNAMIC MACHINES 12 + 4

Homologous units. Specific speed Elementary cascade theory. Theory of turbomachines. Euler's equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V POSITIVE DISPLACEMENT MACHINES 8 + 3

Reciprocating pumps, indicator diagram. Work saved by air vessels. Rotary pumps. Classification. Working and performance curves.

T: 45 + 15 ,TOTAL : 60 PERIODS

TEXT BOOKS

1. Streeter V.L. and Wylie, E.B.Fluid Mechanics, McGraw Hill, 1983

2. Ramamritham, S. Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai and Sons, Delhi 1988.

REFERENCES

1. Kumar, K.L. Engineering Fluid Mechanics(7th Edn.) Eurasia Publishing House (P)Ltd.New Delhi, 1995.
2. Bansal R.K. Fluid Mechanics and Hydraulic Machines. Laxmi Publications (P) Ltd.New Delhi.

ME9261 MACHINE DESIGN L T P C
3 1 0 4

OBJECTIVE

- To familiarise the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data.
- To learn to use catalogues and standard machine components

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

Introduction to the design process – factor influencing machine design, selection of materials based on mechanical properties – Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and 'C' frame – Factor of safety – theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations.

UNIT II DESIGN OF SHAFTS AND COUPLINGS 10

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

UNIT III DESIGN OF TEMPORARY AND PERMANENT JOINTS 9

Threaded fastners – Design of bolted joints including eccentric loading, Knuckle joints, Cotter joints – Design of Welded joints, riveted joints for structures – theory of bonded joints.

UNIT IV DESIGN OF ENERGY STORING ELEMENTS 8

Design of various types of springs, optimization of helical spings – rubber springs – Design of flywheels considering stresses in rims and arms, for engines and punching machines.

UNIT V DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS 9

Sliding contact and rolling contact bearings – Design of hydrodynamic journal bearings, McKee's Eqn., Sommerfield Number, Raimondi & Boyd – Selection of Rolling Contact bearings – Design of Seals and Gaskets – Design of Connecting Rod.

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

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

TEXT BOOKS

1. Shigley J.E. and Mischke C.R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw Hill, 2003.

2. Bhandrari V.B, “Design of Machine Elements”, Second Edition, Tata McGraw-Hill Book Co., 2007.

REFERENCES

1. Sundararajamoorthy T.V, Shanmugam N, “Machine Design”, Anuradha Publications, Chennai.
2. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
3. Ugural A.C, “Mechanical Design – An Integral Approacho, McGRaw-Hill Book Co, 2004.
4. Spotts A.F., Shoup T.E, “Design and Machine Elements” Pearson Education, 2004.

STANDARDS

1. IS 10260 : Part I : 1982 Terms, definitions and classification of Plain bearings Part 1 : Construction.
2. IS10260 : Part I : 1982 Terms, definitions and classification of Plain bearings Part 2 : Friction and Wear.
3. IS 10260 : Part I : 1982 Terms, definitions and classification of Plain bearings Part 3 : Lubrication

ME9215 THERMODYNAMICS L T P C
4 0 0 4

AIM:

To impart the importance of thermal science aspects in the field of manufacturing engineering.

OBJECTIVES:

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

UNIT I BASIC CONCEPTS OF THERMODYNAMICS 9

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

UNIT II FIRST AND SECOND LAW OF THERMODYNAMICS 9

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

UNIT III HEAT ENGINES 14

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

UNIT IV GASES AND VAPOUR MIXTURES 9

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

UNIT V HEAT TRANSFER 9

Conduction – Plane Wall, Cylinder system, Composite Walls – Critical insulation thickness – Simple, fins convection – Free convection and forced convection – Flow over Flat plates and Flow through Pipes – Radiation – Black Body, Grey Body Radiation.

TOTAL: 60 PERIODS

TEXT BOOKS

1. "Thermodynamics an Engineering Approach" Yunus A. Cenegal and Michael A.Boles, Tata McGraw hill, Fourth edition, 2004.
2. "Fundamentals of Engineering Thermodynamics" Michael J.Moran, Howard N.Shapiro, John wiley &Sons, Fourth editon,2000.

REFERENCES

1. "A Text book of Engineering Thermodynamics" R.K.Rajput , Laxmi puplication(P) Ltd. ,Third Edition, 2007.
2. "Engineering Thermodynamics" P.K.Nag, Tata McGraw hill, Third edition, 2005
3. "A course in Thermal engineering" S.Domkundwar, C.P.Kothandaraman, Dhanpat rai & co (p) Ltd, Fifth edition, 2000.

MF9252 ENGINEERING METROLOGY LT P C
3 0 0 3

AIM:

To give a thorough knowledge of measurement and instrumentation of increasing importance in industry. The student will be knowledgeable in various standards and proliferation of computerized and automated inspecting techniques along with the classical metrology.

OBJECTIVE:

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

UNIT I BASIC CONCEPTS OF MEASUREMENTS 8

Need for measurement – Dimensional and Form tolerances – Precision and Accuracy – Errors in Measurements – Causes – Types – Handling of measuring instruments – Maintenance of Instruments – Standards and Practice – Metrology lab – Environment and conditions.

UNIT II LINEAR AND ANGULAR MEASUREMENTS 9

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

UNIT III FORM MEASUREMENTS 9

Measurement of Screw thread and gears – Radius measurement – Surface finish measurement – Auto collimator – Straightness, Flatness and roundness measurements – Principles – Application.

UNIT IV OPTICAL MEASUREMENTS 10

Optical microscope, interference microscope, Tool makers microscope, Vision systems, Precision instrument based on Laser – Use of Lasers – Principle – Laser Interferometer – Application in Linear and Angular measurements – Testing of machine tools using Laser Interferometer.

UNIT V ADVANCES IN METROLOGY 9

Co-ordinate measuring machine – Constructional features – Types – Applications of CMM – CNC CMM applications – Computer Aided Inspection – Machine Vision – Applications in Metrology.

Nanometrology – Introduction – Principles – Nanometer metrology systems – Methods of measuring length and surfaces to nano scale result with interferometers and other devices

TOTAL: 45 PERIODS

TEXT BOOKS

1. Gaylor, Shotbolt and Sharp, "Metrology for Engineers", O.R.Cassel, London, 5th Edition, 1993.
2. R.K.Jain, "Engineering Metrology", Khanna Publishers, 19th Edition, 2005

REFERENCES

1. Thomas, "Engineering Metrology", Butthinson & Co., 1984.
2. Industrial Metrology, Graham T. Smith, Springer-Verlag London Ltd 2002
3. White house, D. J, "Handbook of Surface & Nanometrology", The institute of Physics, London, 1994.
4. M.Mahajan, "A text-Book of Metrology", Dhanpat Rai & Co. (P) Ltd. 2006.

ME9256 MANUFACTURING TECHNOLOGY LAB - II LT P C
0 0 3 2

AIM:

To acquire skills on common basic machining operations and press working

OBJECTIVE:

To study and practice the basic machining operations in the special purpose machines and acquire its applicability in the real time components manufacturing industries.

LIST OF EXPERIMENTS

1. Contour Milling using vertical milling machine
2. Gear Cutting & Gear Hobbing
3. Hexagonal Machining using Horizontal Milling Machine
4. Gear Cutting – Gear Shaping
5. Spline Broaching
6. Exercise in Surface Grinding
7. Exercise in Cylindrical Grinding
8. Exercise in Tool and Cutter Grinder
9. Spur and helical gear cutting in Milling Machine
10. Determination of cutting forces in Milling Machine
11. Study of Turret and Capstan lathe
12. Forming of Simple Components in Press Working and simple Calculations of sheet metal work

TOTAL : 45 PERIODS

REFERENCES

1. Sharma, P.C.A Text book of Prod, S. Chand and Co. Ltd., 2004.
2. Kalpakjian, S., " Manufacturing Engineering and Technology", Pearson Education India Edition, 2006.
3. Roy. A. Lindberg, "Process and Materials of Manufacture", Pearson Education Fourth Edition 2006

CE9212 FLUIDS MECHANICS AND MACHINERY LABORATORY L T P C
0 0 3 2

AIM:

To perform experiments an various types of pumps and turbines to understand their characteristics.

OBJECTIVES:

- To understand the concepts flow through different cross sections.
- To understand and draw characteristics of various pumps.
- To understand and draw performance characteristics of different turbines.

UNIT I FLOW MEASUREMENT

Calibration of Flow Measuring instruments – venturimeter, orificemeter, rotometer, Calibration of flows in open channels – weirs and notches. Estimation of friction factor in flow through pipes.

UNIT II PUMPS

Determination of performance characteristics of pumps – centrifugal pumps, submersible pumps, turbine pumps and positive displacement pumps – reciprocating and gear pumps.

UNIT III TURBINES

Determination of performance characteristics of turbines – reaction turbines and impulse turbines.

TOTAL : 45 PERIODS

REFERENCE

1. CWR, Hydraulics Laboratory Manual,2004

ME9307 DYNAMICS LABORATORY L T P C
0 0 3 2

AIM:

To apply the knowledge gained in kinematics and dynamics of machines to real system.

OBJECTIVES:

- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

LIST OF EXPERIMENTS:

1. a) Study of gear parameters.
   b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential

gear trains.

2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.
   b) Kinematics of single and double universal joints.
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
   b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.
   c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
4. Motorized gyroscope – Study of gyroscopic effect and couple.
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
7. a) Single degree of freedom Spring Mass System – Determination of natural frequency and verification of Laws of springs – Damping coefficient determination.
   b) Multi degree freedom suspension system – Determination of influence coefficient.
8. a) Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies.
   b) Vibration Absorber – Tuned vibration absorber.
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
11. a). Balancing of rotating masses.
    b). Balancing of reciprocating masses.
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses.
    b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.
    c) Determination of transmissibility ratio using vibrating table.

Students should be familiar with the use of the following device/equipments depending upon availability.

1. Tachometers – Contact and non contact
2. Dial gauge
3. Stroboscope
4. Accelerometers – Vibration pickups
5. Displacement meters.
6. Oscilloscope
7. Vibration Shaker
8. F.F.T. Analyzer, and
9. Dynamic Balancing Machine.

TOTAL : 45 PERIODS

ME9264 MACHINE DRAWING LT P C
0 0 4 2

AIM:

A drawing drafted once may have to be read many times and perhaps by many persons. The best way of learning to read drawing is to learn to prepare them. The knowledge in machine drawing is essential tool for any one who expects to work in an industry or to become a professional engineer.

OBJECTIVE:

To train the students to prepare good and accurate drawing of various machine elements ,and assembly drawing of selected machine tool parts.

UNIT I FUNDAMENTALS OF MACHINE DRAWING 8

Code of practice for Machine Drawing – Conventions, Abbreviation and Symbols Sectional views – Types of sectional views Selection of Fits and Tolerances – Method of placing limit dimensions.

UNIT II BASIC MACHINE ELEMENTS 24

The required sectional view of the following machine elements are to be drawn as per the standards.
Threaded joints
Riveted joints
Welded joints
Key, Cotter and Pin joints
Shaft coupling
Bearing
Pipe joints
Gears
Surface finish and its representation

UNIT III ASSEMBLY DRAWING 28

The assembly drawing of the following machine tool parts is to be drawn from the given detailed drawing.
Screw jack, machine vice, swivel bearing
Lathe tailstock, Lathe tool post- Tool head of a shaper
Drilling jig- Drilling machine spindle
Engine piston and connecting rod
Recirculating ball screw, LM guide ways,
Hydraulic and Pneumatic chuck of CNC machine.

TOTAL : 60 PERIODS

TEXT BOOK

1. N.Sidheswar, P.Kanniah and V.S.Sastry, Machine drawing Tata McGraw Hill, 1997.

REFERENCES

1. N.D.Bhatt, Machine drawing, published by RC Patel, Chartstar bookstall, Anand, India, 1997.
2. K.R.Gopalakrishna Machine Drawing, Subhas publications, Subhas stores, 2004.

MF9301 CASTING AND WELDING TECHNOLOGY LT P C
3 0 0 3

AIM:

To impart knowledge on fundamentals of welding technology , cast design and advanced welding and casting processes.

OBJECTIVE:

At the end of this course the student should be able to understand

- Melting procedure of various materials
- Design principles of welding and casting
- Principles of advanced welding and casting processes
- Automation of welding and casting plant

UNIT I MELTING AND POURING 8

Principles of melting practice-fluxing- Degasification and inoculation- types of furnaces-Crucibles, Cupola, Oil fired furnaces – Electric arc and induction furnaces –Melting practice of cast iron, SG iron, steel, aluminum and copper alloys.

UNIT II CASTING DESIGN 10

Solidification of pure metals and alloys-shrinkage in cast metals-design of sprue, runner ,gate and risers-problems in design and manufacture of thin and unequal sections designing for directional solidification, minimum distortion and for overall economy - design problems of L,T,V,X and Y junctions.

UNIT III WELD DESIGN AND WELDING METALLURGY 10

Design of welded components-symbolic representation of welds on drawings- welding classes-residual stresses in welds-weld distortions-design consideration-strength consideration of welded joints-analysis of statistically loaded welded joints-welded structures subjected to fatigue loads.

UNIT IV SPECIAL CASTING AND WELDING PROCESSES 8

Evaporative pattern casting-ceramic mould casting –electro magnetic moulding-squeeze casting –investment casting-shell moulding- PAW-electron beam welding-laser beam welding- friction welding-ultrasonic welding – diffusion welding-high velocity oxy fuel processes

UNIT V QUALITY CONTROL AND AUTOMATION 9

Cleaning and inspection of castings – Casting defect and remedies – foundry automations-moulding machines-Automation of sand plant, moulding and fettling sections of foundry-Dust and fume control-Welding defects –causes and remedies – Non destructive tests – arc welding using robots-weld positioner and manipulators –weld seam tracking-vision system-arc sensing Welding

TOTAL: 45 PERIODS

TEXT BOOKS

1. PARMAR,R.S., Welding Processes and Technology, Khanna Publishers, 1997.
2. JAIN,P.L., Principles of Foundry Technology, Tata McGraw Hill, 2003.

REFERENCES

1. A.S.M Hand book, vol 15,casting,ASM international,1988
2. KLAS WEMAN, welding processes hand book, CRC press,2003
3. CARY and HOWARD,B., Modern Welding Technology, Prentice-Hall, 1989.
4. HEINE, R.W., LOPER.L.R., and ROSENTHAL,C, Principles of Metal Casting, Tata McGraw Hill, 1986.
5. MINKOFF,J., solidification and cast structure,wiley.1986
6. DAVIES, A.C., Welding (10th Edition), Cambridge University Press, 1996.

MF9302 METAL FORMING TECHNOLOGY LT P C
3 0 0 3

AIM:

To impart knowledge in various metal forming process

OBJECTIVES:

At the end of this course the student should be able to understand

- The tools, equipment and principle of operation of primary and secondary manufacturing processes.

- Defects, causes and their remedies of welding, casting and metal forming operations.
- Processing of plastics and fabrication of various types composite material.
- Methods to solve problems on cutting forces, tool life and analytical methods of estimating cutting temperature.

UNIT I INTRODUCTION TO METAL FORMING 7

Classification of Forming Processes - Temperature in Metal working - Hot and Cold working - Introduction to the theory of Plastic Deformation.

UNIT II THEORY AND PRACTICE OF BULK FORMING PROCESSES 15

Analysis of plastic deformation in Forging, Rolling, Extrusion and rod/wire drawing processes - Effect of friction, calculation of forces, work done - Process parameters, equipment used - Defects - applications - Recent advances in Forging, Rolling, Extrusion and drawing processes - Experimental techniques of evaluation of friction in metal forming.

UNIT III SHEET METAL FORMING 9

Conventional processes - H.E.R.F. techniques - Superplastic forming techniques - Principles and process parameters - Advantages, limitations and applications.

UNIT IV SPECIAL FORMING PROCESSES 7

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

UNIT V POWDER METALLURGY FORMING 7

Overview of P/M technique - Advantages - applications - Powder preform forging - powder rolling - Tooling and process parameters.

TOTAL : 45 PERIODS

TEXT BOOK

1. George E. Dieter, Mechanical Metallurgy, McGraw Hill International Book Company, 1988.

REFERENCES

1. Schuler - Metal forming hand book - Springer verlag publication, 1998.
2. Hosford, WF and CAD Dell, R.M. - Metal forming : Mechanics and Metallurgy, Prentice Hall, Englewood Cliffs, 1993.
3. Narayanasamy,R - Theory of Metal Forming Plasticity, Narosa Publishers, New Delhi Nagpal,G.R - Metal Forming Processes, Khanna Publishers, 1988.
4. Chakrabarthy,J - Theory of Plasticity, McGraw Hill Co, 1987.
5. Altan T - Metal Forming - Fundamentals and applications - American Society of Metals.

MF9303 PRECISION ENGINEERING LT P C
3 0 0 3

AIM:

To enable this students to understand the concept of precision engineering, its principles and importance as applicable to instruments and machines.

OBJECTIVE:

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

UNIT I PRECISION ENGINEERING 9

Introduction - Accuracy & precision – Need – application precision machining –Tool based Micro & Ultra precision Machining grinding – Thermal effects – Materials for tools and machine elements – carbides – ceramic, CBN & diamond.

UNIT II TOLERANCE AND FITS 8

Tolerance – Zone – fits – Variation – Hole & shaft system – limits – expected Accuracy of machining processes – Selective assembly – gauges acceptance tests for machine tools.

UNIT III ULTRA PRECISION MACHINE ELEMENTS 9

Introduction – Guide ways – Drive systems – Spindle drive – preferred numbers - Rolling elements – hydrodynamic & hydrostatic bearings – pneumatic bearings.

UNIT IV MEMS 10

Introduction – MEMS – principle – Elements – Characteristics – Design – Application: automobile defence, aerospace etc.,

UNIT V ERROR CONTROL 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. Nakazawa, H. Principles of Precision Engineering, Oxford University Press, 1994.
2. Precision Engineering – R.L. Murthy

REFERENCE

1. Institute of Physics Publishing, Bristol and Philadelphia, Bristol, BSI 6BE U.K.

MF9304 COMPUTER AIDED DESIGN LT PC
3 0 0 3

AIM:

To impart knowledge in the theoretical principles of Computer Aided Design

OBJECTIVE:

To familiarize the student with computer hardware and peripheral
Devices, mathematics of computer graphics, geometric modeling, CAD standards
And to impart fundamental knowledge in Finite Element Analysis

UNIT I INTRODUCTION 5

Product Cycle – Design Process – CAD Hardware – Mainframe, Mini, Workstation and Micro computer Based Systems, Input and Output Devices – Software – Operating System, Geometric Modeling capabilities – hardware Integration and Networking.

UNIT II COMPUTER GRAPHICS 9

Two dimensional transformations – Transformation of Straight Lines – Rotation – Reflection – Scaling – Combined Transformations – Translations and homogeneous co ordinates – Three dimensional transformations – Scaling – Rotation – Reflection – Translation – Projections – Orthographic and Isometric Projections – Clipping – Hidden Line and Surface Removal.

UNIT III GEOMETRIC MODELLING 9

Geometrical Modeling – wire frame, models – entities – surface models – entities – solid models – Entities – Boundary Representation (B-Rep) – Constructive Solid Geometric (CSG) – Sweep and Analytical Solid Modeling.

UNIT IV CAD STANDARDS 11

Graphical Kernel System (GKS) Programmers Hierarchical Interface for Graphics (PHIGS), Initial Graphics Exchange Specification (IGES), Standard for Exchange of product Model Data (STEP), Drawing Exchange Format (DXF), Dimensional Measurement Interface Specification (DMIS) – Introduction to Drafting and Modeling Systems.

UNIT V FINITE ELEMENT ANALYSIS 11

Introduction – Procedures – Element types – Nodal approximation – Element matrices, vectors and equations – Global connectivity – Assembly – Boundary conditions – Solutions techniques – Interfaces to CAD – Introduction to packages, Case Studies – Applications.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ibrahim Zeid, “CAD-CAM Theory and Practice”, Tata McGraw Hill Publishing Co.Ltd., 1991
2. D.F.Rogers and J.A.Adams, “Mathematical Elements in Computer Graphics”, McGraw–Hill Book Company, New York, 1976.

REFERENCES

1. P.Radhakrishnan and C.P.Kothandaraman, “Computer Graphics and Design”, Dhanpat Rai and Sons, New Delhi, 1991.
2. E.Dieter George, “Engineering Design”, McGraw-Hill International Edition, 1991.
3. P.Radhakrishnan and S.Subramanyam, “CAD/CAM/CIM”, Wiley Eastern Ltd., New Age International Ltd., 1994.

ME9303 HYDRAULICS AND PNEUMATICS L T P C
3 0 0 3

AIM:

To understand the basic of fluid power and its application in industrial automation.

OBJECTIVE:

This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic machines, components and systems and their application in recent automation revolution.

UNIT I FLUID POWER PRINCIPLES AND FUNDEMENTALS (REVIEW) 3

Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids Basics of Hydraulics – Pascal’s Law- Principles of flow – Work, Power and Torque. Properties of air– Perfect Gas Laws.

UNIT II HYDRAULIC SYSTEM AND COMPONENTS 13

Sources of Hydraulic power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps, Hydraulic Actuators: Cylinders – Types and construction, Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves- Types, Construction and Operation- Applications – Types of actuation. Accessories: Reservoirs, Accumulators, Intensifiers, Pressure Switches- Applications- Fluid Power ANSI Symbol.

UNIT III HYDRAULIC CIRCUITS 9

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

UNIT IV PNEUMATIC SYSTEM 8

Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Servo systems. Introduction to Fluidics, Pneumatic logic circuits.

UNIT V DESIGN OF HYDRALIC AND PNEMATIC CIRCUITS 12

Designing the components of hydraulic system for Drilling, Planning, Shaping, Punching, Press. – Selection, fault finding and maintenance of hydraulic components- Sequential circuit design for simple application using cascade method, Electro pneumatic circuits. Selection criteria of pneumatic components – Installation fault finding and maintenance of pneumatic components. Microprocessor and PLC- Applications in Hydraulic and Pneumatics- Low cost Automation – Hydraulic and Pneumatic power packs- case studies.

TOTAL : 45 PERIODS

TEXT BOOK

1. Anthony Esposito," Fluid Power with Applications", PHI / Pearson Education, 2005.

REFRENCES

1. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
2. Majumdar, S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw Hill, 2001
3. Majumdar, S.R., "Pneumatic Systems – Principles and Maintenance", Tata McGraw Hill, 2007.
4. Micheal J, Pinches and Ashby, J.G., "Power Hydraulics", Prentice Hall, 1989.
5. Dudelyt, A Pease and John J Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

MF9305 CNC MACHINING TECHNOLOGY L T P C
3 0 0 3

AIM:

To provide knowledge on principle, constructional features, programming, tooling and work holding devices in CNC machine tools

OBJECTIVE:

Upon completion of this subject, student will be able to:

- Understand evolution and principle of CNC machine tools
- Describe constructional features of CNC machine tools
- Explain drives and positional transducers used in CNC machine tools
- Write simple programs for CNC turning and machining centres
- Generate CNC programs for popular CNC controllers
- Describe tooling and work holding devices for CNC machine tools

UNIT I INTRODUCTION TO CNC MACHINE TOOLS 6

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

UNIT II STRUCTURE OF CNC MACHINE TOOL 10

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

UNIT III DRIVES AND CONTROLS 9

Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives – stepper motor, servo principle, DC and AC servomotors, Open loop and closed loop control, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosysn, laser interferometer.

UNIT IV CNC PROGRAMMING 11

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

UNIT V TOOLING AND WORK HOLDING DEVICES 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. "Mechatronics", HMT, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Warren S.Seamers, "Computer Numeric Control", Fourth Edition – Thomson Delmar, 2002.

REFERENCES

1. James Madison, "CNC Machining Hand Book", Industrial Press Inc., 1996.
2. Ken Evans, John Polywka & Stanley Gabrel, "Programming of CNC Machines", Second Edition – Industrial Press Inc, New York, 2002
3. Peter Smid, "CNC Programming Hand book", Industrial Press Inc., 2000
4. Berry Leathan – Jones, "Introduction to Computer Numerical Control", Pitman, London, 1987.
5. Radhakrishnan P "Computer Numerical Control Machines", New Central Book Agency, 2002.
6. Rao P.N., CAD/CAM, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002.

MF9306 CAM LABORATORY L T P C
0 0 4 2

AIM:

To provide practical knowledge in the area of CNC machine tools, PLC and Robots.

OBJECTIVE:

At the end of the course the student should understand

- Concepts of CNC programming and Machining on CNC turning center and Machining center
- Robot and PLC programming Methods

CNC LATHE
Programming, Simulation and Machining using the following features:
Straight & step turning - taper turning - thread cutting - machining of internal surface.

CNC MILLING
Programming, Simulation and Machining using the following features:

Linear, circular interpolation, pocket milling, slotting, peck drilling and other canned cycles

Generation of CNC program using CAM packages

Robot programming - Material handling applications

PLC ladder logic programming

TOTAL : 60 PERIODS

MF9307	**METROLOGY LABORATORY**	**L T P C** **0 0 2 1**

AIM:
To acquire skills in measuring basic contact and contact measuring instruments

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

LIST OF EXERCISES:
Contact methods:
1. Linear and Angular measurement using Autocollimator.
2. Measurement of composite error using gear tester.
3. Calibration of optical comparator and measurement of dimension
4. Determining the accuracy of electrical and optical comparator.
5. Measurement of taper angle using sine bar.
6. Measurement of various angles using Bevel Protractor.

Non-contact measurement techniques:

1. Measurement of Taper angle using Tool Makers Microscope.
2. Measurement of various elements of screw thread using Tools Makers Microscope.
3. Experiments in CMM.

TOTAL : 30 PERIODS

MF9308	**CAD LABORATORY**	**L T P C** **0 0 2 1**

AIM:
To provide practical knowledge in Computer aided modeling and assembly

OBJECTIVE:
To impart hands on experience to students in Geometric Modeling, Assembly and Engineering Drafting.

1. SKETCHER
Introduction- Basic sketch, Constraints – Geometry & Dimensional.

2. SOLID MODELING
Extrude, Revolve, Sweep, Loft, Datum plane creation etc.

3. SURFACE MODELING
Extrude & Revolve surfacing, Advance surfacing technique – Ruled & Loft surfacing, Mesh of curves, Free form surfaces, Surface operations – trium, merge, intersect, etc.

4. FEATURE MANIPULATION
Copy, Edit, Pattern, Suppress, History operations etc.

5. ASSEMBLY
Constraints, Patterns, exploded Views, Interference check, creating components from assembly, mass property calculations, BOM generations and assembly cut sections.

6. DRAFTING
Standard view, Sectional views and Detailing, BOM and Balloon creation.

TOTAL : 30 PERIODS

MF9309	**TECHNICAL SEMINAR**	**LT P C**
		0 0 2 1

To enrich the communication skills of the student and presentations of technical topics of interest, this course is introduced. In this course, a student has to present three Technical papers or recent advances in engineering/technology that will be evaluated by a Committee constituted by the Head of the Department.

MG9362	**INDUSTRIAL MANAGEMENT**	**LT P C**
		3 0 0 3

AIM:
To provide a clear understanding of basic management principles that leads to corporate building.

OBJECTIVES:
- To develop Industrial Management deals with not only functions of management but also organizational structure and dynamics.
- To develop modern concepts of Industrial Management

UNIT I INTRODUCTION **9**
Technology Management - Definition – Functions – Evolution of Modern Management – Scientific Management -Development of Management Thought. Approaches to the study of Management- Forms of Organization – Individual Ownership – Partnership – Joint Stock Companies – Co-operative Enterprises – Public Sector Undertakings, Corporate Frame Work – Share Holders – Board of Directors – Committees – Chief Executive – Line and Functional Managers, Constraints – Environmental – Financial – Legal – Trade Union–

UNIT II FUNCTIONS OF MANAGEMENT 9

Planning – Nature and Purpose – Objectives – Strategies – Policies and Planning Premises – Decision Making – Organizing – Nature and Process – Premises – Departmentalization – Line and staff – Decentralization – Organizational culture, Staffing - selection and training – Placement – Performance appraisal – Career Strategy – Organizational Development. Managing human factor –Controlling - Process of Controlling – Controlling techniques, productivity and operations management – Preventive control, Industrial Safety.

UNIT III ORGANIZATIONAL BEHAVIOUR 9

Definition – Organization – Managerial Role and functions – Organizational approaches, Individual behaviour – causes – Environmental Effect – Behaviour and Performance, Perception – Organizational Implications. Personality – Contributing factors – Dimension – Need Theories – Process Theories – Job Satisfaction, Learning Behaviour – Learning Curves, Work Design and approaches.

UNIT IV GROUP DYNAMICS 9

Groups – Contributing factors -Group Behaviour –– Group Norms, Communication – Process – Barriers to communication – Effective communication, leadership – formal and informal characteristics – Managerial Grid – Leadership styles – Group Decision Making – Leadership Role in Group Decision, Group Conflicts – Types –Causes – Conflict Resolution – Inter group relations and conflict, Organization, centralization and decentralization – Formal and informal – Organizational Structures – Organizational Change and Development – Change Process – Resistance to Change – Culture and Ethics.

UNIT V MODERN CONCEPTS 9

Management by Objectives (MBO) –, Management by Exception (MBE), Strategic Management - Planning for Future direction – SWOT Analysis – Evolving development strategies, information technology in management – Decisions support system – Management Games – Business Process Re-engineering(BPR) – Enterprises Resource Planning (ERP) – Supply Chain Management (SCM) – Activity Based Management (ABM) – Global Perspective - Principles and Steps – Advantages and disadvantages

TOTAL : 45 PERIODS

TEXT BOOK

1. Herald Knottz and Heinz Weihrich, 'Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition, 1980.

REFERENCES

1. S.Chandran, Organizational Behaviours, Vikas Publishing House Pvt.. Ltd, 1994
2. Ties, AF, Stoner and R.Edward Freeman, 'Management' Prentice Hall of India Pvt. Ltd. New Delhi 110011, 1992
3. Joseph J, Massie, 'Essentials of Management' Prentice Hall of India Pvt. Ltd. 1985

ME9301 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS LT P C
3 0 0 3

OBJECTIVES:

- To understand the functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of required views of the final design.

UNIT I LOCATING AND CLAMPING PRINCIPLES 8

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location –

Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

UNIT II JIGS AND FIXTURES 10

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES 10

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNIT IV BENDING FORMING AND DRAWING DIES 10

Difference between bending, forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing reverse re-drawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

UNIT V MISCELLANEOUS TOPICS 7

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke - Course should be supplemented with visits to industries.
(Use of Approved design Data Book permitted).

TOTAL : 45 PERIODS

TEXT BOOKS

1. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
2. Donaldson, Lecain and Goold “Tool Design”, III rd Edition Tata McGraw Hill, 2000.

REFERENCES

1. K. Venkataraman, “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2005.
2. Kempster, “Jigs and Fixture Design”, Hoddes and Stoughton – Third Edition 1974.
3. Joshi, P.H. “Press Tools” – Design and Construction”, Wheels publishing, 1996.
4. Hoffman “Jigs and Fixture Design” – Thomson Delmar Learning, Singapore, 2004.
5. ASTME Fundamentals of Tool Design Prentice Hall of India.Design Data Hand Book, PSG College of Technology, Coimbatore.

MF9351	COMPUTER INTEGRATED PRODUCTION MANAGEMENT SYSTEM	L T P C 3 0 0 3

AIM:

To enable the students to understand the importance of Computer Integrated Production Management System and related topics.

OBJECTIVE:

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

UNIT I PRODUCTION PLANNING AND CONTROL 10

Basic concepts – Types of production System - Functions of production planning and control – problems with Production Planning and Control – Computer Integrated Production Management System– Forecasting – Purpose and methods of forecasting – Single and Double Moving average methods – Single and Double exponential smoothing methods – Simple regression method of forecasting – errors in forecasting.

UNIT II MATERIAL REQUIREMENT PLANNING 10

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

UNIT III SHOP FLOOR CONTROL 7

Functions of shop floor control – order scheduling – order progress – Data logging and acquisition – Automated data collection – Control types – Sensor Technology.

UNIT IV COMPUTER AIDED PROCESS PLANNING 8

Need for process planning – Functions of process planning – Future trend of CAPP – Expert process planning system – case studies.

UNIT V APPROACHES TO CAPP 10

Variant process planning – part family search – Generative method of CAPP – Forward and Backward planning – input format – part description methods – CAD Models – Decision Logic – Artificial Intelligence – Knowledge Representation – Databases and Algorithms – Automatic Process Planning – Programming Practice using C, C++ for Computer Integrated Production Management System Applications

TOTAL : 45 PERIODS

TEXT BOOKS

1. Mikell P.Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2004.
2. S.Kant Vajpayee, Principles of Computer Integrated Manufacturing, Prentice Hall of India, 2006

REFERENCES

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

ME9351 FINITE ELEMENT ANALYSIS LT P C
3 0 0 3

AIM:
To appreciate the need for and applications of numerical techniques for solving problems in mechanical Engineering**.**

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

UNIT I INTRODUCTION 8
Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems – Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II ONE-DIMENSIONAL PROBLEMS 12
One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors. Assembly of Matrices - solution of problems from solid mechanics and heat transfer- Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation – Transverse deflections and Natural frequencies of beams.

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS 10
Second Order 2D Equations involving Scalar Variable Functions – Variational formulation – Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts – Quadrilateral elements – Higher Order Elements.

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 7
Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT V ISOPARAMETRIC FORMULATION AND MISCELLANEOUS TOPICS 8
Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems –

TOTAL : 45 PERIODS

TEXT BOOKS

1. Seshu. P. “Textbook of Finite Element Analysis” Prentice Hall of India, 2003.
2. J.N. Reddy, “ Finite Element Method” Tata McGraw Hill, 2003.

REFERENCES

1. Chandrupatla and Belegundu, “Introduction to Finite Elements in Engineering” PHI / Pearson Education, 2003.
2. Logan. D.L. “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002.
3. Cook R.D., Malkus. D.S. Plesha, ME., “Concepts and Applications of Finite Element Analysis”, John – Wiley Sons 2003.
4. S.S. Rao, “The Finite Element Method in Engineering “Butter worth Heinemann, 2001.

ME9352 MICROPROCESSOR AND MICROCONTROLLER L T P C
3 0 0 3

AIM:
To know the architecture, programming aspects application of 8085 microprocessor and microcontroller.

OBJECTIVE:
To impart knowledge on 8085 Microprocessor and 8051 Microcontroller and its applications. In addition the basic concepts and programming of 8085 Microprocessor and 8051 Microcontroller are introduced which are very much required in the emerging field of automation.

UNIT I 8085 MICROPROCESSOR 10
Introduction-Architecture of 8085-Pin Configuration-Addressing Modes-Instruction set.

UNIT II TIMING DIAGRAM AND PROGRAMMING 8
Instruction cycle-machine cycle-T states and Timing diagram of 8085- Calculation of instruction cycle timings- Assembly Language Programming using 8085 instructions.

UNIT III PERIPHERALS AND INTERFACING 12
Basic interfacing concepts-8255 Programmable Peripheral Interface- interfacing input keyboards- interfacing output display-interfacing memory-A/D and D/A Converters Interfacing.

UNIT IV 8051 MICROCONTROLLER 9
Introduction- Architecture of 8051- Pin configuration- Ports- External Memory- counters and Timers- Serial and Parallel Data I/O- Interrupts – Assembly language programming

UNIT V APPLICATIONS USING INTEL 8085 AND 8051 6
Temperature Control- Stepper Motor Control- Traffic Light Controller. Measurement and speed control of DC motor.

TOTAL : 45 PERIODS

TEXT BOOK
1. Krishna Kant, Microprocessors & Microcontrollers", Prentice Hall of India, 2007.

REFERENCES
1. M.A. Mazidi and J.C. Mazidi, "The 8051 Microcontroller and Embedded systems", PHI / Pearson Education, 2006.
2. P.K.Ghosh and P.R.Sridhar, "Introduction to Microprocessors for Engineers and Scientists", Prentice Hall of India, 2001
3. Kenneth J.Ayala, "The 8051 Microcontroller, Architecture, Programming and applications",Thomson Delmar Learning, Indian Edition, 2007.
4. Douclas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", Tata McGraw Hill, 1999.
5. L.A. Levental, Introduction to microprocessors Software and Hardware Programming", Prentice Hall Inc, 1978.
6. Aditya, P.Mathur, "Introduction to Microprocessors Software", Tata McGraw Hill, 1983
7. Ramesh Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085", Wiley Eastern, 1998.

ME9358 MICROPROCESSOR AND MICRO CONTROLLER LABORATORY **L T P C 0 0 4 2**

AIM:
To impart the knowledge on assembly language programming in 8085 microprocesor, its interfacing and applications,

LIST OF EXPERIMENTS

1. Study of 8085 Microprocessor and 8051 Microcontroller trainer kits and identifying the components.
2. 8085 and 8051 Assembly language programs
   i) Arithmetic operation
   ii) Ascending/descending order and finding largest/ smallest number in an array.
3. 8085 and 8051 Assembly Language Program for code conversion
   i) BCD to binary
   ii) binary to BCD
4. 8051 Assembly Language Program for timer operations.
5. Interfacing of 8 bit A/D and D/A converters using 8085 and 8051
6. Stepper motor interface using 8085 and 8051
7. Display unit interface with 8051 and 8051

TOTAL : 60 PERIODS

MF9352 ADVANCED MACHINE TOOLS LABORATORY **L T P C 0 0 4 2**

AIM:
To provide practical knowledge in Advanced machine tools

OBJECTIVE:
At the end of the course the students will be able to understand principle of working of advanced machine tools.

Simple exercises using the following machines:

1. CNC Wire cut EDM
2. CNC Precision grinding machine (surface and cylindrical)
3. CNC Laser engraving machine
4. Micro machining of 3D parts using
   a. Micro Turning
   b. Micro Milling
   c. Micro EDM
   d. Micro WEDM
   e. Micro WEDG
5. 3D Rapid Prototyping machine
6. CNC Machining centre
7. CNC Turning centre
8. Super finishing machines (Lapping and honing etc)
9. Ultrasonic welding machine

TOTAL : 60 PERIODS

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

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

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

I. PC based session

A. Career Lab (15 periods) Viewing and discussing audio-visual materials

1. **Resume / Report Preparation / Letter Writing:** (3)
   Letter writing – Job application with Resume - Project report - Email etiquette.
2. **Presentation skills:** (3)
   Elements of effective presentation – Structure of presentation - Presentation tools – Body language.
3. **Soft Skills:** (3)
   Time management – Stress management – Assertiveness – Negotiation strategies, Psychometrics - Analytical and logical reasoning.
4. **Group Discussion:** (3)
   Group discussion as part of selection process, Structure of group discussion – Strategies in group discussion – Mock group discussions.
5. **Interview Skills:** (3)
   Kinds of interviews – Interview techniques – Corporate culture – Mock interviews.

TOTAL 30 PERIODS

II. Class Room Session

1. **Resume / Report Preparation / Letter writing**: Students prepare their own resume and report. (9)
2. **Presentation Skills:** Students make presentations on given topics. (12)
3. **Group Discussion**: Students participate in group discussions. (12)
4. **Interview Skills**: Students participate in Mock Interviews (12)

Note: Classroom sessions are practice sessions.

REFERENCES:

1. Prakash P, Verbal and Non-Verbal Reasoning, Macmillan India Ltd., 2nd Edition, New Delhi, 2004.
2. John Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi 2004.
3. Paul V Anderson, Technical Communication, Thomson Wadsworth , 6th Edition, New Delhi, 2007.
4. Edgar Thorpe and Showick Thorpe, Objective English, Pearson Education, 2nd Edition, New Delhi 2007.
5. David Evans, Decision maker, CUP, 1997

Lab Requirement:
1. Teacher console and systems for students.
2. English Language Lab Software
3. Tape recorders

MF9401 OPERATIONS RESEARCH LT P C
3 0 0 3

AIM:
To develop the student efficient in optimizing using limited resources by knowledge in building different mathematical modeling and finding optimal solutions.

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

UNIT I LINEAR MODELS 15
The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8
Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS 6
Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS 6
Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS 10
Decision models – Game theory – Two person zero sum games – Graphical solution-Algebraic solution – Linear Programming solution – Replacement models – Models based on service life – Economic life – Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL : 45 PERIODS

TEXT BOOK
1. H.A. Taha, Operations Research, Prentice Hall of India, 2003, Sixth Edition.

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

ME9402 **MECHATRONICS** **LT P C**
3 0 0 3

AIM

To understand the principles, techniques & components of Mechatronics system And its design

OBJECTIVE

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

UNIT I INTRODUCTION 5

Introduction to Mechatronics- Systems- Concepts of Mechatronics approach-Need for Mechatronics- Emerging area of Mechatronics- Classification of Mechatronics.

UNIT II SENSORS AND TRANSDUCERS 12

Introduction – Performance Terminology- Potentiometers-LVDT-Capacitance sensors-Strain gauges- Eddy current sensor-Hall effect sensor- Temperature sensors- Light sensors- Selection of sensors- Signal processing

UNIT III MOTION CONTROL AND MEASUREMENT SYSTEM 12

Control system- Open Loop and Feedback Control-Measurement system-Drives and actuators-Control devices- Servo systems- Motion converters.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS 8

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

UNIT V DESIGN AND MECHATRONICS 8

Design process-stages of design process-Traditional and Mechatronics design concepts- Case studies of Mechatronics systems- Pick and place Robot- Autonomous mobile robot-Wireless suriviellance balloon- Engine Management system- Automatic car park barrier.

TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCES

1. Godfrey C. Onwubolu, "Mechatronics Principles and Applications", Elsevier, 2006
2. Devadas Shetty and Richard A.Kolk, “Mechatronics systems design”, PWS Publishing company 2007.
3. Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts and Applicatlions” Tata McGraw-Hill Publishing company Limited, 2003.
4. Michael B.Histand and Davis G.Alciatore,” Introduction to Mechatronics and Measurement systems”. McGraw Hill International edition,1999.
5. Bradley D.A, Dawson.D, Buru N.C and Loader A.J, “Mechatronics” Chapman an Hall, 1993.
6. Lawrence J.Kamm, “Understanding Electro-Mechanical Engineering – An Introduction to Mechatronics”, Prentice Hall of India Pvt Ltd, 2000.
7. Dan Necsulescu, “Mechatronics”, Pearson education,2002.
8. Newton C.Braga, “Mechatronics Sourcebook”, Thomson Delmar Learning, Eswar Press, 2003.

GE9022 TOTAL QUALITY MANAGEMENT LT P C
3 0 0 3

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

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

UNIT I INTRODUCTION 9
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES 9
Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9
The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II 9
Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS 9
Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL : 45 PERIODS

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

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

MF9402 FLEXIBLE MANUFACTURING SYSTEMS LT P C
3 0 0 3

AIM:
To impart knowledge on group technology, simulation, computer control, automatic manufacturing systems and factory of the future.

OBJECTIVE:
At the end of this course the student should be able to understand
- Modern manufacturing systems
- To understand the concepts and applications of flexible manufacturing systems

UNIT I PLANNING, SCHEDULING AND CONTROL OF FLEXIBLE MANUFACTURING SYSTEMS 9
Introduction to FMS– development of manufacturing systems – benefits – major elements – types of flexibility – FMS application and flexibility –single product, single batch, n – batch scheduling problem – knowledge based scheduling system.

UNIT II COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING SYSTEMS 9
Introduction – composition of FMS– hierarchy of computer control –computer control of work center and assembly lines – FMS supervisory computer control – types of software specification and selection – trends.

UNIT III FMS SIMULATION AND DATA BASE 9
Application of simulation–model of FMS–simulation software – limitation – manufacturing data systems–data flow–FMS database systems–planning for FMS database.

UNIT IV GROUP TECHNOLOGY AND JUSTIFICATION OF FMS 9
Introduction – matrix formulation – mathematical programming formulation –graph formulation – knowledge based system for group technology – economic justification of FMS- application of possibility distributions in FMS systems justification.

UNIT V APPLICATIONS OF FMS AND FACTORY OF THE FUTURE 9
FMS application in machining, sheet metal fabrication, prismatic component production – aerospace application – FMS development towards factories of the future – artificial intelligence and expert systems in FMS – design philosophy and characteristics for future.

TOTAL : 45 PERIODS

TEXT BOOK
1. Jha, N.K. “Handbook of flexible manufacturing systems”, Academic Press Inc.,1991.

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

MF9403 DESIGN AND FABRICATION PROJECT LT P C
0 0 6 3

The main objective us give the students hands on training in the fabrication of one or more component working model which has been designed by them. The students may be grouped into small groups and work under a Project supervisor. The components to be fabricated may be decided in consultation with the Supervisor and if possible with an industry.

TOTAL : 90 PERIODS

ME9403 COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY LT P C
0 0 3 2

AIM:

To acquire the skills needed to analyze and simulate engineering systems.

OBJECTIVES:

To give exposure to software tools needed to analyze engineering systems.
To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS

A. SIMULATION

1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration and Laplace Transforms

B. ANALYSIS

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of plane strain problems
4. Stress analysis of an axi-symmetric components
5. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
6. Mode frequency analysis of a 2 D component
7. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
8. Harmonic analysis of a 2D component
9. Transient analysis of spring mass system
10. Spectrum analysis of spring mass system
11. Thermal stress analysis of a axisymmetric component
12. Conductive heat transfer analysis of a 2D component
13. Convective heat transfer analysis of a 2D component

TOTAL : 45 PERIODS

ME 9404 MECHATRONICS LABORATORY LT P C
0 0 3 2

AIM:

To know the design, modeling & analysis of basic electrical, hydraulic & pneumatic systems using software and trainer kits.

OBJECTIVES:

1. Design and testing of the circuits such as

i) Pressure control valves ii)Flow control valves iii)Directional control valves
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic hydraulics, pneumatic and electric circuits using software.
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC
5. Speed measurement using Inductive pickup/Proximity sensor.
6. Temperature measurement using thermocouple, thermistor and RTD
7. Servo controller interfacing i) open loop ii) closed loop
8. PID controller interfacing
9. Computer controlled relays, solenoids and DC motors
10. Study of CMM based instrumentation
11. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using
12. LAB VIEW software

TOTAL : 45 PERIODS

MF9404	**COMPREHENSION**	**L T P C** **0 0 2 1**

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

TOTAL: 30 PERIODS

MF9451	**PROJECT WORK**	**L T P C** **0 0 12 6**

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

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

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

MF9021 PRODUCT DESIGN AND DEVELOPMENT LT P C
3 0 0 3

AIM:
The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

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

UNIT I INTRODUCTION 5
Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding customer – prompting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specifications.

UNIT II CONCEPT GNERATION AND SELECTION 5
Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

UNIT III PRODUCT ARCHITECTURE 10
Implications – Product change – variety – component standardization – product performance – manufacturability – product development management – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications.

UNIT IV INDUSTRIAL DESIGN 10
Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 15
Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes – Economic Analysis – Understanding and representing tasks – baseline project planning – accelerating the project – project execution.

TOTAL : 45 PERIODS

TEXT BOOK
1. Kari T.Ulrich and Steven D.Eppinger,"Product Design and Development", McGrtaw-Hill International Edns. 1999.

REFERENCES
1. Kemnneth Crow,"Concurrent Engg./Integrated Product Development", DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book.
2. Stephen Rosenthal, "Effective Product Design and Development", Business OneOrwin, Homewood, 1992, ISBN 1-55623-603-4.
3. Staurt Pugh, "Tool Design –Integrated Methods for Successful Product Engineering", Addison Wesley Publishing, New york, NY.

WEB REFERENCE BOOK
1.http://www.me.mit/.2.7444.

MF9022 NON DESTRUCTIVE TESTING LT P C
3 0 0 3

AIM:
To impart knowledge in various methods of Non Destructive Testing
OBJECTIVE:
On completion of this course, the students are expected to be conversant with
- Principles of various NDT techniques
- The equipment required for the NDT
- The mechanism involved in there NDT techniques
- Applications of NDT and recent trends in NDT

UNIT I LIQUID PENETRANT AND MAGNETIC PARTICLE INSPECTION 9
Liquid penetrant systems – processing cycles – inspection of surface defects – Generation of Magnetic fields – Magnetic particle inspection equipments – Demagnetization – Applications and limitations.

UNIT II RADIOGRAPHY 11
Production of x-rays – Characteristic rays and white ray – Tube current and Voltage – Sources of 8 rays – Half life period – Penetrating power – Absorption of x and y rays – Radiation contrast and film contrast – exposure charts – pentameters and sensitivity – Safety.

UNIT III EDDY CURRENT INSPECTION 7
Eddy current production – Impedance concepts – Inspection of magnetic materials – Inspection of non magnetic materials – influences of various parameters – Advantages and limitations.

UNIT IV ULTRASONIC TESTING 10
Production of ultrasonic waves – Different types of waves – normal beam inspection – Angle beam inspection – thickness measurements – Applications.

UNIT V RECENT TECHNIQUES 8
Non destructive inspection– Instrumentation for non destructive testing – Principles of holography- Principle of acoustic emission – Applications of holographic techniques– advantages and limitations – Other techniques.

TOTAL : 45 PERIODS

TEXT BOOK
1. Barry Hull and Vernon John, “Non Destructive Testing”, MacMillan, 1988.

REFERENCES
1. Americal Society of Metals, Metals Hand Book, 9th Edition, Volume 11 (1980)
2. Birchan, D, “Non Destructive Testing”, Oxford University Press, 1977.
3. Proceedings of the 10th International Acoustic Emission Symposium, Japanese Society for Non Destructive Inspection, Sendai, 1990.
4. Holler, P., “New Procedures in Non Destructive Testing” Springer Verlag, 1983.

MF9023 RAPID PROTOTYPING LT P C
3 0 0 3

AIM:

To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields,

OBJECTIVE:

Generating a good understanding of RP history, its development and applications.
To expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.

UNIT I INTRODUCTION 8

History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format – Other translators – medical applications of RP - On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing.

UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS 10

Classification – Liquid based system - Stereolitho graphy Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system - Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS 10

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

UNIT IV MATERIALS FOR RAPID PROTOTYPING SYSTEMS 10

Nature of material – type of material – polymers, metals, ceramics and composites liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

UNIT V REVERSE ENGINEERING AND NEW TECHNOLOGIES 7

Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Rafiq I. Noorani, Rapid Prototyping – Principles and Applications, Wiley & Sons, 2006.
2. Chua C.K, Leong K.F and Lim C.S, Rapid Prototyping: Principles and Applications, second edition, World Scientific, 2003.

REFERENCES

1. N.HOPKINSON, R.J.M, HAUGE, P M, DICKENS, “Rapid Manufacturing – An Industrial revolution for the digital age”, Wiley, 2006
2. IAN GIBSON, “Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying”, Wiley, 2006
3. Paul F.Jacobs, Rapid Prototyping and Manufacturing, “Fundamentals of Stereolithography”, McGraw Hill 1993.
4. D.t.Pham and S.S.Dimov, “Rapid Manufacturing”, Springer Verlog 2001.

MF9024 **COMPUTER SIMULATION** **LT P C**
3 0 0 3

AIM:
To teach the various aspects of simulation and its applications

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

UNIT I INTRODUCTION 5
Concept of simulation – simulation as a decision making tool-Monte Carlo simulation.

UNIT II RANDOM NUMBERS/VARIATES 9
Pseudo random numbers – methods of generating random variates – random variates for uniform, normal, binominal, passion, exponential distributions.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 15
Problem formulation – data collection and reduction – logic developments – initial conditions – run length, tabular method of simulation – development of models using higher level languages for systems like queuing, production, inventory and maintenance – output analysis and interpretation, validation.

UNIT IV DISCRETE SYSTEM SIMULATION LANGUAGES 8
Need for simulation language – Comparison of simulation languages: SIMCRIPT, GASP, SIMULA, GPSS, PROMODEL, etc…

UNIT V CASE STUDIES USING SIMULATION LANGUAGES 8
Development of simulation models using the simulation language studies for systems for systems like, queuing systems, production systems, inventory systems, maintenance and replacement systems, investment analysis and network.

TOTAL : 45 PERIODS

TEXT BOOK
1. Jerry Banks and John S.Carson, Barry L Nelson, David M.Nicol, P.Shahabudeen "Discrete event system simulation"' Pearson, 2007.

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

WEB REFERENCE BOOK
1. http:www.bcnn.net

MF9025 QUALITY CONTROL AND RELIABILITY ENGINEERING LT P C
3 0 0 3

AIM:

To impart knowledge about Quality, controlling methods and reliability

OBJECTIVE:

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

UNIT I STATISTICAL QUALITY CONTROL 9

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

UNIT II ACCEPTANCE SAMPLING 9

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

UNIT III RELIABILITY ENGINEERING 9

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

UNIT IV FAILURE DATA ANALYSIS 9

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

UNIT V RELIABILITY PREDICTION AND MANAGEMENT 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCES

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

MF9026 PROCESS PLANNING AND COST ESTIMATION LT P C
3 0 0 3

AIM:
To impart knowledge in process planning, cost estimation and budgeting

OBJECTIVE:
At the end of this course the student should be able to understand
- Traditional process planning and need methods of computer aided process planning
- Importance and procedure of costing
- Elements of costing
- Budgeting and decision making
- Cost estimation of various manufacturing methods

UNIT I PROCESS PLANNING 10
Introduction – Types of production importance of process planning – steps involved in manual experienced Process Planning –need for CAPP – Variant and Generative approaches of CAPP- Future trend of CAPP.

UNIT II ESTIMATION AND COSTING 7
Estimating – Importance, aims, function of estimating – Constituents of estimation – Estimating procedure – sources of errors – costing – Aims of costing – costing procedure – methods of costing – classification of costs – Advantages of efficient costing – Difference between estimating and costing.

UNIT III ELEMENTS OF COSTS 8
Price determination – Elements of costs – Ladder of cost – Material cost Determination of direct material cost – Labour cost – Determination of direct labour cost- over heads – classification of overhead expenses – Depreciation- Methods of depreciation – Allocation of overhead expenses .

UNIT IV COST ECONOMICS 8
Budget – Essentials of budgeting – Types of Budgets – Budgetary control – Objectives – Benefits – Measures of cost economics – Make or buy decision and Analysis

UNIT V PRODUCT COST ESTIMATION 12
Estimation of Material cost – Estimation of machine shop – Lathe operations – Milling operations – Grinding operations – Planning & shaping operations. Estimation in welding shop – Arc welding – Gas Welding –Flame cutting- Estimation of metal forming – Forging –Forging losses - Estimation in Foundry shop – Moulding – pattern making.

TOTAL : 45 PERIODS

TEXT BOOKS

1. G.B.S.Narang and V.Kumar, “Production and Costing”, Khanna Publishers, New Delhi 1995.
2. T.R.Banga and S.C.Sharma, “Estimating and Costing”, Khanna Publishers, New Delhi 1986.

REFERENCES

1. M.Adithan and B.S.Pabla, “Estimating and Costing”, Konark Publishers Pvt. Ltd., 1989.
2. A.K.Chitale and R.C.Gupta, “Product Design and Manufacturing”, Prentice Hall Pvt. Ltd., 2005.
3. Nanua Singh, “System approach to Computer Integrated Design and Manufacturing”, John Wiley & Sons, Inc., 1996.
4. Joseph G.Monks, “Operations Management, Theory & Problems”, McGraw Hill Book Company, 1982.

MF9027 PROCESSING OF PLASTICS AND COMPOSITE MATERIALS LT P C
3 0 0 3

AIM:
To provide sound knowledge in plastics, composites and their processing

OBJECTIVE:
To impart sound knowledge in
- Types of plastics, their structure, properties and applications
- Processing, machinery and joining of plastics
- Processing of Polymer Matrix and Metal Matrix Composites and their applications.

UNIT I INTRODUCTION TO PLASTICS AND COMPOSITES 7
Chemistry and Classification of Polymers – Properties of Thermo Plastics – Properties of Thermosetting Plastics – Applications – Merits and Disadvantages. Fibres – Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers – Matrix Materials – Polymers, Metals and Ceramics

UNIT II PROCESSING OF PLASTICS 9
Extrusion – Injection Moulding – Blow Moulding – Compression and Transfer Moulding – Casting – Thermo Forming.

UNIT III MACHINING AND JOINING OF PLASTICS 7
General Machining properties of plastics – Machining Parameters and their effect – Joining of Plastics – Mechanical Fasteners – Thermal bonding – Press Fitting.

UNIT IV PROCESSING OF POLYMER MATRIX COMPOSITES 13
Open Mould Processes, Bag Moulding, Compression Moulding with BMC and SMC – Filament winding – Pultrusion – Centrifugal Casting – Injection Moulding – Application of PMC's.

UNIT V PROCESSING OF METAL MATRIX COMPOSITES 9
Solid State Fabrication Techniques – Diffusion Bonding – Powder Metallurgy Techniques – Plasma Spray, Chemical and Physical Vapour Deposition of Matrix on Fibres – Liquid State Fabrication Methods – Infiltration – Squeeze Casting – Rheo Casting – Compo casting – Application of MMCS.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Akira Kobyashi, "Machining of Plastics", McGraw Hill
2. Harold Belofsky, Plastics : "Product Design and Process Engineering, Hanser Publishers, 1995.

REFERENCES

1. Bera, E and Moet, A, "High Performance Polymers", Hanser Publishers, 1991.
2. Hensen, F, "Plastics Extrusion Technology", Hanser Publishers, 1988.
3. Johannaber F, "Injection Moulding Machines", Hanser Publishers, 1983.
4. Rauwendaal, C, "Polymer Extrusion", Hanser Publishers, 1990.
5. Rosatao, D.V., "Blow Moulding Handbook, Hanser publisher, 1989
6. Seamour, E.B., "Modern Plastics Moulding", John Wiley.
7. John Dalmonte, "Plastics Moulding", John Wiley
8. Kishan K.Chawla, "Composite Materials Science and Engineering", Springer Verlag, 1987.
9. Agarwal, D. and Broutman L.J., "Analysis and Performance of Fiber Composites", Wiley, 1990.
10. Mallick, P.K. and Newman, S. "Composite Materials Techno logy", Hanser Publishers, 1990.

WEB REFERENCE BOOK

1. www.innotech.ch/unsere-leistungen/gruppen/mec/Fvwo2 e.htm.

MF9028 NUCLEAR ENGINEERING LT P C
3 0 0 3

AIM:

To impart knowledge in nuclear physics and nuclear reactions

OBJECTIVE:

To impart knowledge in the nuclear physics, materials and manufacturing methods of nuclear reactors and its safety aspects.

UNIT I NUCLEAR PHYSICS 7

Nuclear model of the atom – Equivalence of mass and energy – Binding – Radio activity – Half Life – Neutron interactions – Cross sections.

UNIT II NUCLEAR REACTIONS AND REACTOR MATERIALS 7

Mechanism of fission and fusion – radio activity – Chain Reactions – Critical mass and composition – Nuclear fuel cycles and its characteristics – Uranium production and purification Zirconium, thorium, beryllium.

UNIT III REPROCESSING 12

Nuclear fuel cycles – spent fuel characteristics – Role of solvent Extraction in reprocessing – Solvent extraction equipment.

UNIT IV NUCLEAR REACTIONS 9

Reactors – types of fast breeding reactors – Design and Construction of fast breeding reactors – heat transfer techniques in nuclear reactors – reactor shielding, Fusion reactors.

UNIT V SAFETY, DISPOSAL AND PROFILERATION 10

Nuclear plant safety – Safety systems – Changes and consequences of an accident – Criteria for safety – Nuclear waste - Type of waste and its disposal – Radiation hazards and their prevention – Weapons proliferation.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Thomas, J.Cannol Y, “Fundamentals of Nuclear Engineering”, John Wiley, 1978.
2. S.Glassstone and A.Sesonske, “Nuclear Reactor Engineering”, Princeton, Van Nostrand, 1963.

REFERENCES

1. A.G.Bellamy and N.A.Hill, “Extraction and Metallurgy of Uranium”, Thorium and beryllium, International series of monographs on nuclear energy, London, Pergamon Press, 1963.
2. C.B.Amphlett,”Treatment and Disposal of Radioactive waster”, International series of monographs on nuclear energy, London, Pergamon Press, 1961.
3. A.S.Coffinberry and W.N.Miner,”The Metal Plutonium”, University of Chicago Press, 1961.
4. B.Prakash, S.R.Kantan and N.K.Rao, “Metallurgy of Thorium Production”, Vienna International Atomic Energy Agency, Monograph No.22, 1962.

MF9029 TOTAL PRODUCTIVE MAINTENANCE LT P C
3 0 0 3

AIM:
To teach various methods of maintenance and planning methods

OBJECTIVE:
At the end of this course the student should be able to understand
- To understand maintenance concepts
- To understand the modern practices in maintenance

UNIT I MAINTENANCE CONCEPTS 9
Objectives and functions – Tero technology – Reliability Centered Maintenance (RCM) – maintainability prediction – availability and system effectiveness- maintenance costs – maintenance organization

UNIT II MAINTENANCE MODELS 9
Minimal repair – maintenance types – balancing PM and breakdown maintenance- PM schedules: deviations on both sides of target values – PM schedules: functional characteristics – replacement models

UNIT III TOTAL PRODUCTIVE MAINTENANCE 9
Zero breakdowns – Zero Defects and TPM – maximizing equipment effectiveness – autonomous maintenance program – five pillars of TPM – TPM small group activities – TPM organization – management decision – educational campaign – creation of organizations – establishment of basic policies and goals – formation of master plan. - TPM implementation

UNIT IV MAINTENANCE LOGISTICS 9
Human factors in maintenance – maintenance manuals – maintenance staffing methods – queuing applications – simulation – spare parts management – maintenance planning and scheduling

UNIT V ONLINE MONITORING 9
Condition Monitoring Techniques– Vibration Monitoring, Signature Analysis – Wear Debris Monitoring – Maintenance Management Information System - Expert systems – Corrosion Monitoring and Control

TOTAL : 45 PERIODS

TEXT BOOKS

1. Seiichi Nakajima, Introduction to TPM, Productivity Press, Chennai, 1992.
2. Gopalakrishnan, P. and Banerji, A.K., Maintenance and Spare Parts Management,
3. Prentice – Hall of India Pvt. Ltd., 1991.

REFERENCES

1. Goto, F., “Equipment planning for TPM Maintenance Prevention Design”,Productivity Press, 1992.
2. Shirose, K., “Total Productive Maintenance for Workshop Leaders”, Productivity Press, 1992.
3. Shirose, K., “TPM for Operators”, Productivity Press, 1996.
4. Suzuki, T., “New Directions for TPM”, Productivity Press, 1993.
5. Kelly, A.., “Maintenance Planning and Control”, Butterworth, London, 1991.

MF9030 MICRO MACHINING PROCESSES LT P C
3 0 0 3

AIM:

The purpose of this subject is understand the principles of various micro fabrication processes.

OBJECTIVES:

Upon completion of this subject, student will be able to:

- Understand principle of microsystems and feed back systems
- Know the different methods of microfabrication.
- Understand the properties and microstructure of materials
- Appreciate Integration processes in detail
- Enhance his knowledge in semiconductor manufacturing processes.

UNIT I INTRODUCTION 8

Introduction to Micro System design, Material properties, micro fabrication technologies. Structural behavior, sensing methods, micro scale transport - feed back systems.

UNIT II MICROMECHANICS 9

Microstructure of materials, its connection to molecular structure and its consequences on macroscopic properties – Phase transformations in crystalline solids including martensite, ferroelectric, and diffusional phase transformations, twinning and domain patterns, smart materials

UNIT III BASIC MICRO-FABRICATION 10

Bulk Processes – Surface Processes – Sacrificial Processes and Bonding Processes– Special machining: Laser beam micro machining – Electrical Discharge Machining – Ultrasonic Machining – Electro chemical Machining. Electron beam machining.

UNIT IV MECHANICAL MICROMACHINING 10

Theory of micromachining – Chip formation – Size effect in micromachining – microturning, micromilling, microdrilling - Micromachining tool design – Precision Grinding – Partial ductile mode grinding – Ultraprecision grinding – Binderless wheel – Free form optics.

UNIT V SEMI CONDUCTORS MANUFACTURING 8

Basic requirements - clean room – yield model – Wafer IC manufacturing – feature micro fabrication technologies – PSM – IC industry – New Materials – Bonding and layer transfer – devices – micro fabrication industries.

TOTAL : 45 PERIODS

TEXT BOOK

1. Sami Franssila, “Introduction to Micro Fabrication”, John Wiley and sons Ltd., UK, 2004, ISBN: 978-0-470-85106-7

REFERENCES

1. Madore J, “Fundamental of Micro Fabrication”, CRC Press, 2002
2. Mark J. Jackson, “Microfabrication and Nanomanufacturing”, CRC Press, 2006
3. Peter Van Zant, “Microchip fabrication”, McGraw Hill, 2004
4. Mohamed Gad-el-Hak, “The MEMS Handbook”, CRC Press, 2006

MF9031 **ROBOTICS** **LT P C**
3 0 0 3

AIM:
To provide in-depth knowledge in various elements of Industrial Robotics

OBJECTIVE:
The objective of this course in to impart knowledge in the fundamentals of Industrial Robotics, viz. Robot Anatomy, Drives, Sensors, end effectors, Robot kinematics and programming

UNIT I FUNDAMENTALS OF ROBOT 8
Robot – Definition – Robot Anatomy – Co ordinate Systems, Work Envelope Types and classification – Specifications – pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their Functions – Need for Robots – Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9
Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 10
Requirements of a sensor, Principles and Applications of the following types of Sensors – Types of sensors – contact and non contact sensors.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 9
Homogeneous Transformation equation – DH representation - Forward kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of manipulators with Three Degrees of Freedom, Six Degrees of freedom – Deviations and problems.
Lead Through Programming, Robot Programming Languages – VAL programming – Motion Commands, Sensor Commands, End Effecter commands and simple programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 9
Advanced Robotics – Micro and Bio robotics - Implementation of Robots in Industries – Various Steps; Safety considerations for Robot Operations; Economic Analysis of Robots – Pay back method, Euac Method, Rate of Return Method.

TOTAL : 45 PERIODS

TEXT BOOK
1. M.P.Groover, “Industrial Robotics – Technology, Programming and Applications”, McGraw Hill, 2001.

REFERENCES
1. Fu, K.S.Gonzaiz R.C., and Lee 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.
4. Surendar Kumar, “Industrial Robots and Computer Integrated Manufacturing”, Oxford and IBH Publishing Co. Pvt. Ltd., 1991.
5. S.R.Deb”Robotics Technology oand Flexible Automation” Tata McGraw Hill Book Co., 1994.

MF9032 ARTIFICIAL INTELLIGENCE LT P C
3 0 0 3

AIM:
To give the basic principles, structure and application of different types of logical systems, softwares and knowledge representations.

OBJECTIVE:
The objective of this course is to familiarize the students in the basic principles of Artificial Intelligence and important topics such as Heuristics, game playing, knowledge representation

UNIT I INTRODUCTION 10
Definition – Pattern recognition – Criteria of Success – Production Systems – Control Strategies – Heuristic search – Problem Characteristics – Production System Characteristics – Forward and backward reasoning – Matching indexing – Heuristic Functions – Search – Search Algorithms.

UNIT II GAME PLAYING 8
Overview – Minimax search procedure – Adding Alpha – Beta cutoffs – Waiting for Quiescence – Secondary search

UNIT III KNOWLEDGE REPRESENTATION 10
Use of Predicate logic – Introduction to representation – representing – simple facts in logic – augmenting the representation – resolution – Conversion to clause from – The basis of resolution – Unification of algorithm – Question answering – Natural Deduction.

UNIT IV KNOWLEDGE REPRESENTAION USING OTHER LOGIC 8
Non-monotonic reasoning – Statistical and Probabilistic reasoning – Techniques for dealing with a random world and deterministic world – rule based system.

UNIT V STRUCTURAL REPRESENTATIONS OF KNOWLEDGE 9
Common knowledge structures – Level of representation – Right structure – Declarative representations – Semantic nets – Conceptual dependency – Frames – Scripts – Procedural representation – Natural language understanding – Perception – learning – Implementation A.I. Systems.

TOTAL : 45 PERIODS

TEXT BOOK
1. Peter Norvig, Stuart Russell," Artificial Intelligence, A modern approach", Prentice Hall of India Pvt. Ltd,2006

REFERENCES
1. M.W. Richaugh, "Artificial Intelligence, A Knowledge Based Approach", PWS Rent Publishing, Boston.
2. Charniac, E. and M.C.Dermott, "Introduction to Artificial Intelligence", Pearsion Education,2002

MF9033 MECHANICAL VIBRATIONS AND NOISE LT P C
3 0 0 3

AIM:
To impart fundamental knowledge in the area of mechanical vibration and noise.
To train the students to analyze and find solution for practical industrial vibration and noise problem and its control.

OBJECTIVES:

- To understand the fundamental knowledge on vibrating systems.
- To understand how to model the physical vibrating systems mathematically and the basic behavior of vibration measuring instruments and their industrial applications.
- To understand the fundamental of noise and its control.

UNIT I INTRODUCTION 8

Relevance and need for vibration analysis – Mathematical modeling of Vibrating Systems – Discrete and Continuous systems - Review of Single degree of freedom Systems – Free and Forced Vibrations- Various Damping Models.

UNIT II TWO DEGREE OF FREEDOM SYSTEMS 8

Free and forced vibrations of damped and undamped systems – Equations of motion Coordinate Coupling and Principal Coordinates – Dynamic Vibration Absorbers – Orthogonality principle, Technical Applications.

UNIT III MULTI DEGREE OF FREEDOM SYSTEMS 10

Equations of motion – Method of influence coefficients – Free vibration of undamped system – Natural frequencies and mode shapes, solutions by matrix method and influence coefficients. Mode shape Orthogonality – Free vibration of damped system – Rayleigh – damping, General viscous damping – Forced Vibrations of Multi degree of freedom system – Harmonic excitations.

UNIT IV VIBRATION MEASUREMENT 10

Vibration Monitoring – Data Acquisition – Vibration Parameter Selection – Vibration Sensors – Accelerometers – Performance Characteristics – Sensor Location Signal Preamplifications- Types of Preamplifiers – Instrumentation – Tape Recorders- Real Time Analysis – Digital Fourier Transforms – FFT Analysis – Vibration Meters- Vibration Signatures – Standards – Vibration Testing Equipment.

UNIT V FUNDAMENTALS OF NOISE 9

Sources of noise –noise terminology and concepts.- noise measurements – Systematic approach to diagnosing and correcting noise-Managing - Noise and Vibration at Work-Noise control methods

TOTAL : 45 PERIODS

TEXT BOOKS

1. J.S. Rao and K.Gupta, Introductory Course on Theory and Practice of Mechanical Vibrations, Wiley Eastern Ltd., 1991.
2. Industrial Noise Control: Fundamentals and Applications, By Lewis H. Bell, Published CRC Press, ISBN 0824790286,1994

REFERENCES

1. P.Srinivasan, Mechanical Vibration Analysis, Tata-Mc Graw Hill, New Delhi, 1982
2. G.K.Grover, Mechanical Vibrations, New Chand and Bros., Roorkee, 1989.
3. Seto, Mechanical Vibrations, Schaum Series, McGraw Hill Book Co.,
4. Rao V.Dukkipatti and J.Srinivas, Text book of mechanical Vibrations, Prentice Hall of India, New Delhi, 2004.

MF9034 VALUE ENGINEERING AND REENGINEERING L T P C
3 0 0 3

AIM:
To teach the concepts of value engineering as applied in industries

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

UNIT I FUNDMENTALS OF VALUE ENGINEERING 8
Value Types – How to add value job plan – Technique employed – who will do value engineering – Organizing the value engineering study – Benefits.

UNIT II STEP BY STEP APPLICATION OF JOB PLAN 10
Selection of project and team members – general phase – information phase – function phase – creative phase – evaluation phase – Investigation phase – implementation phase – Audit.

UNIT III WORK SHEETS AND GUIDE LINES 9
Preparation of worksheets – general and information phase – Function Classification, relationship and summary – Meaningful costs – Cost analysis – idea listing and comparison – Feasibility ranking – Investigator phase, study summary – guidelines for writing value engineering proposal – Financial aspects – List cycle cost analysis – Oral presentation – Audit – Case studies and Discussion.

UNIT IV REENGINEERING PRINCIPLES 10
The 6R's of organizational transformation and reengineering – process reengineering – preparing the workforce – Methodology – PMI leadership expectation – Production and service improvement model – Process improvement.

UNIT V IMPLEMENTATION OF REENGINEERING 8
Process analysis techniques – Work flow analysis – Value analysis approach – Nominal group technique – Fish bone diagram – Pareto analysis – team building – Force field analysis – Implementation.

TOTAL : 45 PERIODS

TEXT BOOKS

1. S.S.Iyer, "Value Engineering", New Age Information, 1996.
2. Del L.Younker, "Value Engineering" Marcel Dekker, Inc. 2003
3. M.S.Jayaraman and Ganesh Natarajan,"Business Process Reengineering", Tata McGraw Hill, 1994.

REFERENCE

1. Dr.Johnson, A.Edosomwan, "Organization Transformation and Process reengineering", British Library Cataloguing in Publication data, 1996.

MF9035 ELECTRONICS MANUFACTURING TECHNOLOGY LT P C
3 0 0 3

AIM:
To import knowledge on electronics manufacturing and packaging technology.

OBJECTIVE:
Upon the completion of the subject, student will be able to:

- Understand wafer preparation and PCB fabrication
- Know the types of Mounting Technologies and components for electronics assembly
- Appreciate SMT process in detail.
- Know various Defects, Inspection Equipments SMT assembly process.
- Learn repair, rework and quality aspects of Electronics assemblies.

UNIT I INTRODUCTION TO ELECTRONICS MANUFACTURING 8
History, definition, wafer preparation by growing, machining, and polishing, diffusion, microlithography, etching and cleaning, Printed circuit boards, types- single sided, double sided, multi layer and flexible printed circuit board, design, materials, manufacturing, inspection.

UNIT II COMPONENTS AND PACKAGING 8
Introduction to packaging, types-Through hole technology(THT) and Surface mount technology(SMT), Through hole components – axial, radial, multi leaded, odd form. Surface-mount components- active, passive. Interconnections - chip to lead interconnection, die bonding, wire bonding, TAB, flip chip, chip on board, multi chip module, direct chip array module, leaded, leadless, area array and embedded packaging, miniaturization and trends.

UNIT III SURFACE MOUNT TECHNOLOGY PROCESS 12
Introduction to the SMT Process, SMT equipment and material handling systems, handling of components and assemblies - moisture sensitivity and ESD, safety and precautions needed, IPC and other standards, stencil printing process - solder paste material, storage and handling, stencils and squeegees, process parameters, quality control. Component placement- equipment type, flexibility, accuracy of placement, throughput, packaging of components for automated assembly, Cp and Cpk and process control. soldering- reflow process, process parameters, profile generation and control, solder joint metallurgy, adhesive, underfill and encapsulation process - applications, materials, storage and handling, process and parameters.

UNIT IV INSPECTION AND TESTING 9
Inspection techniques, equipment and principle - AOI, X-ray. Defects and Corrective action - stencil printing process, component placement process, reflow soldering process, underfill and encapsulation process, electrical testing of PCB assemblies- In circuit test, functional testing, fixtures and jigs.

UNIT V REPAIR, REWORK, QUALITY AND RELIABILITY OF ELECTRONICS ASSEMBLIES 7
Repair tools, methods, rework criteria and process, thermo-mechanical effects and thermal management, Reliability fundamentals, reliability testing, failure analysis, design for manufacturability, assembly, reworkability, testing, reliability, and environment.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Surface Mount Technology –Principles and practice by Ray Prasad – second edition , Chapman and Hall ,1997 ,New York , ISBN 0-41-12921-3
2. Fundamentals of microsystem packaging by Rao.R .Tummala, Mc -Graw Hill 2001 , ISBN 00-71-37169-9

REFERENCES
1. Failure Modes and Mechanisms in Electronic Packages, Puligandla Viswanadham and Pratap Singh, Chapman and Hall, New York , N.Y. ISBN 0-412-105591-8.
2. Area Array Interconnection Handbook, Paul Totta and Karl Puttlitz, and Kathleen Stalter , Kluwer Academic Publishers, Norwell, MA, USA, 2001.ISBN 0-7923-7919-5.
3. Reflow Soldering Process and Trouble Shooting SMT,BGA,CSP and Flip Chip Technologies by Ning-Cheng Lee,Elsevier Science, ISBN 0-7506-7218-8.
4. Surface Mount Technology Terms and Concepts by Zarrow , Phil, Elsevier Science and Technology,1997.ISBN 0750698756
5. Electronic Packaging and Interconnection Handbook, by C.A.Harper, Second Edition, McGraw Hill Inc., New York, N.Y.,1997,ISBN 0-07-026694-8
6. www.ipc.org
7. www.smta.org

ML9254 POWDER METALLURGY LT P C
3 0 0 3

OBJECTIVE:
- This course teaches powder preparation, characterization, compaction and sintering.
- This knowledge is essential to understand powder metallurgy applications in aerospace, automobile and machining materials.

UNIT I CHARACTERISTICS AND TESTING OF METAL POWDERS 10
Sampling, chemical composition purity, surface contamination etc. Particle size. and its measurement, Principle and procedure of sieve analysis, microscopic analysis: sedimentation, elutriation, permeability. adsorption methods and resistivity methods: particle shape, classifications, microstructure. specific surface area. apparent and tap density. green density. green strength, sintered compact density, porosity, shrinkage.

UNIT II POWDER MANUFACTURE AND CONDITIONING 10
Mechanical methods Machine milling, ball milling, atomization, shotting. Chemical methods, condensation, thermal decomposition, carbonyl. reduction by gas-hydride, dehydride process, electro deposition, precipitation from aqueous solution and fused salts, hydrometallurgical method. Physical methods: Electrolysis and atomization processes, types of equipment, factors affecting these processes, examples of powders produced by these methods, applications, powder conditioning, heat treatment, blending and mixing, types of equipment, types of mixing and blending

UNIT III POWDER COMPACTION 7
Pressureless compaction: slip casting and slurry casting. Pressure compaction lubrication, single ended and double ended compaction, isostatic pressing, powder rolling, forging and extrusion, explosive compaction.

UNIT IV SINTERING 8
Stage of sintering, property changes, mechanisms of sintering, liquid phase sintering and infiltration, activated sintering, hot pressing and Hot Isostatic Pressing HIP, vacuum sintering, sintering furnaces and sintering atmosphere, finishing operations – sizing, coining, repressing and heat treatment.

UNIT V APPLICATIONS 10
Major applications in aerospace. nuclear and automobile industries. Bearing Materials types, self lubrication and other types, methods of production, properties, applications. Sintered Friction Materials-clutches, brake linings, Tool Materials- cemented carbides, oxide ceramics, Cermets- Dispersion strengthened materials.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Sinha A. K., "Powder Metallurgy", Dhanpat Rai & Sons. New Delhi, 1982.
2. Ramakrishnan, P.," Powder Metallurgy",New Age International Publishers, 1st edition, 2007

REFERENCES

1. ASM Handbook. Vol. 7, "Powder Metallurgy", Metals Park, Ohio, USA, 1990.
2. Animesh Bose., "Advances in Particulate Materials", Butterworth - Heinemann. New Delhi, 1995.
3. Kempton. H Roll., "Powder Metallurgy", Metallurgical Society of AMIE, 1988.
4. Ramakrishnan. P., "Powder Metallurgy Opportunities for Engineering Industries", Oxford and IBH Publishing Co., Pvt. Ltd, New Delhi, 1987.
5. Erhard Klar., "Powder Metallurgy Applications, Advantages and Limitations", American Society for Metals, Ohio, 1983.
6. Sands. R. L. and Shakespeare. C. R. "Powder Metallurgy", George Newes Ltd. London, 1966

IE9035 SUPPLY CHAIN MANAGEMENT LT P C
3 0 0 3

OBJECTIVE:

To cover the basics of supply chain concepts, associated networks, tools and techniques required for evaluating various supply chain processes .

UNIT I STRATEGIC FRAMEWORK 5

Objective, decision phases, process views, examples, strategic fit, supply chain drivers and metrics

UNIT II SUPPLY CHAIN NETWORKS 10

Distribution networks, Facility networks and design options, Factors influencing, Models for facility location and capacity allocation, Transportation networks and design options, Evaluating network design decisions

UNIT III MANAGING DEMAND AND SUPPLY IN A SUPPLY CHAIN 10

Predictable variability in a supply chain, Economies of scale and uncertainty in a supply chain – Cycle and safety Inventory, Optimum level of product availability, Forward Buying, Multi-echelon cycle inventory

UNIT IV SOURCING AND PRICING IN A SUPPLY CHAIN 10

Cross-Functional drivers, Role of sourcing in a supply chain, Logistics providers, Procurement process, Supplier selection, Design collaboration, Role of Pricing and Revenue Management in a supply chain

UNIT V INFORMATION TECHNOLOGY AND COORDINATION IN A SUPPLY CHAIN 10

The role of IT in supply chain, The supply chain IT frame work, Customer Relationship Management, Supplier relationship management, Future of IT in supply chain, EBusiness in supply chain, Bullwhip effect – Effect of lack of co-ordination in supply chain, Building strategic partnerships, CPFR

TOTAL : 45 PERIODS

TEXT BOOK

1. Sunil Chopra and Peter meindl, "Supply Chain Management , Strategy, Planning, and operation", PHI, Third edition,2007

REFERENCES

1. Jeremy F.Shapiro, “Modeling the supply chain”, Thomson Duxbury ,2002
2. James B.Ayers, “Handbook of Supply chain management”, St.Lucle press, 2000.

ME9022 NEW AND RENEWABLE SOURCES OF ENERGY LT P C
3 0 0 3

AIM:

To instruct the importance of renewable energy and its utilization for the thermal and electrical energy needs and also the environmental aspects of theses resources.

OBJECTIVE:

At the end of the course, the student expected to understand and analyze the pattern of renewable energy resources Suggest methodologies / technologies for its utilization. Economics of the utilization and environmental merits

UNIT I SOLAR ENERGY 9

Solar Radiation – Measurements of solar Radiation and sunshine – Solar Thermal Collectors – Flat Plate and Concentrating Collectors – Solar Applications – fundamentals of photo Voltaic Conversion – solar Cells – PV Systems – PV Applications.

UNIT II WIND ENERGY 9

Wind Data and Energy Estimation – wind Energy Conversion Systems – Wind Energy generators and its performance – Wind Energy Storage – Applications – Hybrid systems.

UNIT III BIO - ENERGY 9

Biomass, Biogas, Source, Composition, Technology for utilization – Biomass direct combustion – Biomass gasifier – Biogas plant – Digesters – Ethanol production – Bio diesel production and economics.

UNIT IV OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY 9

Tidal energy – Wave energy – Data, Technology options – Open and closed OTEC Cycles – Small hydro, turbines – Geothermal energy sources, power plant and environmental issues.

UNIT V NEW ENERGY SOURCES 9

Hydrogen, generation, storage, transport and utilisation, Applications: power generation, transport – Fuel cells – technologies, types – economics and the power generation

TOTAL : 45 PERIODS

TEXT BOOKS

1. G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 1999.
2. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

REFERENCES

1. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K., 1996.
2. Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, 1986.
3. G.N. Tiwari, solar Energy – Fundamentals Design, Modelling and applications, Narosa Publishing House, New Delhi, 2002.
4. L.L. Freris, Wind Energy Conversion systems, Prentice Hall, UK, 1990.

ME9025 DESIGN FOR MANUFACTURING LT P C
3 0 0 3

AIM:
To give exposure to interrelation between design and manufacture.

OBJECTIVES:
- To understand the principles of design such the manufacturing of the product is possible.
- Various design aspects to be considered for manufacturing the products using different processes.

UNIT I DESIGN FOR MANUFACTURING APPROACH AND PROCESS 9
Methodologies and tools, design axioms, design for assembly and evaluation, minimum part assessment. Taguchi method, robustness assessment, manufacturing process rules, designer's tool kit, Computer Aided group Technology, failure mode effective analysis, Value Analysis. Design for minimum number of parts, development of modular design, minimizing part variations, design of parts to be multi-functional, multi-use, ease of fabrication, Poka Yoke principles.

UNIT II GEOMETRIC ANALYSIS 9
Surface finish, review of relationship between attainable tolerance grades and difference machining processes. Analysis of tapers, screw threads, applying probability to tolerances.

UNIT III FORM DESIGN OF CASTINGS AND WELDMENTS 9
Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols.

UNIT IV MECHANICAL ASSEMBLY 9
Selective assembly, deciding the number of groups, control of axial play, examples, grouped datum systems - different types, geometric analysis and applications – design features to facilitate automated assembly.

UNIT V TRUE POSITION THEORY 9
Virtual size concept, floating and fixed fasteners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging, examples. Operation sequence for typical shaft type of components. Preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples.

TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCES

1. Spotts M.F., "Dimensioning and Tolerance for Quantity Production, Prentice Hall Inc., 1983.
2. Oliver R. Wade, "Tolerance Control in Design and Manufacturing", Industrial Press Inc. New York Publications, 1967.
3. James G. Bralla, "Hand Book of Product Design for Manufacturing" McGraw Hill Publications, 1983.
4. Trucks H.E., "Design for Economic Production", Society of Manufacturing Engineers, michigan, 2nd edition, 1987.

ME9032 COMPUTATIONAL FLUID DYNAMICS LT P C
3 0 0 3

AIM:
To impart the knowledge of numerical techniques to the solution of fluid dynamics and heat transfer problems.

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

PREREQUISITE:
Fundamental Knowledge of partial differential equations, Heat Transfer and Fluid Mechanics

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8
Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momemtum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II FINITE DIFFERENCE METHOD 9
Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – solution methods for finite difference equations – Elliptic equations – Iterative solution Methods – Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations.

UNIT III FINITE VOLUME METHOD (FVM) FOR DIFFUSION 9
Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank – Nicolson and fully implicit schemes.

UNIT IV FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 10
Steady one-dimensional convection and diffusion – Central, upwind differencing schemes-properties of discretization schemes – Conservativeness, Boundedness, Trasnportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT V CALCULATION FLOW FIELD BY FVM 9
Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants. Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models

TOTAL : 45 PERIODS

TEXT BOOKS

1. T.J. Chung, Computational Fluid Dynamics, Cambridge University, Press, 2002.
2. Versteeg, H.K., and Malalasekera, W., An Introduction to Computational Fluid Dynamics: The finite volume Method, Longman, 1998.
3. Ghoshdastidar , P.S., computer Simulation of flow and heat transfer, Tata McGraw Hill Publishing Company Ltd., 1998.

REFERENCES

1. Patankar, S.V. Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation, 2004.
2. Muralidhar, K., and Sundararajan, T., computationsl Fluid Flow and Heat Transfer, Narosa Publishing House, NewDelhi, 1995.
3. Ghoshdastidar P.S., Heat Transfer, Oxford Unversity Press, 2005.
4. Prodip Niyogi, Chakrabarty .S.K., Laha .M.K. Introduction to Computational Fluid Dynamics, Pearson Education, 2005.
5. Introduction to Computational Fluid Dynamics Anil W. Date Cambridge University Press, 2005.

MA9262 NUMERICAL METHODS L T P C
3 1 0 4

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS (10 +3)

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

UNIT II INTERPOLATION AND APPROXIMATION (8 + 3)

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

UNIT III NUMERICAL DIFFERENTATION AND INTEGRATION (9 + 3)

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS (9 + 3)

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

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS (9 + 3)

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

L: 45 T: 15 TOTAL : 60 PERIODS

TEXT BOOKS

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

REFERENCES

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.

2. Gerald, C. F. and Wheatley, P. O., “Applied Numerical Analysis”, 6th Edition, Pearson Education Asia, New Delhi, 2006.
3. Brian Bradie, “A friendly introduction to Numerical analysis”, Pearson Education Asia, New Delhi, 2007.

GE9021 PROFESSIONAL ETHICS IN ENGINEERING LT P C
3 0 0 3

AIM

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

OBJECTIVES

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

UNIT I ENGINEERING ETHICS 9

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

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

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

UNIT III ENGINEER’S RESPONSIBILITY FOR SAFETY 9

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

UNIT IV RESPONSIBILITIES AND RIGHTS 9

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

UNIT V GLOBAL ISSUES 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCES

1. Charles D Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, (1999).
2. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, (2003)

3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, (2003)

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

AIM

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

OBJECTIVES

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

UNIT I INTRODUCTION 10

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

UNIT II PREPARATION METHODS 10

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

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 5

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

UNIT IV PREPARATION ENVIRONMENTS 10

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

UNIT V CHARECTERISATION TECHNIQUES 10

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

TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCES

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

PT9071 PACKAGING MATERIALS & TECHNOLOGY LT P C
3 0 0 3

OBJECTIVES:

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

UNIT I FUNDAMENTALS OF PACKAGING 6

Definition, functions of packaging, types and selection of package, Packaging hazards, interaction of package and contents, materials and machine interface, Environmental and recycling considerations - life cycle assessment Package Design - Fundamentals, factors influencing design, stages in package development, graphic design, Structural design – simulation softwares

UNIT II PACKAGING MATERIALS 11

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

UNIT III CONVERSION TECHNOLOGY 12

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

UNIT IV SPECIALITY PACKAGING 9

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

UNIT V TESTING 7

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. Aaron L.Brody & Kenneth S.Marsh, “Encyclopedia of Packaging Technology”,John Wiley Interscience Publication, II Edition, 1997.

2. F.A. Paine, “Fundamentals of Packaging”, Brookside Press Ltd., London, 1990.
3. A.S.Athayle, “Plastics in Flexible Packaging”, Multi-tech Publishing Co., First Edition, 1992.

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