AFFILIATED INSTITUTIONS

ANNA UNIVERSITY, CHENNAI

R - 2008

B.E. MANUFACTURING ENGINEERING

II TO VIII SEMESTERS CURRICULUM AND SYLLABI

SEMESTER II

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	HS2161	Technical English – II*	3	1	0	4
2.	MA2161	Mathematics – II*	3	1	0	4
3.	PH2161	Engineering Physics – II*	3	0	0	3
4.	CY2161	Engineering Chemistry – II*	3	0	0	3
5. a	ME2151	Engineering Mechanics (For non-circuit branches)	3	1	0	4
5. b	EE2151	Circuit Theory (For branches under Electrical Faculty)	3	1	0	4
5. c	EC2151	Electric Circuits and Electron Devices (For branches under I & C Faculty)	3	1	0	4
6. a	GE2151	Basic Electrical & Electronics Engineering (For non-circuit branches)	4	0	0	4
6. b	GE2152	Basic Civil & Mechanical Engineering (For circuit branches)	4	0	0	4
PRACTICAL						
7.	GE2155	Computer Practice Laboratory-II*	0	1	2	2
8.	GS2165	Physics & Chemistry Laboratory – II*	0	0	3	2
9. a	ME2155	Computer Aided Drafting and Modeling Laboratory (For non-circuits branches)	0	1	2	2
9. b	EE2155	Electrical Circuits Laboratory (For branches under Electrical Faculty)	0	0	3	2
9. c	EC2155	Circuits and Devices Laboratory (For branches under I & C Faculty)	0	0	3	2
				TOTAL : 28 CREDITS		
10.	-	English Language Laboratory +	0	0	2	-

A. <u>CIRCUIT BRANCHES</u>

I   Faculty of Electrical Engineering

   1. B.E. Electrical and Electronics Engineering
   2. B.E. Electronics and Instrumentation Engineering
   3. B.E. Instrumentation and Control Engineering

II   Faculty of Information and Communication Engineering

   1. B.E. Computer Science and Engineering
   2. B.E. Electronics and Communication Engineering
   3. B.E. Bio Medical Engineering
   4. B.Tech. Information Technology

B. <u>NON – CIRCUIT BRANCHES</u>

I   Faculty of Civil Engineering

   1. B.E. Civil Engineering

II   Faculty of Mechanical Engineering

   1. B.E. Aeronautical Engineering
   2. B.E. Automobile Engineering
   3. B.E. Marine Engineering
   4. B.E. Mechanical Engineering
   5. B.E. Production Engineering

III   Faculty of Technology

   1. B.Tech. Chemical Engineering
   2. B.Tech. Biotechnology
   3. B.Tech. Polymer Technology
   4. B.Tech. Textile Technology
   5. B.Tech. Textile Technology (Fashion Technology)
   6. B.Tech. Petroleum Engineering
   7. B.Tech. Plastics Technology

SEMESTER – III

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA 2211	Transforms and Partial Differential Equation	3	1	0	4
ME3202	Engineering Materials and Metallurgy	3	0	0	3
EE3203	Electrical Drives and Control	3	0	0	3
CE3204	Strength of Materials	3	0	0	3
ME3205	Mechanics of Machines	3	1	0	4
MF3206	Manufacturing Processes – I	3	0	0	3
PRACTICAL					
CE3207	Strength of Materials Laboratory	0	0	3	2
EE3208	Electrical Engineering &Measurements Laboratory	0	0	3	2
ME3209	Manufacturing Technology Laboratory - I	0	0	3	2
MF3210	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					
MA3211	Probability and Statistics	3	1	0	4
MF3212	Manufacturing Processes – II	3	0	0	3
ME 2204	Fluid Mechanics and Machinery	3	1	0	4
ME2303	Design of Machine Elements	3	1	0	4
ME3215	Thermodynamics	3	0	0	3
MF3216	Engineering Metrology	3	0	0	3
PRACTICAL					
ME3217	Manufacturing Technology Laboratory - II	0	0	3	2
CE3218	Fluid Mechanics and Machinery Laboratory	0	0	3	2
ME3219	Dynamics Laboratory	0	0	3	2
ME3220	Machine Drawing	1	0	2	2
	TOTAL	19	3	11	29

SEMESTER V

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MF3301	Casting and Welding Technology	3	0	0	3
MF3302	Metal Forming Technology	3	0	0	3
MF3303	Precision Engineering	3	0	0	3
MF3304	Computer Aided Design	3	0	0	3
ME3305	Hydraulics and Pneumatics	3	0	0	3
MF3306	CNC Machining Technology	3	0	0	3
PRACTICAL					
MF3307	CAM Laboratory	0	0	4	2
MF3308	Metrology Laboratory	0	0	2	1
MF3309	CAD Laboratory	0	0	2	1
MF3310	Technical Seminar	0	0	2	1
	TOTAL	18	0	10	23

SEMESTER VI

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MG3314	Industrial Management	3	0	0	3
ME2029	Design of Jigs, Fixtures and Press Tools	3	0	0	3
MF3313	Computer Integrated Production Management System	3	0	0	3
ME3314	Finite Element Analysis	3	0	0	3
ME3315	Microprocessor and Micro controller	3	0	0	3
	Elective – 1	3	0	0	3
PRACTICAL					
ME3316	Microprocessor and Micro controller Laboratory	0	0	4	2
MF3317	Advanced Machine Tools Laboratory	0	0	4	2
GE3318	Communication Skills Laboratory	0	0	4	2
	TOTAL	**18**	**0**	**12**	**24**

SEMESTER VII

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MF3401	Operations Research	3	0	0	3
ME3402	Mechatronics	3	0	0	3
GE2022	Total Quality Management	3	0	0	3
MF3404	Flexible Manufacturing systems	3	0	0	3
	Elective – II	3	0	0	3
	Elective – III	3	0	0	3
PRACTICAL					
MF3405	Design and Fabrication Project	0	0	6	3
ME3406	Computer Aided Simulation and Analysis Laboratory	0	0	3	2
ME3407	Mechatronics Laboratory	0	0	3	2
MF3408	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					
MF3409	Project work	0	0	12	6
	TOTAL	**6**	**0**	**12**	**12**

LIST OF ELECTIVES FOR B.E.MANUFACTURING ENGINEERING

ELECTIVE – I

CODE NO	COURSE TITLE	L	T	P	C
MF3001	Product Design and Development	3	0	0	3
MF3013	Mechanical Vibration and noise	3	0	0	3
ML3016	Powder Metallurgy	3	0	0	3
MA2264	Numerical Methods	3	1	0	4
GE2025	Professional Ethics in Engineering	3	0	0	3

ELECTIVE – II

CODE NO	COURSE TITLE	L	T	P	C
MF3014	Value Engineering and Reengineering	3	0	0	3
MF3015	Electronics Manufacturing Technology	3	0	0	3
IE3017	Supply Chain Management	3	0	0	3
ME2023	Renewable Sources of Energy	3	0	0	3
ME3019	Design for Manufacturing	3	0	0	3

ELECTIVE – III

CODE NO	COURSE TITLE	L	T	P	C
MF3009	Total Productive Maintenance	3	0	0	3
MF3010	Micromachining Processes	3	0	0	3
MF3011	Robotics	3	0	0	3
MF3012	Artificial Intelligence	3	0	0	3
GE2023	Fundamentals of Nanoscience	3	0	0	3

ELECTIVE – IV

CODE NO	COURSE TITLE	L	T	P	C
MF3005	Quality Control and Reliability Engineering	3	0	0	3
MF3006	Processes Planning and Cost Estimation	3	0	0	3
MF3007	Processing of Plastics and Composite Materials	3	0	0	3
PT3024	Packaging Materials and Technology	3	0	0	3

ELECTIVE – V

CODE NO	COURSE TITLE	L	T	P	C
MF3002	Non Destructive Testing	3	0	0	3
MF3003	Rapid Prototyping	3	0	0	3
MF3004	Computer Simulation	3	0	0	3
MF3008	Nuclear Engineering	3	0	0	3
ME2032	Computational Fluid Dynamics	3	0	0	3

HS2161   **TECHNICAL ENGLISH II**   **L T P C**
                                                                               3 1 0 4

AIM

To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES

- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.

UNIT I   **12**

Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:
1. Exercises on word formation using the prefix 'self' - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II   **12**

Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:
1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III   **12**

Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations .

Suggested activities:
1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object –verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
4. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV   **12**

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:
1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V   **9**

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:
1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TOTAL: 60 PERIODS

TEXT BOOK
1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

REFERENCES
1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition, Pearson Education, 2007.

Extensive Reading:
1. Robin Sharma, 'The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

Note:
The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

MA2161 **MATHEMATICS – II** **L T P C**
3 1 0 4

UNIT I **ORDINARY DIFFERENTIAL EQUATIONS** **12**
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II **VECTOR CALCULUS** **12**
Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelpipeds.

UNIT III **ANALYTIC FUNCTIONS** **12**
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation.

UNIT IV **COMPLEX INTEGRATION** **12**
Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

UNIT V **LAPLACE TRANSFORM** **12**
Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.
Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL: 60 PERIODS

TEXT BOOK
1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", 3rd Edition, Laxmi Publications (p) Ltd., (2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

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

PH2161   **ENGINEERING PHYSICS – II**   **L T P C**
                                                                             3 0 0 3

UNIT I   CONDUCTING MATERIALS   9
Conductors – classical free electron theory of metals – Electrical and thermal
conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical
theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi
Function – Density of energy states – carrier concentration in metals.

UNIT II   SEMICONDUCTING MATERIALS   9
Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of
Fermi level with temperature – electrical conductivity – band gap determination –
extrinsic semiconductors – carrier concentration derivation in n-type and p-type
semiconductor – variation of Fermi level with temperature and impurity concentration –
compound semiconductors – Hall effect –Determination of Hall coefficient – Applications.

UNIT III   MAGNETIC AND SUPERCONDUCTING MATERIALS   9
Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro
magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti –
ferromagnetic materials – Ferrites – applications – magnetic recording and readout –
storage of magnetic data – tapes, floppy and magnetic disc drives.
Superconductivity : properties - Types of super conductors – BCS theory of
superconductivity(Qualitative) - High Tc superconductors – Applications of
superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV   DIELECTRIC MATERIALS   9
Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space
charge polarization – frequency and temperature dependence of polarisation – internal
field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown –
uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V   MODERN ENGINEERING MATERIALS   9
Metallic glasses: preparation, properties and applications.
Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application,
advantages and disadvantages of SMA
Nanomaterials: synthesis –plasma arcing – chemical vapour deposition – sol-gels –
electrodeposition – ball milling - properties of nanoparticles and applications.
Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour
deposition - structure – properties and applications.
                                                                    TOTAL : 45 PERIODS

TEXT BOOKS
1. Charles Kittel ' Introduction to Solid State Physics', John Wiley & sons,
   7th edition, Singapore (2007)
2. Charles P. Poole and Frank J.Ownen, 'Introduction to Nanotechnology', Wiley
   India(2007) (for Unit V)

REFERENCES
1. Rajendran, V, and Marikani A, 'Materials science'Tata McGraw Hill publications,
   (2004) New delhi.
2. Jayakumar, S. 'Materials science', R.K. Publishers, Coimbatore, (2008).
3. Palanisamy P.K, 'Materials science', Scitech publications(India) Pvt. LTd., Chennai,
   second Edition(2007)
4. M. Arumugam, 'Materials Science' Anuradha publications, Kumbakonam, (2006).

CY2161   **ENGINEERING CHEMISTRY – II**   **L T P C**
                                                                          3 0 0 3

AIM

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

OBJECTIVES
- The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
- Principles of corrosion control
- Chemistry of Fuels and combustion
- Industrial importance of Phase rule and alloys
- Analytical techniques and their importance.

UNIT I   ELECTROCHEMISTRY   9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe^{2+} vs dichromate and precipitation – Ag^+ vs Cl^- titrations) and conduct metric titrations (acid-base – HCl vs, NaOH) titrations,

UNIT II   CORROSION AND CORROSION CONTROL   9

Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating.

UNIT III   FUELS AND COMBUSTION   9

Calorific value – classification – Coal – proximate and ultimate analysis metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods-knocking – octane number and cetane number – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels-water gas, producer gas, CNG and LPG, Flue gas analysis – Orsat apparatus – theoretical air for combustion.

UNIT IV   PHASE RULE AND ALLOYS   9

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT V   ANALYTICAL TECHNIQUES   9

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

                                                          TOTAL: 45 PERIODS

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

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

ME2151   **ENGINEERING MECHANICS**   **L T P C**
                                                                    3 1 0 4

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

UNIT I   BASICS & STATICS OF PARTICLES   12
Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II   EQUILIBRIUM OF RIGID BODIES   12
Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III   PROPERTIES OF SURFACES AND SOLIDS   12
Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV   DYNAMICS OF PARTICLES   12
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V   FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS   12
Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction.
Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

                                                        TOTAL: 60 PERIODS

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

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

EE2151	**CIRCUIT THEORY**	**L T P C**
	(Common to EEE, EIE and ICE Branches)	**3 1 0 4**

UNIT I   BASIC CIRCUITS ANALYSIS   12
Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

**UNIT II   NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND
                AC CIRCUITS: 12**
Network reduction: voltage and current division, source transformation – star delta conversion.
Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III   RESONANCE AND COUPLED CIRCUITS   12
Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT IV   TRANSIENT RESPONSE FOR DC CIRCUITS   12
Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT V   ANALYSING THREE PHASE CIRCUITS   12
 Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL: 60 PERIODS

 TEXT BOOKS
1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",Tata McGraw HIll publishers, 6th edition, New Delhi, (2002).
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).

REFERENCES
1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).

2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi (2001).
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

EC2151   **ELECTRIC CIRCUITS AND ELECTRON DEVICES**   **L T P C**
                          (For ECE, CSE, IT and Biomedical Engg. Branches)   **3 1 0 4**

UNIT I   CIRCUIT ANALYSIS TECHNIQUES   12
Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II   TRANSIENT RESONANCE IN RLC CIRCUITS   12
Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

UNIT III   SEMICONDUCTOR DIODES   12
Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

UNIT IV   TRANSISTORS   12
Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT V   SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment only)   12
Tunnel diodes – PIN diode, varactor diode – SCR characteristics and two transistor equivalent model – UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.
                                                                    TOTAL : 60 PERIODS
TEXT BOOKS
1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series,Tata McGraw Hill, (2001)
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits",Tata McGraw Hill, 2nd Edition, (2008).
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, (2008).

REFERENCES
1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Education, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits",Tata McGraw Hill, 2nd Edition, 2008.

GE2151   BASIC ELECTRICAL AND ELECTRONICS ENGINEERING   L T P C
(Common to branches under Civil, Mechanical and Technology faculty)   4 0 0 4

UNIT I   ELECTRICAL CIRCUITS & MEASURMENTS   12
Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.
Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II   ELECTRICAL MECHANICS   12
Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III   SEMICONDUCTOR DEVICES AND APPLICATIONS   12
Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.
Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV   DIGITAL ELECTRONICS   12
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V   FUNDAMENTALS OF COMMUNICATION ENGINEERING   12
Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

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

TOTAL: 60 PERIODS

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

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

GE2152   **BASIC CIVIL & MECHANICAL ENGINEERING**   **L T P C**
(Common to branches under Electrical and I & C Faculty)   **4 0 0 4**

A – CIVIL ENGINEERING

UNIT I   SURVEYING AND CIVIL ENGINEERING MATERIALS   15
Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II   BUILDING COMPONENTS AND STRUCTURES   15
Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

TOTAL: 30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III   POWER PLANT ENGINEERING   10
Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV   I C ENGINES   10
Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V   REFRIGERATION AND AIR CONDITIONING SYSTEM   10
Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

TOTAL: 30 PERIODS

REFERENCES
1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering",Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham. S, "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. (1999).
3. Seetharaman S. "Basic Civil Engineering", Anuradha Agencies, (2005).
4. Venugopal K and Prahu Raja V, "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2000).

GE2155   **COMPUTER PRACTICE LABORATORY – II**   **L T P C**
                                                                           0 1 2 2
LIST OF EXPERIMENTS

1. UNIX COMMANDS   **15**

Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING   **15**

Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX   **15**

Dynamic Storage Allocation-Pointers-Functions-File Handling

                                                    TOTAL: 45 PERIODS

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware
1 UNIX Clone Server
3 3 Nodes (thin client or PCs)
Printer – 3 Nos.

Software
OS – UNIX Clone (33 user license or License free Linux)
Compiler - C

GS2165   **PHYSICS LABORATORY – II**   **L T P C**
                                                                           0 0 3 2

LIST OF EXPERIMENTS
 1. Determination of Young's modulus of the material – non uniform bending.
 2. Determination of Band Gap of a semiconductor material.
 3. Determination of specific resistance of a given coil of wire – Carey Foster   Bridge.
 4. Determination of viscosity of liquid – Poiseuille's method.
 5. Spectrometer dispersive power of a prism.
 6. Determination of Young's modulus of the material – uniform bending.
 7. Torsional pendulum – Determination of rigidity modulus.

   • **A minimum of FIVE experiments shall be offered.**

   • **Laboratory classes on alternate weeks for Physics and Chemistry.**

   • **The lab examinations will be held only in the second semester.**

LIST OF EXPERIMENTS
 1. Conduct metric titration (Simple acid base)
 2. Conduct metric titration (Mixture of weak and strong acids)
 3. Conduct metric titration using $BaCl_2$ vs Na_2SO_4
 4. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
 5. PH titration (acid & base)
 6. Determination of water of crystallization of a crystalline salt (Copper   sulphate)
 7. Estimation of Ferric iron by spectrophotometry.

> • **A minimum of FIVE experiments shall be offered.**
>
> • **Laboratory classes on alternate weeks for Physics and Chemistry.**
>
> • **The lab examinations will be held only in the second semester.**

ME2155   COMPUTER AIDED DRAFTING AND MODELING LABORATORY L T P C
                                                                              0 1 2 2

List of Exercises using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.

2. Drawing of a Title Block with necessary text and projection symbol.

3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.

4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.

5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).

6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)

7. Drawing of a simple steel truss.

8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,

9. Drawing isometric projection of simple objects.

10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

List of Equipments for a batch of 30 students:

1. Pentium IV computer or better hardware, with suitable graphics facility -30 No.
2. Licensed software for Drafting and Modeling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.

EE2155   **ELECTRICAL CIRCUIT LABORATORY**   **L T P C**
(Common to EEE, EIE and ICE)   **0 0 3 2**

LIST OF EXPERIMENTS
1. Verification of ohm's laws and kirchoff's laws.
2. Verification of Thevemin's and Norton's Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
9. Frequency response of series and parallel resonance circuits.
10. Frequency response of single tuned coupled circuits.

TOTAL: 45 PERIODS

EC2155   **CIRCUITS AND DEVICES LABORATORY**   **L T P C**
           0 0 3 2

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET
11. Characteristics of Diac and Triac.
12. Characteristics of Photodiode and Phototransistor.

TOTAL: 45 PERIODS

ENGLISH LANGUAGE LABORATORY (Optional)   L T P C
                                                   0 0 2 -

1. Listening: **5**
Listening & answering questions – gap filling – Listening and Note taking- Listening to telephone conversations

2. Speaking: **5**
Pronouncing words & sentences correctly – word stress – Conversation practice.

CLASSROOM SESSION   **20**
1. Speaking: Introducing oneself, Introducing others, Role play, Debate-Presentations: Body language, gestures, postures.
   Group Discussions etc
2. Goal setting – interviews – stress time management – situational reasons

EVALUATION
(1) Lab Session – 40 marks

    Listening   – 10 marks
    Speaking   – 10 marks
    Reading   – 10 marks
    Writing   – 10 marks

(2) Classroom Session – 60 marks

    Role play activities giving real life context – 30 marks
    Presentation   – 30 marks

NOTE ON EVALUATION
1. Examples for role play situations:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.

2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.

REFERENCES:
1. Hartley, Peter, Group Communication, London: Routledge, (2004).
2. Doff, Adrian and Christopher Jones, Language in Use – (Intermediate level), Cambridge University Press, (1994).
3. Gammidge, Mick, Speaking Extra – A resource book of multi-level skills activities , Cambridge University Press, (2004).
4. Craven, Miles, Listening Extra - A resource book of multi-level skills activities, Cambridge, Cambridge University Press, (2004).
5. Naterop, Jean & Rod Revell, Telephoning in English, Cambridge University Press, (1987).

LAB REQUIREMENTS
1. Teacher – Console and systems for students
2. English Language Lab Software
3. Tape Recorders.

MA2211   TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATION   L T P C
(Common to all branches)   3 1 0 4

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differtial Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I   FOURIER SERIES   9 + 3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

UNIT II   FOURIER TRANSFORMS   9 + 3

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III   PARTIAL DIFFERENTIAL EQUATIONS   9 + 3

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV   APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS   9 + 3

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

UNIT V   Z -TRANSFORMS AND DIFFERENCE EQUATIONS   9 + 3

Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem - Formation of difference equations – Solution of difference equations using Z-transform.

LECTURES: 45 TUTORIALS : 15   TOTAL : 60 PERIODS

TEXT BOOKS

1. Grewal, B.S, 'Higher Engineering Mathematics' 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES

1   Bali.N.P and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications(P) Ltd. (2007)

2. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).

3. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education (2007).

4. Erwin Kreyszig 'Advanced Engineering Mathematics', Eighth edition-Wiley India (2007).
.

ME 3202   **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.
6. Donald R.Askeland and Pradeep P.Phule, The Science and Engineering of Materials, Thomson 5th edition, 2007.

EE3203   **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.

CE3204   **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

ME3205   **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.

MF3206   **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.

CE3207   **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

EE3208   **ELECTRICAL ENGINEERING &MEASUREMENTS**   **L T P C**
                                       LABORATORY   **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

ME3209   **MANUFACTURING TECHNOLOGY LABORATORY - I**   **L T 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

MF3210   **METALLURGY AND NON DESTRUCTIVE TESTING**   **L T P C**
                          LABORATORY   **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

MA3211   **PROBABILITY AND STATISTICS**   **L T P C**
                                                                      3 1 0 4

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

UNIT I   TWO-DIMENSIONAL RANDOM VARIABLES   9 + 3
Joint distributions – Marginal and Conditional distributions – Covariance – Correlation
and Linear regression – Transformation of random variables-Linberg Levy central limit
theorem

UNIT III   TESTING OF HYPOTHESIS   9 + 3
Tests for single mean – Proportion – Difference of means – Tests for single variance
and equality of variances – χ^2-test for goodness of fit – Independence of attributes.

UNIT IV   DESIGN OF EXPERIMENTS   9 + 3
Completely randomized design – Randomized block design – Latin square design - 2^2-
factorial design.

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

                                    L: 45, T: 15, Total : 60 PERIODS
BOOKS FOR STUDY:

  1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for
     Engineers and Scientists", Pearson Education, Asia , 8th edition, 2007.

  2. R.A. Johnson, C.B. Gupta, "Miller and Freund's Probability and Statistics for
     Engineers", Pearson Education, Asia, 7th edition, 2006, / R.A. Johnson, "Miller
     and Freund's Probability and Statistics for Engineers', Prentice Hall of India,
     7th edition, 2007.

BOOKS FOR REFERENCES:

  1. J.L. Devore, "Probability and Statistics for Engineering and the Sciences",
     Thomson Brooks/Cole, International Student Edition, 7th edition, 2008.

  2. J. S. Milton, J.C. Arnold, " Introduction to Probability and Statistics", Tata
     McGraw Hill, 4th edition, 2007.

  3. S.M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists,
     3rd edition, Academic Press, (An imprint of Elsevier), 2004

MF3212   **MANUFACTURING PROCESSES – II**   **L T P C**
                                                                        3 0 0 3

OBJECTIVES

At the end of this course the student should be able to understand
1) The tools, equipment and principle of operation of primary and secondary manufacturing processes.
2) Defects, causes and their remedies of welding, casting and metal forming operations.
3) Processing of plastics and fabrication of various types composite material.
4) Methods to solve problems on cutting forces, tool life and analytical methods of estimating cutting temperature.

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   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 - Calculations -Cutting temperature-causes, effects, measurement, estimation and control-Tool failure modes-wear mechanisms – tool life - Machinability -Surface finish and integrity of machined surfaces- - Machining economics- cutting tool materials-Cutting tool reconditioning-Cutting fluids.

                                                              TOTAL: 45 PERIODS

TEXT BOOK:
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.

REFERENCE BOOKS
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

ME2204   **FLUID MECHANICS AND MACHINERY**   **L T P C**
                                                                 3 1 0 4

OBJECTIVES:
a.   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.
b.   The applications of the conservation laws to flow though pipes and hydraulics machines are studied

UNIT I   INTRODUCTION   12
Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equiation, energy equation, momentum equation and moment of momentum equation.

UNIT II   FLOW THROUG CIRCULAR CONDUITS   12
Laminar flow though circular conduits and circular annuli. Boundary layer concepts. Boundary layer thickness. Hydraulic and energy gradient. Darcy – Weisbach equaition. Friction factor and Moody diagram. Commercial pipes. Minor losses. Flow though pipes in series and in parallel.

UNIT III   DIMENSIONAL ANALYSIS   9
Dimension and units: Buckingham's Π theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

UNIT IV   ROTO DYNAMIC MACHINES   16
Homologus units. Specific speed. Elementary cascade theory. Theory of turbo machines. Euler's equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V   POSITIVE DISPLACEMENT MACHINES   11
Recriprocating pumps, Indicator diagrams, Work saved by air vessels. Rotory pumps. Classification. Working and performance curves.

TOTAL : 60 PERIODS

TEXT BOOKS:
1. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES:
1.   Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi, 1988.
2.   Kumar. K.L., Engineering Fluid Mechanics (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 1995.
3.   Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi.

ME2303 **DESIGN OF MACHINE ELEMENTS** **L T P C**
3 1 0 4

OBJECTIVES
- 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.

UNITV   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. S10260 : 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

ME3215	THERMODYNAMICS	LT P C
		3 0 0 3

UNIT I   SYSTEM AND LAWS OF THERMODYNAMICS   9

Closed and open systems – Equilibrium – First law – Second law – Reversibility – Entropy – Processes – Heat and work transfers- Entropy change.

UNIT II   POWER CYCLES AND INTERNAL COMBUSTIONS ENGINES   9

Carnot cycle – Otto cycle – Diesel cycle – Dual cycle – Brayton cycle – Air standard efficiency

Two stroke and Four stroke engines – SI and CI engines- Gas turbine operation.

UNIT III   STEAM BOILERS AND TURBINES   9

Steam properties – use of Steam tables and charts – Steam power cycle – Boilers and Accessories – Boiler testing – Layout of thermal power stations

Steam turbines – Impulse and Reaction turbine – Compounding of turbines – simple velocity diagrams.

UNIT IV   AIR COMPRESSORS, REFRIGERATION AND AIR CONDITIONING   9

Reciprocating and Rotary compressors – Staging compressor work – Vapour compression refrigeration cycle – applications - Air conditioning system – Layout selection.

UNIT V   HEAT TRANSFER   9

Conduction – plane wall, cylinder, sphere, composite walls – Critical insulation thickness – Simple fins – Convection – free convection and forced convection - Flow over flat plates and flow through pipes – Empirical relations – Radiation – Black body, Grey body radiation – Heat Exchangers – Cooling of machines.

TOTAL : 45 PERIODS

TEXT BOOKS :

1. Nag P. K, 'Basic and Applied Thermodynaics' Tata McGraw-Hill, 1995.
2. Kothadaraman C.P and Domkundwar, 'Applied Thermodynamics', Dhanpat Rai and Sons, 1988.
3. Sachdeva R. C, 'Heat Transfer', Wiley Eastern Ltd.1992
4. T. Roy Choudhury, 'Basic Engineering Thermodynamics', Tata McGraw-Hill Publishing Co.Ltd.1997.

REFERENCES :

1. Ballaney P. L, 'Applied Thermodynamics,' Khanna Publishers.
2. Rai and Sorao, 'Applied Thermodynamics', Satya Prakasm 1985.

MF 3216   **ENGINEERING METROLOGY**   **L T P C**
                                                                    3 0 0 3

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 - Precision and Accuracy - Errors in Measurements - Causes – Types- Handling of measuring instruments- Maintenance of Instruments.

UNIT II   LINEAR AND ANGULAR MEASUREMENTS   9
Measurement of Engineering Components - Comparators, Slip gauges, Rollers, Limit gauges - Design and Applications - Auto collimator - 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 - Straightness, Flatness and roundness measurements - Principles - Application.

UNIT IV   LASER METROLOGY   10
Precision instrument based on Laser - Use of Lasers - Principle – Interference microscope -Laser Interferometer - Application in Linear and Angular measurements - Testing of machine tools using Laser Interferometer.

UNIT   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

ENGINEERING METROLOGY
1. R.K.Jain, " Engineering Metrology ", Khanna Publishers, 19th Edition, 2005..

REFERENCES:
1. Gaylor, Shotbolt and Sharp, " Metrology for Engineers ", O.R.Cassel, London, 1993.
2. Thomas, " Engineering Metrology ", Butthinson & Co., 1984.
3. Books an Workshop Technology and Manufacturing Processes.

ME3217   MANUFACTURING TECHNOLOGY LAB – II   L T P C
                                                               0 0 3 2

OBJECTIVE

Student should acquire skills on common basic machining operations and press working.

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

CE3218   FLUIDS MECHANICS AND MACHINERY LABORATORY   L T P C
                                                                   0 0 3 2

1.   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.

2.   PUMPS

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

3.   TURBINES

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

                                                          TOTAL : 45 PERIODS

REFERENCE

1. CWR, Hydraulics Laboratory Manual,2004

ME3219   DYNAMICS LABORATORY   L T P C
                                                                   0 0 3 2

OBJECTIVES:
 i) To supplement the principles learnt in kinematics and Dynamics of Machinery.
ii) 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.

ME3220   **MACHINE DRAWING**   **L T P C**
                                                               1 0 2 2
OBJECTIVE
        Acquiring the knowledge of machine drawing, which is essential language of industry, means much more than merely learning to draw. The knowledge in machine drawing is essential tool for any one who expects to work in an industry or to become a professional engineer. In either field, the preparation of good and accurate drawing is essential and important as the ability to read drawing correctly. 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.

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.

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

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 BOOKS

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

REFERENCE BOOKS

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.

MF3301	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.

MF3302   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.

MF3303   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.

MF3304	COMPUTER AIDED DESIGN	LT P C
		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.

ME3305　　　　　　　　**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.

MF3306 **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.

MF3307   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

MF3308   **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

MF3309   **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

MF3310   **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.

MG3314   **INDUSTRIAL MANAGEMENT**   **LT P C**
                                                                          3 0 0 3

OBJECTIVE

To provide a clear understanding of basic management principles that leads to corporate building. Industrial Management deals with not only functions of management but also organizational structure and dynamics and includes 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. Leading – Managing human factor – Leadership – Communication, 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 – Behavior and Performance, Perception – Organizational Implications. Personality – Contributing factors – Dimension – Need Theories – Process Theories – Job Satisfaction, Learning and Behavior – Learning Curves, Work Design and approaches.

UNIT IV   GROUP DYNAMICS   9

Group Behavior – Groups – Contributing factors – 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.

ME2029   **DESIGN OF JIGS, FIXTURES & PRESS TOOLS**   **L T 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 ax- symmetric, 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.
6. Design Data Hand Book, PSG College of Technology, Coimbatore.

MF3313	COMPUTER INTEGRATED PRODUCTION	L T P C
	MANAGEMENT SYSTEM	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.

ME3314	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.

ME3315   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.

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.

ME3316   **MICROPROCESSOR AND MICRO CONTROLLER**   **L T P C**
                                          LABORATORY   **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

MF3317   **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

GE3318   **COMMUNICATION SKILLS LABORATORY**   **L T P C**
                                                                 0 0 4 2

Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students' overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them 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	(Weightage 40%)	24 periods

A. ENGLISH LANGUAGE LAB (18 Periods)

1. LISTENING COMPREHENSION: (6)
Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

2. READING COMPREHENSION: (6)
Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. SPEAKING: (6)
Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English.

Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. DISCUSSION OF AUDIO-VISUAL MATERIALS (6 PERIODS)

(Samples are available to learn and practice)

1. **RESUME / REPORT PREPARATION / LETTER WRITING** (1)
   Structuring the resume / report - Letter writing / Email Communication - Samples.

2. **PRESENTATION SKILLS:** (1)
   Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3. **SOFT SKILLS:** (2)
   Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. **GROUP DISCUSSION:** (1)
   Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. **INTERVIEW SKILLS:** (1)
   Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.

II. Practice Session	(Weightage – 60%)	24 periods

1. **Resume / Report Preparation / Letter writing**: Students prepare their own resume and report. (2)

2. **Presentation Skills:** Students make presentations on given topics. (8)

3. **Group Discussion**: Students participate in group discussions**.** (6)

4. **Interview Skills**: Students participate in Mock Interviews (8)

TEXT BOOKS

1. Anderson, P.V, **Technical Communication**, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Prakash, P, **Verbal and Non-Verbal Reasoning**, Macmillan India Ltd., Second

Edition, New Delhi, 2004.

REFERENCES
1. John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi, 2004.
2. Evans, D, **Decisionmaker**, Cambridge University Press, 1997.
3. Thorpe, E, and Thorpe, S, **Objective English**, Pearson Education, Second Edition, New Delhi, 2007.
4. Turton, N.D and Heaton, J.B, **Dictionary of Common Errors**, Addison Wesley Longman Ltd., Indian reprint 1998.

LAB REQUIREMENT

1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

Requirement for a batch of 60 students

Sl.No.	Description of Equipment	Quantity required
1.	**Server** ○ PIV system ○ 1 GB RAM / 40 GB HDD ○ OS: Win 2000 server ○ Audio card with headphones (with mike) ○ JRE 1.3	1 No.
2.	**Client Systems** ○ PIII or above ○ 256 or 512 MB RAM / 40 GB HDD ○ OS: Win 2000 ○ Audio card with headphones (with mike) ○ JRE 1.3	60 No.
3.	Handicam Video Camera (with video lights and mic input)	1 No.
4.	Television - 29"	1 No.
5.	Collar mike	1 No.
6.	Cordless mikes	1 No.
7.	Audio Mixer	1 No.
8.	DVD Recorder / Player	1 No.
9.	LCD Projector with MP3 /CD /DVD provision for audio / video facility - **Desirable**	1 No.

MF3401   **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.

ME3402   **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.

GE2022   **TOTAL QUALITY MANAGEMENT**   **L T P C**
                                                       3 0 0 3

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

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

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

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

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

TOTAL: 45 PERIODS

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

REFERENCES:
1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 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.

MF3404   **FLEXIBLE MANUFACTURING SYSTEMS**   **L T P C**
                                                        3 0 0 3

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

OBJECTIVES:
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.

MF3405   **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

ME3406   **COMPUTER AIDED SIMULATION AND ANALYSIS**   **LT P C**
                    LABORATORY   **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

ME3407   **MECHATRONICS LABORATORY**   **L T 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

MF3408   **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

MF3409   **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.

MF3001   **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.

| MF3013 | 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.

ML3016   **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

MA2264	NUMERICAL METHODS	L T P C
		3 1 0 4

AIM
With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically.

OBJECTIVES
* At the end of the course, the students would be acquainted with the basic concepts in numerical methods and their uses are summarized as follows:
* The roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.
* When huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
* The numerical differentiation and integration find application when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.
* Since many physical laws are couched in terms of rate of change of one/two or more independent variables, most of the engineering problems are characterized in the form of either nonlinear ordinary differential equations or partial differential equations. The methods introduced in the solution of ordinary differential equations and partial differential equations will be useful in attempting any engineering problem.

UNIT I   SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS   9
Solution of equation –Fixed point iteration: x=g(x) method - Newton's method – Solution of linear system by Gaussian elimination and Gauss-Jordon method– Iterative method - Gauss-Seidel method - Inverse of a matrix by Gauss Jordon method – Eigen value of a matrix by power method and by Jacobi method for symmetric matrix.

UNIT II   INTERPOLATION AND APPROXIMATION   9
Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulas.

UNIT III   NUMERICAL DIFFERENTIATION AND INTEGRATION   9
Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulae – Double integrals using trapezoidal and Simpsons's rules.

UNIT IV   INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL
                    EQUATIONS   9
Single step methods: Taylor series method – Euler method for first order equation –
Fourth order Runge – Kutta method for solving first and second order equations –
Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V   BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL
                   DIFFERENTIAL EQUATIONS   9
Finite difference solution of second order ordinary differential equation – Finite difference
solution of one dimensional heat equation by explicit and implicit methods – One
dimensional wave equation and two dimensional Laplace and Poisson equations.

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

TEXT BOOKS

1. Veerarjan, T and Ramachandran, T. 'Numerical methods with programming in 'C'
   Second Editiion, Tata McGraw-Hill Publishing.Co.Ltd. (2007).
2. Sankara Rao K, 'Numerical Methods for Scientisits and Engineers' – 3rd editiion
   Printice 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. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th
   Edition, Khanna Publishers, New Delhi, 2004

GE2025   PROFESSIONAL ETHICS IN ENGINEERING   L T P C
                                                                                                3 0 0 3

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

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

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

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

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

TOTAL: 45 PERIODS

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

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

MF3014   VALUE ENGINEERING AND REENGINEERING   LT 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.

MF3015   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

IE3017   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.

ME2023   RENEWABLE SOURCES OF ENERGY   L T 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.

OBJECTIVES:
*   At the end of the course, the student expected to do 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, TODAL, 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 utilization, Applications : power generation, transport – Fuel cells – technologies, types – economics and the power generation

TOTAL: 45 PERIODS

TEXT BOOK:
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.

ME3019   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.

MF3009   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.

MF3010   **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

MF3011   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.

MF3012   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

GE2023   FUNDAMENTALS OF NANOSCIENCE   L T P C
3 0 0 3

UNIT I   INTRODUCTION   10

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

UNIT II   PREPARATION METHODS   10

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

UNIT III   PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES   5

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

UNIT IV   PREPARATION ENVIRONMENTS   10

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

UNIT V   CHARECTERISATION TECHNIQUES   10

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

TOTAL : 45 PERIODS

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

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

MF3005   QUALITY CONTROL AND RELIABILITY ENGINEERING   L T 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.

MF3006 **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.

MF3007   PROCESSING OF PLASTICS AND COMPOSITE MATERIALS   LT P C
                                                                    3 0 0 3

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

OBJECTIVES:
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.

PT3024	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.

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

MF3002   **NON DESTRUCTIVE TESTING**   **LT P C**
                                                                      3 0 0 3

AIM:
To impart knowledge in various methods of Non Destructive Testing

OBJECTIVES:
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.

**MF3003   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.

MF3004   **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

MF3008   **NUCLEAR ENGINEERING**   **L T 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.

ME2032	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.