AFFILIATED INSTITUTIONS

ANNA UNIVERSITY, CHENNAI

R - 2008
B.E. INDUSTRIAL 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	-

* **Common to all B.E. / B.Tech. Programmes**

+ **Offering English Language Laboratory as an additional subject (with no marks) during 2nd semester may be decided by the respective Colleges affiliated to Anna University Chennai.**

A. CIRCUIT BRANCHES

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. NON – CIRCUIT BRANCHES

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

III SEMESTER

CODE	COURSE TITLE	L	T	P	C
THEORY					
IE3201	Work System Design	3	0	0	3
MA2211	Transforms and Partial Differential Equation	3	1	0	4
ME 2201	Manufacturing Technology – I	3	0	0	3
ME3205	Mechanics of Machines	3	1	0	4
CE3204	Strength of Materials	3	0	0	3
IE3202	Operations Research - I	3	1	0	4
PRACTICAL					
ME3209	Manufacturing Technology Laboratory I	0	0	3	2
IE3203	Work System Design Laboratory	0	0	2	1
CE3207	Strength of Materials laboratory	0	0	3	2
	TOTAL	**18**	**3**	**8**	**26**

IV SEMESTER

CODE	COURSE TITLE	L	T	P	C
THEORY					
MA3211	Probability and Statistics	3	1	0	4
ME 2204	Fluid Mechanics and Machinery	3	1	0	4
ME2303	Design of Machine Elements	3	1	0	4
ME2252	Manufacturing Technology -II	3	0	0	3
ME3222	Thermodynamics	4	0	0	4
IE3251	Engineering Economy, Costing and Accounting	3	1	0	4
PRACTICAL					
CE3218	Fluid Mechanics and Machinery Laboratory	0	0	3	2
ME3217	Manufacturing Technology Laboratory II	0	0	3	2
	TOTAL	**19**	**4**	**6**	**27**

V SEMESTER

CODE	COURSE TITLE	L	T	P	C
THEORY					
IE3301	Principles of Management	3	0	0	3
IE3302	Operations Research - II	3	1	0	4
IE3303	Statistical Quality Control	4	0	0	4
IE3304	Applied Ergonomics	3	0	0	3
IE3305	Manufacturing Automation	3	0	0	3
	Elective I	3	0	0	3
PRACTICAL					
IE3306	Automation Laboratory	0	0	3	2
IE3307	Ergonomics Lab	0	0	2	1
IE3308	Technical Seminar	0	0	2	1
	TOTAL	**19**	**1**	**7**	**24**

VI SEMESTER

CODE	COURSE TITLE	L	T	P	C
THEORY					
IE3351	Multi-Variate Statistical Analysis	3	0	0	3
IE3352	Principles of Computer Integrated Manufacturing Systems	3	0	0	3
IE3353	Reliability Engineering	3	0	0	3
IE3354	Facility layout and Materials handling	3	0	0	3
IE3355	Production Planning and Control	3	0	0	3
	Elective - II	3	0	0	3
PRACTICAL					
IE3356	Production System Design Project	0	0	6	3
IE3357	Statistical Applications and Optimization lab	0	0	3	2
GE3318	Communication Skills Laboratory	0	0	4	2
	TOTAL	18	0	13	25

VII SEMESTER

CODE	COURSE TITLE	L	T	P	C
THEORY					
IE3401	Design of Experiments	3	1	0	4
GE2022	Total Quality Management	3	0	0	3
IE3402	Simulation Modeling and Analysis	3	0	0	3
IE3403	Operations Scheduling	3	0	0	3
	Elective –III	3	0	0	3
	Elective – IV	3	0	0	3
PRACTICAL					
IE3404	Discrete Simulation Laboratory	0	0	3	2
IE3405	Comprehension	0	0	2	1
	TOTAL	18	1	5	22

VIII SEMESTER

CODE	COURSE TITLE	L	T	P	C
THEORY					
	Elective - V	3	0	0	3
	Elective - VI	3	0	0	3
PRACTICAL					
IE3451	Project work	0	0	12	6
	TOTAL	6	0	12	12

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 190

LIST OF ELECTIVES FOR B.E. INDUSTRIAL ENGINEERING

ELECTIVE - I

CODE	COURSE TITLE	L	T	P	C
IE3004	Information Systems Analysis and Design	3	0	0	3
IE3005	Advanced Optimization Techniques	3	0	0	3
IE3009	Computational Methods and Algorithms	3	0	0	3
IE3010	Decision Support and Intelligent Systems	3	0	0	3
IE3011	Evolutionary Optimization	3	0	0	3
IE3012	Systems Engineering	3	0	0	3

ELECTIVE - II

CODE	COURSE TITLE	L	T	P	C
ME3014	Automobile Engineering	3	0	0	3
ME2029	Design of Jigs, Fixtures and Press tools	3	0	0	3
ME3314	Finite Element Analysis	3	0	0	3
MA2264	Numerical Methods	3	1	0	4

ELECTIVE - III

CODE	COURSE TITLE	L	T	P	C
IE3008	Modeling of Manufacturing Systems	3	0	0	3
MF3011	Robotics	3	0	0	3
MF3015	Electronics Manufacturing Technology	3	0	0	3
MF3404	Flexible Manufacturing Systems	3	0	0	3
GE2023	Fundamentals of Nano Science	3	0	0	3

ELECTIVE - IV

CODE	COURSE TITLE	L	T	P	C
IE3003	Human Resources Management	3	0	0	3
IE3007	Technology Management	3	0	0	3
IE3017	Supply Chain Management	3	0	0	3
MG2021	Marketing Management	3	0	0	3
ME2035	Entrepreneurship Development	3	0	0	3

ELECTIVE - V

CODE	COURSE TITLE	L	T	P	C
IE3001	Productivity Management and Re-engineering	3	0	0	3
IE3006	Value Engineering and Project Management	3	0	0	3
MF3001	Product Design and development	3	0	0	3
PT3024	Packaging Materials and Technology	3	0	0	3

ELECTIVE - VI

CODE	COURSE TITLE	L	T	P	C
ME3021	Energy Conservation & Management	3	0	0	3
IE3002	Safety Engineering and Management	3	0	0	3
IE3013	Maintenance Engineering & Management	3	0	0	3
GE2025	Professional Ethics in Engineering	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 BOOKS:

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   IC 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
         ⬜33 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.**

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

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 LABORATORYL 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.

                                                    TOTAL: 45 PERIODS

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.

IE3201   **WORK SYSTEM DESIGN**   **L T P C**
                                                                       3 0 0 3

OBJECTIVE
- To impart knowledge in the area of Method study and Time study so that students can implement these principles and techniques to improve productivity in manufacturing and Service sectors.

UNIT I   PRODUCTIVITY   9
Total time for a job or operation, total work content and ineffective time, – Production and Productivity - Productivity and standard of living, Factors affecting Productivity, Productivity measurement Models.

UNIT II   METHODS ENGINEERING   9
Methods Engineering-Steps -Tools and techniques, Motion study.

UNIT III   WORK MEASUREMENT   9
Stop watch time study, performance rating, allowances, Development of Standard data, learning effect. Work measurement in Automated Processes. Computerised Labour standards.

UNIT IV   APPLIED WORK MEASUREMENT   9
Work sampling, Group Timing Technique (GTT), predetermined time systems, types, Methods Time Measurement (MTM), Wage incentive plans.

UNIT V   WORK DESIGN FOR OFFICE WORK   9
Organization and methods (O & M), Work measurement of office work, Work Analysis techniques applied to support staff, Form design and control.

                                                         TOTAL: 45 PERIODS
TEXT BOOK:
1. Barnes, R.M. Motion and Time Study, Design and measurement of work, John Wiley sons(Asia), Seventh edition,2002.

REFERENCES:
1. Benjamin W.Niebel, Andris Freivalds, Methods, standards & Work Design, McGraw hill, Eleventh edition, 2002.
2. ILO, Introduction to Work Study, Oxford and IBH publishing , 2001
3. Maynard H.B, Industrial Engineering Hand book,McGraw-Hill,2001

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).

ME2201   **MANUFACTURING TECHNOLOGY – I**   **L T P C**
                                                                        3 0 0 3

OBJECTIVE

To introduce the students the concepts of some basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and plastics component manufacture.

UNIT I   METAL CASTING PROCESSES   9

Sand casting – Sand moulds - Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines - Melting furnaces – Working principle of Special casting processes – Shell, investment casting – Ceramic mould – Lost Wax process – Pressure die casting – Centrifugal casting – CO_2 process – Sand Casting defects – Inspection methods

UNIT II   JOINING PROCESSES   9

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, seam welding – Percusion welding - Gas metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG welding – Principle and application of special welding processes - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding – Diffusion welding – Weld defects – Brazing and soldering process – Methods and process capabilities – Filler materials and fluxes – Types of Adhesive bonding.

UNIT III   BULK DEFORMATION PROCESSES   9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – Characteristics of the process – Types of Forging Machines – Typical forging operations – Rolling of metals – Types of Rolling mills - Flat strip rolling – Shape rolling operations – Defects in rolled parts - Principle of rod and wire drawing - Tube drawing —– Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion —– Equipments used.

UNIT IV   SHEET METAL PROCESSES   9

Sheet metal characteristics - Typical shearing operations, bending and drawing operations – Stretch forming operations —– Formability of sheet metal – Test methods – Working principle and application of special forming processes - Hydro forming – Rubber pad forming – Metal spinning – Introduction to Explosive forming, Magnetic pulse forming, Peen forming, Super plastic forming.

UNIT V   MANUFACTURING OF PLASTIC COMPONENTS   9

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Compression moulding, Transfer moulding - Typical industrial applications – Introduction to Blow moulding – Rotational moulding – Film blowing – Extrusion - Thermoforming, - Bonding of Thermoplastics.

                                                        TOTAL: 45 PERIODS

TEXT BOOKS

1. Hajra Choudhury, "Elements of Workshop Technology, Vol. I and II", Media Promotors Pvt Ltd., Mumbai, 2001
2. S.Gowri, P.Hariharan, and A.Suresh Babu, "Manufacturing Technology 1", Pearson Education , 2008.

REFERENCES
1. B.S. Magendran Parashar & R.K. Mittal,"Elements of Manufacturing Processes", Prentice Hall of India, 2003.
2. P.N. Rao,"Manufacturing Technology",Tata McGraw-Hill Publishing Limited, II Edition, 2002.
3. P.C. Sharma, "A text book of production technology",S. Chand and Company, IV Edition,   2003.
4. Begman, 'Manufacturing Process", John Wilely & Sons, VIII Edition, 2005.
5. Serope Kalpajian, Steven R.Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc. 2002(Second Indian Reprint).
6. Beddoes.J and Bibby M.J, 'Principles of Metal Manufacturing Processes', Elsevier, 2006.
7. Rajput R.K, 'A text book of Manufacturing Technology', Lakshmi Publications, 2007.

ME3205   **MECHANICS OF MACHINES**   **L T 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.

T:45 +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:
IS 2458:2001, Vocabulary of Gear Terms – Definitions related to Geometry.
IS 3756 : 2002, Method of Gear Correction – Addendum modification for External cylindrical gears with parallel axes.
IS 5267 : 2002 Vocabulary of Gear Terms – Definitions Related to Worm Gear Geometry.
IS 12328 : Part 1 : 1988 Bevel Gear Systems Part -1 Straight Bevel Gears.
IS12328 : 1988 Bevel Systems Part – 2 Spiral Bevel Gears.

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

IE3202   OPERATIONS RESEARCH – I   L T P C
3 1 0 4

OBJECTIVE:
To learn the basics of deterministic optimization tools

UNIT I   LINEAR PROGRAMMING   10
Introduction - Formulation of linear programming models – Assumptions-Graphical solution procedure – solving LPP using simplex algorithm – Degeneracy, Alternative Optima, Unbounded identification- LP Applications- Data Envelopment Analysis-Revised Simplex Method

UNIT II   ADVANCES IN LPP - I   10
Duality theory - Interpretation of dual variables- Primal Dual Relationships – Role of duality in sensitivity analysis - Dual simplex method – Graphical based and Simplex based Sensitivity analysis –- Transportation problems, transportation simplex method– Assignment problems, Hungarian method- LP formulation of transportation and Assignment networks- Traveling sales man problem

UNIT III   ADVANCES IN LPP - II   6
Integer Linear programming formulations, graphical solution of the LP relaxation, Graphical solution to all integer problem, applications involving 0-1 variables, introduction to cutting plane and branch & bound methods – Multi objective optimization - Goal programming problem formulation.

UNIT IV   NETWORK MODELS   12
Maximal flow problem – Shortest route problem – Minimal spanning tree problem - Project networks, CPM, PERT, Crashing of networks, L P model for crashing – project costing and control.

UNIT V   DYNAMIC PROGRAMMING   7

Elements of dynamic programming – stage and state, characteristics of DP problems, recursive relationship, Bellman's principle of optimality – computational procedure for shortest route problem, knapsack problem, production and inventory control problem.

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

TEXT BOOKS
1. Hillier and Lieberman Introduction to Operations Research, TMH, 2000
2. R.Panneerselvam, Operations Research,PHI,2006

REFERENCES
1. Philips, Ravindran and Solberg, Operations Research, John Wiley,2002
2. Hamdy A Taha, Operations Research – An Introduction, Prentice Hall India,2003
3. Ronald L Rardin, Optimisation in Operations Research, Pearson, 2003
4. David R. Anderson, et al , An Introduction to Management Science – Quantitative approaches to Decision Making, Thomson,2003

ME3209   MANUFACTURING TECHNOLOGY LAB-I   L T P C
**   0 0 3 2**

AIM:
To have knowledge on common basic machining operations

OBJECTIVES:
To study and practice the various operations that can be performed in lathe, shaping, drilling, milling etc. and equip with the practical knowledge required in the core industries.

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 and Milling Operations.

TOTAL: 45 PERIODS

IE3203   **WORK SYSTEM DESIGN LAB**   **L T P C**
                                                                 0 0 2 1

OBJECTIVE:
To understand the theory better and apply in practice, practical training is given in the following areas

1. Graphic tools for method study
2. Peg board experiment
3. Stop watch time study
4. Performance rating exercise
5. Work sampling
6. MTM practice

                                                TOTAL: 30 PERIODS

CE3207   **STRENGTH OF MATERIALS LABORATORY**   **L T P C**
                                                                  0 0 3 2

AIM:
To perform various types test like tension, compression impact tests in Laboratory.

OBJECTIVES:
• To understand the various mechanical properties by conducting tensile test.

1. To understand the hardness value of different materials
2. Tension test on mild steel / tor steel rod
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen
6. Hardness test on metals
7. Compression test on helical spring
8. Deflection test on carriage spring

                                                TOTAL : 45 PERIODS

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

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

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

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

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

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

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

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

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

ME2204   **FLUID MECHANICS AND MACHINERY**   **L T P C**
(Common to Aeronautical, Mechanical, Automobile & Production) **3 1 0 4**

OBJECTIVES
- 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.
- 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 acomponent 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 springs -- rubber springs -- Design of flywheels considering stresses in rims and arms, for engines and punching machines.

UNIT V   DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS   9

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

LECTURE: 45 TUTORIAL: 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. Bhandari 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, 2003.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.

STANDARDS

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

ME 2252   **MANUFACTURING TECHNOLOGY – II**   **L T P C**
                                                                3 0 0 3

OBJECTIVE
To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching
To understand the basic concepts of computer numerical control (CNC) machine tool and CNC programming.

UNIT I   THEORY OF METAL CUTTING   9
Introduction: material removal processes, types of machine tools – theory of metal cutting: chip formation, orthogonal cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids.

UNIT II   CENTRE LATHE AND SPECIAL PURPOSE LATHES   9
Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle - Turret Indexing mechanism, Bar feed mechanism.

UNIT III   OTHER MACHINE TOOLS   9
Reciprocating machine tools: shaper, planer, slotter - Milling : types, milling cutters, operations - Hole making : drilling - Quill mechanism , Reaming, Boring, Tapping - Sawing machine: hack saw, band saw, circular saw; broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT IV   ABRASIVE PROCESSES AND GEAR CUTTING   9
Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing, abrasive jet machining - Gear cutting, forming, generation, shaping, hobbing.

UNIT V   CNC MACHINE TOOLS AND PART PROGRAMMING   9

Numerical control (NC) machine tools – CNC: types, constructional details, special features – design considerations of CNC machines for improving machining accuracy – structural members – slide ways –linear bearings – ball screws – spindle drives and feed drives. Part programming fundamentals – manual programming – computer assisted part programming**.**

TOTAL : 45 PERIODS

TEXT BOOKS
1. Hajra Choudry, "Elements of Work Shop Technology – Vol. II", Media Promoters. 2002
2. HMT – "Production Technology", Tata McGraw-Hill, 1998.

REFERENCES:
1. Rao, P.N. "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2003.
2. P.C. Sharma, "A Text Book of Production Engineering", S. Chand and Co. Ltd, IV edition, 1993.
3. Shrawat N.S. and Narang J.S, 'CNC Machines', Dhanpat Rai & Co., 2002.
4. P.N.Rao, 'CAD/CAM Principles and Applications', TATA Mc Craw Hill, 2007.
5. M.P.Groover and Zimers Jr., 'CAD/CAM' Prentice Hall of India Ltd., 2004.
6. Milton C.Shaw, 'Metal Cutting Principles', Oxford University Press, Second Edition, 2005.
7. Rajput R.K, 'Atext book of Manufacturing Technology', Lakshmi Publications, 2007.
8. Philip F.Ostwald and Jairo Munoz, 'Manufacturing Processes and systems', John Wiley and Sons, 9th Edition,2002.
9. Mikell P.Groover, 'Fundamentals of Modern Manufacturing,Materials, Processes and Systems', John Wiley and Sons, 9th Edition,2007.
10. Chapman. W. A. J and S.J. Martin, Workshop Technology, Part III, Viva Books Private Ltd., 1998

ME3222   **THERMODYNAMICS**   **L T P C**
                                                                    4 0 0 4

AIM:
- To impart the importance of thermal science aspects in the field of manufacturingengineering.

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

UNIT I   BASIC CONCEPTS OF THERMODYNAMICS   9
Thermodynamics and Energy – Systems – Types and properties - State and Equilibrium - Processes and Cycles – Forms of Energy – Temperature and Zeroth law of Thermodynamics – Pure substances – Phase change processes of pure substances – Property diagrams – Internal energy – Enthalpy – Energy transfer by Heat, Work and Mass – Applications.

UNIT II   FIRST AND SECOND LAW OF THERMODYNAMICS   9
First law of thermodynamics – Energy balance for closed systems and steady flow systems – Applications of First law of Thermodynamics – Energy balance for Unsteady flow processes – Second law of Thermodynamics – Entropy – Carnot principles – Change in Entropy – Entropy and irreversibility – Third law of Thermodynamics - Applications.

UNIT III   HEAT ENGINES   15
Internal Combustion Engines – C.I and S.I Engines – Four Stroke and Two Stroke Engines – Gas Turbines. Boilers – Fire Tube Boiler & Water Tube Boilers – Boiler Accessories and Components. Turbines – Impulse Turbine and Reaction Turbine – Turbine Components. Refrigeration Cycle – Vapour Compression & Vapour Absorption System – Gas Refrigeration System – Environmental friendly Refrigerants – Air Conditioning.

UNIT IV   GASES AND VAPOUR MIXTURES   9
Ideal and Real gases – Vander waals equations – Reduced property – Compressibility chart -Properties of mixture of gases – Dalton's law and Gibbs – Dalton law – Internal energy, Enthalpy and specific heats of gas mixtures.

UNIT V   HEAT RANSFER   9
Conduction – Plane Wall, Cylinder system, Composite Walls – Critical insulation thickness – Simple, fins convection – Free convection and forced convection – Flow over Flat plates and Flow through Pipes – Radiation – Black Body, Grey Body Radiation.3403

                                                    TOTAL: 60 PERIODS

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

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

IE3251   ENGINEERING ECONOMY, COSTING AND ACCOUNTING   L T P C
$\qquad$**3 1 0 4**

OBJECTIVES:
- To impart knowledge in the areas of cost estimation, pricing of products, cost control methods and principles of accounting.
- After undergoing the course, the students will be able to estimate cost of products, analyze product cost and suggest cost reduction measure.

UNIT I   INTRODUCTION   6
Objectives of Managerial Economics, Firm, Cost Estimation, Costing, Cost Accounting, Factors Influencing Managerial Decisions & Theoretical Concepts, Classification and Elements of cost.

UNIT II   PRODUCTION ANALYSIS AND PRICING   9
Production Function-Least Cost Combination of Inputs-Factor Productivities & Return to Scale-Determinants of Price-Pricing under different objectives and Market Structures-Price Discrimination & Pricing methods in practice.

UNIT III   ESTIMATION   10
Estimation of Material, Labor and Overhead Cost, Allocation of Overheads. Estimation for different types of jobs.

UNIT IV   COSTING   10
Job Costing-Operating Costing-Process Costing- Standard Costing (Variance Analysis)

UNIT V   ACCOUNTING   10
Balance Sheet-Profit & Loss Statement-Evaluation of Investment decisions- Average Rate of Return-Payback Period-Net Present Value & IRR.

$\qquad$**L: 45 T: 15 TOTAL: 60 PERIODS**

TEXT BOOKS:
1. Jawaharlal, Cost Accounting, TMH, 1996
2. A. Ramachandran Aryasry & VV.Ramana Murthy, Engg Economics & Financial Accounting, TMH, NewDelhi, 2004.

REFERENCES:
1. James.C.Van Home, "Fundamentals of fincancial Management", PHI, NewDelhi, 2004.
2. V.L.Mote, Samuel Paul & G.S.Gupta, Managerial Economics-Concepts & Cases, TMH, Co, NewDelhi, 1989
3. T.P.Banga & S.C.Sharma, Mechancial Estimating and Costing, Khanna Publishers, 1984.

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

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

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

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

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

UNIT III   TURBINES
Determination of performance characteristics of turbines – reaction turbines and impulse turbines.

                                                    TOTAL : 45 PERIODS
REFERENCE:
  1. CWR, Hydraulics Laboratory Manual,2004

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

AIM:
To acquire skills on common basic machining operations and press working

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

LIST OF EXPERIMENTS

1. Contour Milling using vertical milling machine

2. Gear Cutting using milling machine

3. Gear Hobbing

4. Gear Shaping

5. Hexagonal Machining using Horizontal Milling Machine

6. Gear Cutting – Gear Shaping

7. Spline Broaching

8. Exercise in Surface Grinding

9. Exercise in Cylindrical Grinding

10. Exercise in Tool and Cutter Grinder

11. Spur and helical gear cutting in Milling Machine

12. Determination of cutting forces in Milling Machine

13. Study of Turret and Capstan lathe

14. Forming of Simple Components in Press Working and simple Calculations of

sheet metal work

TOTAL : 45 PERIODS

IE3301 **PRINCIPLES OF MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVE:
- To explain the basic principles of management, namely, Planning, Organizing, Staffing, Leading and Controlling and application of these principles in any given organization.

UNIT I PLANNING 9
Nature and Purpose of Planning – Objectives –Strategies, Pricing & Planning Process and Decision Making.

UNIT II ORGANIZING 9
Nature and Purpose of Organizing –Basic Departmentation – Line/Staff Authority and Decentralization –Effective Organization and Organizational Culture.

UNIT III STAFFING 9
HRM and Selection - Performance Appraisal & Wages Strategy –Manager and Organizationl Development..

UNIT IV LEADING 9
Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication – Process of Communication – Barriers and Breakdown – Effective Communication – Electronic media in Communication.

UNIT V CONTROLLING 9
System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

TOTAL: 45 PERIODS

TEXT BOOK:
1. Herold Koontz and Heinz Weibrich, "Essentials of Management", TMH, 2001.

REFERENCES:
1. James.A.F., Stones and R.Edward Freeman, "Management", PHI, 1992.
2. Josesph.L.Massic, "Essentials of Management", PHI, 1985.

IE3302   **OPERATIONS RESEARCH – II**   **L T P C**
                                                               3 1 0 4

OBJECTIVE:
To impart knowledge on some probabilistic optimization techniques

UNIT I   DETERMINISTIC INVENTORY MODELS   9
Purchase model with no shortages – manufacturing model with no shortage –
Purchase model with shortage – Manufacturing model with shortages –model with
price breaks

UNIT II   PROBABILISTIC INVENTORY MODELS   9
Probabilistic inventory model – Reorder point model – multi product-Selective
Inventory control.

UNIT III   QUEUING THEORY   9
Queuing theory terminology   – Single server, multi server, Limited queue capacity –
applications – Markov chains

UNIT IV   DECISION THEORY   12
Decision making under certainty – Decision making under risk – Decision making
under uncertainty – Decision tree analysis – MCDM – AHP. Game Theory - Two
person zero sum games, pure and mixed strategies – graphical solution – solving by
LP.

UNIT V   REPLACEMENT MODELS   6
Replacement models – Money value, present worth factor and discount rate.

                                                   TOTAL: 60 PERIODS
TEXT BOOK
1. Philips, Ravindran and Solberg, Operations Research, John Wiley,2002

REFERENCES
1. Hamdy A Taha, Operations Research – An Introduction, Prentice Hall ndia,2003
2. Ronald L Rardin, Optimisation in Operations Research, Pearson, 2003
3. David R. Anderson, et al , An Introduction to Management Science –
   Quantitative approaches to Decision Making, Thomson,2003

IE3303   **STATISTICAL QUALITY CONTROL**   **L T P C**
                                                                  4 0 0 4
OBJECTIVE
• This course is concerned with the applications of statistical tools in measuring
  and controlling the quality of products/processes

UNIT I   QUALITY FUNDAMENTALS   5

Importance of quality, meaning of quality, quality dimensions, quality planning, quality control, SQC, Quality assurance, quality costs, economics of quality, quality and productivity, quality and reliability, quality loss function.

UNIT II   CONTROL CHARTS FOR VARIABLES   10

Process variation,– Statistical basis, 3 – sigma control limits, Rational sub-grouping, $\bar{X}$,R and S charts, Interpretation of charts, warning and modified control limits, operating characteristic curve for $\bar{X}$ – chart, SPC -process capability analysis – C_p, C_{PK}, C_{pm}, Machine capability, Gauge capability.

UNIT III   CONTROL CHARTS FOR ATTRIBUTES   10

P, np, C, U and ku charts, demerits control chart, Multi – variable chart, individual measurement charts – moving average and moving range charts, quality control in service sector.

UNIT IV   ACCEPTANCE SAMPLING   10

Need for Acceptance sampling, economics of sampling, sample selection, single and Double sampling – O.C. curves, Average outgoing quality (AOQ), Average sample number (ASN), Average total inspection (ATI), Multiple and sequential sampling, sampling plans – military standards, Dodge – Roming, IS 2500.

UNIT V   METROLOGY & INSPECTION   10

Fundamental methods of measurement, precision & accuracy, measurement devices - Linear and Angular - Coordinate Measuring Machine, Destructive and Non-Destructive Testing methods.

L : 45 T:15   TOTAL: 60 PERIODS

TEXT BOOK :
1. Douglus C.Montgomery, Introduction to Statistical Quality Control, John Wiley & Sons, 2004.

REFERENCES :
1. Statistical Quality Control, Eugene L.Grant and Richard S.Leaven Worth, TMH, Seventh Edition, 2000.
2. Quality Control. Dale H.Besterfield, Pearson Education Asia, Seventh Edition,2004.

IE3304   **APPLIED ERGONOMICS**   **L T P C**
3 0 0 3

OBJECTIVE
To explain the general principles that govern the interaction of humans and their working environment for improving worker performance and safety.

UNIT I   INTRODUCTION   3

Brief history of human factors engineering/Ergonomics – Interdisciplinary nature.

UNIT II   HUMAN PERFORMANCE: 10

Factors influencing performance – Information receiving and processing – Information theory and its application - Human response and errors – Signal detection theory – Biostatic and Biodynamic Mechanics.

UNIT III   PHYSIOLOGICAL ASPECTS OF HUMAN AT WORK   12

Metabolism – Physiological factors involved in muscular activity – Measurement of energy expenditure – Quantitative work load analysis - Physical work capacity and its evaluation – Physiological fatigue – Work and rest schedules – Physical fitness tests.

UNIT IV   WORK PLACE DESIGN: 12

Problems of body size, Anthropometry measures, Work posture - Work space layout and work station design – Design of displays, controls and VDT work stations - Hand tool design. illumination.

UNIT V   OCCUPATIONAL HEALTH AND SAFETY   8

Industrial accidents, Personal Protective devices, Safety Management practices – Effect of Environment – heat, cold & noise – NIOHS regulations and Factories Act

TOTAL : 45 PERIODS

TEXT BOOK

1. Bridger, R.S., Introduction to Ergonomics, McGraw Hill, 1995.

REFERENCES

1. Martin Helander, A guide to Ergonomics of Manufacturing, TMH, 2006.
2. Mecormik, T.J., Human Factors Engineering, TMH, 1990.
3. John Grimaldi, Safety Management, A.I.B.S., 5th Edition, Hazard Control Technology 2003
4. Philips, Chandler A, Human Factors Engineering, John Wiley and Sons, Inc. 2000

IE3305   MANUFACTURING AUTOMATION   L T P C
                                                     3 0 0 3

OBJECTIVE

To give a brief exposure to automation principles and applications to production systems covering few types of automation.

UNIT I   MANUFACTURING OPERATIONS   9

Automation in production systems, principles and strategies, Product/production relationships, Production concepts and mathematical models, Costs of manufacturing operations.

UNIT II   CONTROL TECHNOLOGIES   9

Automated systems – elements, functions, levels, Continuous Vs discrete control, Computer process control, Sensors, Actuators, ADC, DAC, Programmable logic controllers – ladder logic diagrams.

UNIT III   NUMERICAL CONTROL AND ROBOTICS   9

NC - CNC – Part programming – DNC – Adaptive control – Robot anatomy – Specifications – End effectors – Industrial applications

UNIT IV   AUTOMATED HANDLING AND STORAGE   9

Automated guided vehicle systems – AS/RS – carousel storage, Automatic data capture- Bar coding technology.

UNIT V   COMPUTER-AIDED DESIGN   9

Fundamentals of CAD – design process, manufacturing database – Computer graphics – functions, constructing the geometry, transformation, wire frame Vs solid modelling.

TOTAL : 45 PERIODS

REFERENCES
1. Mikell P.Groover, Automation, "Production Systems and Computer Integrated Manufacturing" PHI, 2003.
2. Mikell P.Groover, Emory W. Zimmers, Jr., "CAD/CAM: Computer - Aided Design and Manufacturing", PHI, 2007.

IE3306	AUTOMATION LABORATORY	L T P C
		0 0 3 2

1. Part programming for CNC lathe

2. Simulation and machining practice in CNC lathe

3. Part programming for CNC Milling machine

4. Practice in CNC milling machine

5. Programming exercise for robot

6. Programming of PLC using ladder logic diagram

7. Experiments using PLC.

TOTAL : 45 PERIODS

IE3307	ERGONOMICS LAB	L T P C
		0 0 2 1

OBJECTIVE:
To provide hands on experience in some areas of Ergonomics

1. Effect of speed of walking on treadmill using heart rate and energy expenditure

2. Effect of workload on heart rate using Ergo cycle.
3. Evaluation of physical fitness using step test
4. Effect of work-rest schedule on physical performance (Ergo cycle / tread mill)
5. Development of anthropometric data for male and female.
6. Application of anthropometric data for the design of desk for students
7. Evaluation of physical facilities (chairs, tables etc.) through comfort rating.
8. Evaluation of cognitive performance of individuals
9. Analysis of noise level in different environments
10. Study of Illumination at work places.

TOTAL : 30 PERIODS

IE3308	TECHNICAL SEMINAR	L T PC

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.

TOTAL : 30 PERIODS

IE 3351   **MULTI VARIATE STATISTICAL ANALYSIS**   **L T P C**
3 0 0 3

OBJECTIVE:
To impart knowledge on applications of Multi Variate Statistical analysis.

UNIT I   REGRESSION AND CORRELATION   9
Simple Regression, and Correlation – estimation using the regression line, correlation analysis, Multiple Regression and Canonical Correlation analysis – finding the multiple regression equation, modeling techniques, Making inferences about population parameters

UNIT II   MULTIVARIATE NORMAL   9
An overview of multivariate methods, Multivariate normal distribution, Eigen values and Eigen vectors

UNIT III   FACTOR ANALYSIS   9
Principal components analysis – objectives, estimation of principal components, testing for independence of variables, Factor analysis model – factor analysis equations and solution

UNIT IV   DISCRIMINANT ANALYSIS   9
Discriminant analysis – discrimination for two multi variate normal populations- Discriminant rules –Discriminant Functions.

UNIT V   CLUSTER ANALYSIS   9
Cluster analysis – clustering methods, Multivariate analysis of variance

TOTAL : 45 PERIODS

TEXT BOOK:
1. Dallas E Johnson, Applied multi variate methods for data analysis, Duxbury Press (1998)

REFERENCE:
1. Richard I Levin, Statistics for Management, PHI (2000)

IE3352   **PRINCIPLES OF COMPUTER INTEGRATED**   **L T P C**
MANUFACTURING SYSTEMS   **3 0 0 3**
OBJECTIVE:

To provide some aspects of Fixed, Flexible and integrated automation along with their applications

UNIT I   GT AND FMS   9
Part families, production flow analysis, cellular manufacturing, ROC, Flexible manufacturing systems- components, FMS applications, FMS analysis – bottleneck model.

UNIT II   TRANSFER LINES   9
Automated production lines – applications, Analysis – with and without buffers automated assembly systems, line unbalancing concept.

UNIT III   MANUFACTURING SUPPORT SYSTEMS   9
Product design and CAD, CAD/CAM and CIM, Computer aided process planning-variant and generative approaches, Concurrent engineering and design for manufacture, Lean production, Agile manufacturing.

UNIT IV   FUNDAMENTALS OF COMMUNICATIONS   9
Information, Communications matrix, Computer communications, Network architecture, Tools and techniques.

UNIT V   DATABASE AND CIM MANAGEMENT   9
Manufacturing data, database technology, Database management, Management OF CIM – role, cost justification, expert systems

TOTAL: 45 PERIODS

REFERENCES:

1. Mickel P Groover, Automation production systems and computer integrated manufacturing, PHI, second edition, 2003.
2. S.Kant Vajpayee, Principles of Computer-Integrated Manufacturing, PHI, 2005

IE3353   RELIABILITY ENGINEERING   L T P C
3 0 0 3
OBJECTIVE:
To cover the basic concepts of reliability, reliability estimation, and reliability management

UNIT I   RELIABILITY CONCEPTS   6
Reliability definition – Reliability function – Graphical representation – a priori, a posteriori probabilities of survival. Component mortality – Mortality curve – Useful life – Reliability mathematics.

UNIT II   FAILURE DATA MODELING: 13
Failure data requirements – Measures of reliability: Failure rate, MTBF, MTTF – Median time to failure – Comparison of measures of central tendency – Design life – Performance parameters using histogram – Survival curves – Failure time distributions Variable failure rates – Ranking of data – Probability plotting: Binomial, Exponential, Weibull hazard plotting – Goodness of fit: Chi square test – Kolmogorov Smirnov test – Confidence intervals.

UNIT III   RELIABILITY PREDICTION AND MODELING: 13
Series – parallel configurations – Redundant systems – Standby systems – K out of n redundancy – Reliability of complex systems: RBD approach – Baye's decomposition method – Cut and tie sets – Fault tree analysis – Markov model – Software reliability prediction and measurement.

UNIT IV   RELIABILITY MANAGEMENT: 8

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

UNIT V   RISK ASSESSMENT: 5

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

TOTAL : 45 PERIODS

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

IE3354   FACILITY LAYOUT AND MATERIAL HANDLING   L T P C
                                                              3 0 0 3
OBJECTIVE
To explain the basic principles in facilities planning, location, layout designs and material handling systems

UNIT I   FACILITY LOCATION   12
Introduction , Factors affecting location decisions , Location theory , Qualitative models , Semi-Quantitative models -Composite measure , Brown & Gibbs model , Break-Even analysis model, Single facility location problems – Median model, Gravity location model, Mini-Max model, Multi-facility location problems, Network and warehouse location problems.

UNIT II   FACILITY LAYOUT DESIGN   9
Need for Layout study , Factors influencing plant layout ,Objectives of a good facility layout, Classification of layout , Layout procedure – Nadler's ideal system approach, Immer's basic steps, Apple's layout procedure, Reed's layout procedure –Layout planning – Systematic Layout Planning – Information gathering, flow analysis and activity analysis, relationship diagram, space requirements and availability, designing the layout. Utilities planning

UNIT III   COMPUTERISED LAYOUT PLANNING   9
Concepts, Designing process layout – CRAFT, ALDEP, CORELAP – Trends in computerized layout, Algorithms and models for Group Technology - ROC and Bond Energy Algorithms.

UNIT IV   DESIGNING PRODUCT LAYOUT   6
Line balancing - Objectives, Line balancing techniques – Largest Candidate rule- Kilbridge and Wester method- RPW method- COMSOAL.

UNITV   MATERIAL HANDLING AND PACKAGING   9

Objectives and benefits of Material handling, Relationship between layout and Material handling, Principles of material handling, Unit load concept, Classification of material handling equipments, Equipment selection, Packaging.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Francis, R.L., and White, J.A.Facilities layout and Location, Prentice Hall of India, 2002.

REFERENCES:

1. Tompkins, White et al., Facilities planning, John Wiley & Sons, inc. 2003.
2. James, Apple, Material Handling System design, Ronald Press, 1980.
3. Krajewski, J. and Ritzman, Operations Management – Strategy and Analysis, Addison – Wesley publishing company inc. 5th Edition, 1999.
4. Pannerselvam,R.Production & operations Management, PHI, 2nd Edition, 2005

IE3355	**PRODUCTION PLANNING AND CONTROL**	**L T P C**
		3 0 0 3

OBJECTIVE:
To give an overview of techniques applicable to production planning, scheduling and control

UNITI   INTRODUCTION   5
Introduction to Production Systems, Objectives and Scope of Operation Management, Operations Management Frame work, Relationship of operations with other Functional areas, Manufacturing Vs Service sector, Operations Decision making, Production Design Process and Process choices

UNIT II   FORECASTING   10
Need for Forecasting, Factors affecting Demand, Demand Patterns, Qualitative Forecasting Methods-Delphi techniques, Market Research, Nominal Group Technique etc, Quantitative Forecasting methods–Moving Average Methods, Exponential Smoothing Methods, Regression methods, Monitoring and Control of Forecasts, Selection of forecasting methods, Forecasting Process.

UNIT III   AGGREGATE PLANNING   10
Role of Aggregate Planning, Inputs to Aggregate planning, Pure and Mixed strategies, Mathematical Models for Aggregate planning – Transportation Method, Linear programming Formulation, Linear Decision Rules, Master Production Schedule(MPS), Procedure for developing MPS, MRP terminology, process of MRP, Lot sizing in MRP

UNIT IV   CAPACITY MANAGEMENT   10
Types of Capacity, Measures of capacity, Factors affecting capacity, Capacity planning, Systematic approach to capacity planning, Long-term and short-term capacity decisions, Tools for capacity planning, Theory of Constraints,MRP–II, Capacity Requirement planning ,Basics of ERP.

UNIT V   PRODUCTION ACTIVITY CONTROL   10
Objectives and Activities of Production Activity Control, Flow-shop and Job shop production activity control.

TOTAL: 45 PERIODS

REFERENCES:

1. Lee J.Krajewski, Larry P.Ritzman, Operations Management Strategy and Analysis, PHI, 6th Edition, 2003.
2. Norman Gaither, Greg Frazier, Operations Management, Thomson Learning, 9th Edition, 2002.

3. Pannerselvam,R.Production & operations Management, PHI, 2nd Edition,2005
4. Seetharama .L.Narasimhan,Dennis W.McLeavey,Peter J.Billington, Production Planning and Inventory Control,PHI,second edition,2003.
5. B.Mahadevan, Operations Management:Theory and Practice,Pearson Education, 2006.

IE3356   PRODUCTION SYSTEM DESIGN PROJECT   L T P C
0 0 6 3

OBJECTIVE:

- To apply the concepts of various techniques covered in the areas of Industrial Engineering in a given practical situation.

Projects shall be assigned in the following areas:

- Forecasting and Aggregate Planning
- Materials Requirement Planning and Capacity Planning
- Transportation and Distribution of goods
- Group technology and Cellular manufacturing
- Production and Project Scheduling
- Quality Control
- Plant Layout Design
- Methods improvement in manufacturing and service organisation

TOTAL: 90 PERIODS

IE3357   STATISTICAL APPLICATIONS AND OPTIMIZATION LAB   LT P C
0 0 3 2

OBJECTIVE:

- To give adequate exposure to applications of software packages in the areas of Applied Statistics, Operations Research and Reliability

UNIT-I   Basic Statistics
        1. Mean, Median, Mode, measures of dispersion

UNIT- II   Use of Spreadsheet
        2. Look up tables, Statistics

UNIT- III   Use of RELIASOFT
        3. Data analysis

UNIT- IV   Simple Operation Research Programs
        4. Initial Solution of TP, Inventory Price Break Models

UNIT- V Optimization Package (TORA /LINDO)
  5. LP Models
  6. Transportation
  7. Assignment
  8. Maximal flow
  9. Minimal spanning tree
  10. Shortest route
  11. Network scheduling

TOTAL: 45 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.

IE3401   **DESIGN OF EXPERIMENTS**   **L T P C**
                                                                    3 1 0 4

OBJECTIVE:
To impart knowledge on statistical tools for industrial experimentation related to selection of product and process parameters in various environments.

UNIT I   CONCEPTS AND TERMINOLOGY   5
Review of hypothesis testing – P Value, "t" Vs paired "t" test, simple comparative experiment, planning of experiment – steps. Terminology - factors, levels, variables, Design principles – replication, randomization, blocking, confounding, Analysis of variance, sum of squares, degrees of freedom.

UNIT II   SINGLE FACTOR EXPERIMENTS   10
Completely randomized design, Randomized block design, effect of coding the observations, Latin Square design, orthogonal contrasts, comparison of treatment means – Duncan's multiple range test, Newman- Keuel's test, Fisher's LSD test, Tukey's test.

UNIT III   FACTORIAL EXPERIMENTS   10
Main and interaction effects, Rules for sum of squares and expected mean square, two and three factor full factorial design, 2^k designs with two and three factors, Hate's algorithm, practical applications.

UNIT IV   SPECIAL EXPERIMENTAL DESIGNS   10
Blocking and confounding in 2^k design, nested design, split – plot design, two level fractional factorial design, fitting regression models, introduction to response surface methods- Central composite design.

UNIT V   TAGUCHI TECHNIQUES   10
Introduction, Orthogonal designs, data analysis using ANOVA and response graph, parameter design – noise factors, objective functions (S/N ratios), multi-level factor OA designs, applications.

                                            TOTAL : 45 +15 = 60 PERIODS

TEXT BOOK :
1. Douglus C.Montgomery, Design and Analysis of Experiments, John Wiley & Sons,2005

REFERENCES :
1. Angela M.Dean and Daniel Voss, Design and Analysis of Experiments, Springer texts in Statistics, 2000.
2. Philip J.Ross, Taguchi Techniques for Quality Engineering, Prentice Hall, 1989.

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.

IE3402   SIMULATION MODELING AND ANALYSIS   L T P C
3 0 0 3

OBJECTIVE:
To cover various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

UNIT I   INTRODUCTION   3
Systems – Modelling – types – systems components – Simulation basics

UNIT II   RANDOM NUMBERS/VARIATES   10
Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc – Testing of Random variates – Monte Carlo Simulation

UNIT III   DESIGN OF SIMULATION EXPERIMENTS   12
Steps on Design of Simulation Experiments – Development of models using of High-level language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

UNIT IV SIMULATION LANGUAGES 12
Need for simulation Languages – Comparisons & Selection of Languages – GPSS-ARENA- EXTEND – Study of any one of the languages

UNIT V CASE STUDIES USING SIMULATION LANGUAGES 8

TOTAL: 45 PERIODS

REFERENCES
1. Jerry Banks, John S Corson,Barry.L. Nelson,David M. Nicol and P.Shahabudeen, Discrete Event Systems Simulation, Pearson education, Fourth edition,2007.
2. Geoffrey Gordon, Systems Simulation, Prentice Hall, 2002
3. Law A M & Kelton W D, Simulation Modelling and analysis, Tata McGraw-Hill, 2003
4. David Kelton, Rondall P Sadowski, David T Sturrock, Simulation with Arena, Mc Graw Hill, 2004
5. Thomas J Schriber, Simulation Using GPSS, John Wiley,2002.
   http://www.bcnn.net

IE3403	OPERATIONS SCHEDULING	L T P C
		3 0 0 3

OBJECTIVE:

To impart knowledge on various scheduling techniques applicable to Job shop, Flow shop configurations.

UNIT I SCHEDULING AND SEQUENCING 6
Scheduling function – Scheduling theory – Sequencing and scheduling objectives – Constraints – Pure sequencing problem – Ready time – Flow time – Lateness – Tardiness- In process inventory – SPT, EDD, WSPT – Regular measure of performance- Sequencing theorems.

UNIT II SINGLE MACHINE MODEL 10
Minimization of number of tardy jobs: Hodgson's algorithm – Minimizing mean flow time: Smith's rule – Minimizing mean tardiness: Wilkerson Irwin algorithm – Dynamic programming approach – Branch and Bound algorithm – Neighbourhood search technique – Non simultaneous arrivals – Minimizing mean tardiness for dependent jobs – Minimizing weighted mean flow time: Horn's method, Sidney's algorithm-Sequence dependent set up times.

UNIT III PARALLEL MACHINE MODEL 8
Independent jobs: McNaughton's algorithm for makespan minimization– Heuristic procedures to minimize mean flow time and makespan – Minimizing mean weighted flow time: H_1 heuristic and H_m heuristic– Dependent jobs: Hu's algorithm – Muntz Coffman algorithm.

UNIT IV FLOW SHOP MODEL 10
Characteristics – Johnson's algorithm – Extension of Johnson's rule – Campbell Dudek Smith algorithm – Palmer's heuristic approach – Start lag, Stop lag – Mitten's algorithm – Ignall Schrage algorithm - Despatch index heuristic

UNIT V   JOB SHOP MODEL   **11**

Characteristics-Graphical description – Jackson's method – Feasible, Semi-active schedules – Active schedule generation – Non delay schedule generation – Heuristics schedule generation – Priority dispatching rules – simulation – Open shop scheduling

REFERENCES:

1. Introduction to sequencing and scheduling – Kenneth R.Baker John Wiley & Sons, New York, 2000.
2. Industrial scheduling – Dilip R.Sule, PWS Publishing company, Boston, 1997.

IE 3404   **DISCRETE SIMULATION LABORATORY**   **L T P C**
                                                                    0 0 3 2

OBJECTIVE

To give hands on experience with reference to computer based discrete system simulation experiments

1. Random Number Generation
   Mid Square, Constant Multiplier, Congruential

2. Random variates Generation
   Exponential, Poisson, Normal, Binomial

3. Testing of Random variates
   Chi-Square, KS, Run

4. Monte Carlo Simulation
   Random Walk Problem

5. Queuing Models
   Single, Multi Server

6. Other IE oriented models
   Inventory, Replacement, Production system etc

7-10 Use of Simulation Language/Package

                                                     TOTAL: 45 PERIODS

IE3405   **COMPREHENSION**   **L T P C**
                                                                         0 0 2 1

AIM:

To give a comprehensive knowledge and understanding in the various fields of Industrial Engineering

The objective of this comprehension is to achieve an understanding of the fundamentals of contemporary manufacturing systems including materials, manufacturing process, product and process control, computer integrated manufacture and quality. The students work in groups and solve a variety of problems given to them. The problems given to the students should be of real like

industrial problems selected by a group of faculty members of the concerned department. A minimum of three small problems have to be solved by each group of students. The evaluation is based on continuous assessment by a group of Faculty Members constituted by the professor in-charge of the course.

TOTAL: 30 PERIODS

IE3451   **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.

IE3004   **INFORMATION SYSTEMS ANALYSIS AND DESIGN**   **L T P C**
                                                                          3 0 0 3
OBJECTIVE:
To impart knowledge on the basics of systems analysis and design required for developing application software in a given environment.

UNIT I   OVERVIEW   6
Information and Management - types of information, Examples of Information systems, Information Systems analysis overview, Information gathering - sources

UNIT II   DATA FLOW DIAGRAMS   10
System Requirements specifications, Feasibility analysis, Data flow diagrams – logical and physical DFDs, Process specification methods, Decision tables

UNIT III   ER DIAGRAMS   12

Logical database design – ER model, Normalizing relations; Data input methods; Database Management Systems – database design, Object oriented systems modeling

UNIT IV   E-COMMERCE   8

Designing outputs, Security of Information systems, E-commerce

UNIT V   APPLICATIONS   9

System design example: Document and data flow diagrams, Feasibility of the system, System specifications, Database design, Control, audit and test plan

TOTAL: 45 PERIODS

REFERENCES:
1. V. Rajaraman, Analysis and Design of Information Systems, PHI, 2004
2. Jeffrey L Whitten et al, Systems Analysis and Design Methods, McGraHill,2003

IE3005   ADVANCED OPTIMIZATION TECHNIQUES   L T P C
                                                         3 0 0 3

OBJECTIVE

Some of the Operations Research techniques which are not covered in the first level course are dealt with.

UNIT I   MULTI CRITERIA MODELS   9

Data Envelopment Analysis, Multicriteria Decision Problems- Goal Programming, Analytic Hierarchy Process

UNIT II   NON –LINEAR MODELS -I   9

Types of Non-linear programming problems, unconstrained optimization, Linearly Constrained Optimization, Quadratic Programming, Convex Programming,

UNIT III   NON –LINEAR MODELS –II   9

KKT conditions for constrained optimization, Separable programming, Non-convex programming, Geometric programming

UNIT IV   MARKOV PROCESSES   9

Markov Processes, Neural network based optimization

UNIT V   METAHEURISTICS   9

Metaheuristics - Genetic Algorithms, Simulated Annealing, Ant Colony Optimization.

TOTAL: 45 PERIODS

REFERENCES :
1. Hillier and Liberman, Introduction to Operations Research, TMH, 2000
2. Singiresu S Rao, Engineering Optimization, Wiley,1998
3. Kalyanmoy Deb, Optimization for Engineering Design, PHI,2000
4. David R. Anderson, et al , An Introduction to Management Science – Quantitative approaches to Decision Making, Thomson,2003
5. Fred Glover et al., Handbook of Metaheuristics, Kluwer,2003

IE3009   **COMPUTATIONAL METHODS & ALGORITHMS**   **L T P C**
                                                            3 0 0 3

OBJECTIVE
- A brief introduction to algorithmic design tools with some applications

UNIT I   INTRODUCTION   5
Review of C/C++ - writing and debugging large programs-controlling numerical errors

UNIT II   ALGORITHM DESIGN METHODS   12
Greedy – divide and conquer – backtracking – branch & bound – heuristics- Meta heuristics

UNIT III   BASIC TOOLS   12
Structured approach – networks – trees – data structures

UNIT IV   COMPUTATIONAL PERFORMANCE   6
Time complexity – space complexity – algorithm complexity

UNIT V   APPLICATIONS   10
Sorting – searching - net works – scheduling – optimisation models – IE applications

                                                    TOTAL : 45 PERIODS
REFERENCES:
1. Goodman S F & Headtruemu ST , Introduction to design of algorithms, McGraw Hill,2002
2. Sahni, Data Structures, algorithms and applications in C++, McGraw Hill, 2003
3. Dromey,R.G.,How to solve it with computers?,PHI,2002
4. Alfred V. Aho , Jeffrey D. Ullman and John E. Hopcroft,Data Structures and Algorithms,Addison-Wesley ,1993.

IE3010   DECISION SUPPORT AND INTELLIGENT SYSTEMS   L T P C
                                                            3 0 0 3

OBJECTIVE:
To impart knowledge on basics of DSS and Knowledge based systems

UNIT I   INTRODUCTION   5
Managerial decision making, system modeling and support-preview of the modeling process-phases of decision making process.

UNIT II   ANALYSIS   10
DSS components- Data warehousing, access, analysis, mining and visualization-modeling and analysis-DSS development.

UNIT III   TECHNOLOGIES   10
Group support systems- enterprise DSS- supply chain and DSS-knowledge management methods, technologies and tools.

UNIT IV   EXPERT SYSTEMS   10

Artificial intelligence and expert systems-concepts, structure, types-knowledge acquisition and validation-difficulties, methods, selection.

UNIT V   SEMANTIC NETWORKS   10

Representation in logic and schemas, semantic networks, production rules and frames, inference techniques, intelligent system development, implementation and integration of management support systems.

TOTAL: 45 PERIODS

REFERENCES

1. Efraim Turban and Jay E Aronson, Decision Support and Intelligent Systems, Pearson education Asia, Sixth edition, 2002.
2. S S Mitra, Decision support systems, tools and techniques, John Wiley, 1996.
3. Elain Rich and Kevin Knight, Artificial intelligence, TMH,1993.

IE3011	EVOLUTIONARY OPTIMIZATION	L T P C
		3 0 0 3

OBJECTIVE

To cover some of the evolutionary algorithms and their applications in optimization

UNIT I   INTRODUCTION   9

Introduction to evolutionary computation, Evolutionary computation and AI, Historical branches of evolutionary computation

UNIT II   SEARCH SCHEMA   9

Search operators, Selection schemes, Ranking methods, Importance of representation

UNIT III   EVOLUTIONARY ALGORITHMS   9

Evolutionary combinatorial optimization – evolutionary algorithms, Constraint handling

UNIT IV   GENETIC PROGRAMMING   9

Genetic programming – steps, Search operators on trees, examples

UNIT V   MULTIOBJECTIVE OPTIMISATION   9

Pareto optimality, Multiobjective evolutionary algorithms, Analysis of evolutionary algorithms

TOTAL : 45 PERIODS

REFERENCES:

1. W Banzhaf et al , Genetic Programming – An introduction, Morgan Kanfmann Publications (1999)
2. X Yao, "Evolutionary computations – Theory and Applications", World Scientific Publications (1999)
3. J Baeck, "Handbook of Evolutionary computation", IOS Press, 1997.
4. Goldberg D E , Genetic Algorithms in search, optimization, Addison Wesley (1989)

IE3012   **SYSTEMS ENGINEERING**   **L T P C**
                                                                    3 0 0 3

OBJECTIVE :
- To cover the basics of systems engineering study steps and associated techniques in the systems analysis.

UNIT I   INTRODUCTION   6
Definitions, Systems theory, Life-Cycle phases, Systems Engineering processes, Seven-phase and twenty-two phase life cycle for systems acquisition.

UNIT II   FORMULATION OF ISSUES   9
Problem or Issue identification, Formulation of issues with an example – Identification of needs, alterables, constraints, Value system design, Requirements statement, Generation of Alternatives or System synthesis, Feasibility studies.

UNIT III   ANALYSIS OF ALTERNATIVES   12
Analysis of systems with uncertain and imperfect information, structural modeling – trees, causal loops, and influence diagrams, system dynamics models, Economic models, Reliability models, Discrete event models.

UNIT IV   DECISION ASSESSMENT   9
Interpretation of alternative courses of action, Formal Decisions – prescriptive and normative decision assessments, Descriptive decision models – Group decision making.

UNIT V   SYSTEMS ENGINEERING MANAGEMENT   9
Organizational structures, Methods for systems Engineering Management, Human and cognitive factors in Systems Engineering and Systems Management.

                                                          TOTAL: 45 PERIODS

TEXT BOOK
1. Andrew P.Sage, James E.Armstrong Jr, "Introduction to Systems Engineering", John Wiley and Sons Inc. 2000.

REFERENCES:
1. Andrew P.Sage, "Systems Engineering", John Wiley & Sons, 1992.
2. Andrew P.Sage, William B.Rouse, "Hand book of Systems Engineering and Management", John Wiley & Sons, 1999**.**

ME3014   **AUTOMOBILE ENGINEERING**   **L T P C**
                                                                      3 0 0 3
AIM :
Impartation of basic principles of Automotive Vehicular systems with suitable illustrations and numerical problems ; also enlightenment of development trends.

OBJECTIVE :
To provide a comprehensive view of automobile engineering to the students.

PREREQUISITE :
Other branch students may be offered this course without any preconditions. However, a orientation programme lasting a duration of 10 hours may be offered on selected topics like thermodynamics and vehicle mechanics.

UNIT I   **INTRODUCTION**   **5**

Basic layouts of automotive vehicles including electric and hybrid electric systems, specifications and performance parameters of vehicles. Types of vehicle bodies. & chasses.

UNIT II   **ENGINE SYSTEMS**   **10**

Reciprocating engine systems, Rotary engine systems, Electric motors, Hybrid systems, Gas turbine systems. Development trends like GDI and HCCI engine systems, complex hybrid electric systems, closed loop controls in piston engine systems, Alternate Fuel systems for propulsion engines. Vehicular pollutants emission and their controls. Three Way Catalytic converter features. Electronic Engine Management systems.

UNIT III   **TRANSMISSION SYSTEM**   **10**

Types of Clutch, gear box (manual and automatic), propeller shafting, differential and types of rear axle.

UNIT IV   **AUTOMOTIVE SAFETY HANDLING AND COMFORT**
                            SYSTEMS   **10**

Braking System, Steering System, Suspension system, Electrical system, Safety systems, HVAC system.

UNIT V   **TESTING AND SERVICING OF AUTOMOBILES**   **10**

A brief discussion on the following :
Engine Tuning
Chassis Dynamometry
Tests for emissions of pollutants like HC, CO, NOx and particulates
Wind tunnel Testing of vehicles

TOTAL: 45 PERIODS

TEXT BOOK:
1. Automotive Mechanics, William H Crouse and Donald L. Anglin, Tata McGraw Hill Publishing Company Ltd., 2004, Tenth Edition.

REFERENCES:
1. Automotive Handbook, Bosch, Robert Bosch GmbH, Germany 2004, Sixth Edition.
2. Automotive Technology – A Systems Approach, Jack Erjavek, Thomson Learning, 3rd Edition, 1999.

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.

ME3314   **FINITE ELEMENT ANALYSIS**   **L T 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   9
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   9
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   9
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   9
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   9**
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. J 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.

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 com plicated 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

IE3008   MODELLING OF MANUFACTURING SYSTEMS   L T P C
3 0 0 3

OBJECTIVE:
To cover some of the modeling paradigms applicable for discrete items manufacturing systems and evaluation of such systems performance.

UNIT I   FOCUSED FACTORIES   9
Manufacturing Systems and Models, Focused factory types, Group Technology – assigning machines to groups, assigning parts to machines, Mathematical program for group formation

UNIT II   UNPACED PRODUCTION LINES   9
Production lines – Paced with and without buffers – computing system effectiveness; unpaced lines – impact of random processing times and recovery of throughput through buffers

UNIT III   FMS PLANNING MODELS   9
FMS planning and Control Hierarchy – part selection and loading problems – knapsack and loading heuristic

UNIT IV   MARKOV MODELS   9
Stochastic processes in manufacturing, Markov chain models – DTMC and CTMC, steady state analysis, Simulation models of manufacturing systems

UNIT V   QUEUING AND PETRINET MODELS   9
Queuing networks in manufacturing – Jackson and Gordon Newell, product form solution, Petrinets in manufacturing – basic concepts, stochastic petrinets, system performance measure

TOTAL: 45 PERIODS

REFERENCES
1. Ronald G Askin, "Modeling and Analysis of Manufacturing systems", Wiley sons, 2003.

2. Viswanadham and Narahari, "Performance modeling of automated manufacturing systems", PHI, 2003.
3. Nicholas J M, "Competitive Manufacturing Management", TMH, 2001.
4. Buzacot and Shantikumar, "Queueing networks in Manufacturing", Wiley Sons, 2000.
5. Reisig W, "System Design Using Petrinets", Springer, 2000.

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.

MF3015   ELECTRONICS MANUFACTURING TECHNOLOGY   L T P C
3 0 0 3

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

OBJECTIVES:
- 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   9
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
4. Technologies by Ning-Cheng Lee,Elsevier Science, ISBN 0-7506-7218-8.
5. Surface Mount Technology Terms and Concepts by Zarrow , Phil, Elsevier Science and Technology,1997.ISBN 0750698756
6. Electronic Packaging and Interconnection Handbook, by C.A.Harper, Second Edition, McGraw Hill Inc., New York, N.Y.,1997,ISBN 0-07-026694-8
7.. www.ipc.org
8. www.smta.org

MF3404	FLEXIBLE MANUFACTUIRNG 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.

OBJECTIVE:

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

UNIT I   PLANNING, SCHEDULING AND CONTROL OF FLEXIBLE MANUFACTURING SYSTEMS   9

Introduction to FMS - scope – types – benefits – major elements – Types of flexibility – FMS application and flexibility - optimization – Single product, N – 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 supervising 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 - Application of possibility distributions in FMS systems justification.

UNIT V   APPLICATIONS OF FMS AND FACTORY OF THE FUTURE   9

FMS application in aerospace machining sheet metal fabrication, prismatic component production - 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. Ltd., 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.

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.

IE3003   **HUMAN RESOURCE MANAGEMENT**   **L T P C**
                                                                3 0 0 3

OBJECTIVE:

- To introduce the basic principles of group dynamics and associated concepts required for Human resource management in organizations

UNIT I   INDIVIDUAL BEHAVIOR   9

Personality –Types –Influencing Personality – Learning Process, Attribute – Perception – Motivation Theories

UNIT II   GROUP BEHAVIOR   9

Group Organization, Group Dynamics, Emergence of Informal Leader, Leadership Styles-theories,Group decision making, Inter personal Relations, Communication - Team.

UNIT III   DYNAMICS OF ORGANIZATIONAL BEHAVIOR   9

Organizational Climate, the Satisfactory –Organizational change – the Change Process & Change Management.

UNIT IV   HUMAN RESOURCES PLANNING   9

Requirements of Human Resources –HR audit, Recruitment-Selection-Interviews

UNIT V   HUMAN RESOURCES DEVELOPMENT   9

Employee Training-Career Development-Performance Appraisal-Compensation-safety and Health-Employee Relation-Management Development.

TOTAL: 45 PERIODS

TEXT BOOK:
1. Stephen R. Robbins, "Organizational Behavior", PHI, 1998.

REFERENCES:
1. David A. Decenzo & Stephen R. Robbins, "Personnel/Human Resources Management", PHI, 1997.
2. Fred Lutherans, "Organizational Behavior", Oxford University Press, 2000.

IE3007   **TECHNOLOGY MANAGEMENT**   **L T P C**
                                                                3 0 0 3
UNIT I   INTRODUCTION   9
Technology management - Scope, components, and overview. Technology and environment, Technology and society, Technology Impact analysis, environmental, social, legal, political aspects, techniques for analysis - steps involved. Technology policy strategy: Science and technology Policy of India, implications to industry.

UNIT II   TECHNOLOGY FORECASTING MODELS   9
Technology forecasting - need, methodology and methods - trend Analysis, Analogy, Delphi, Soft System Methodology, Mathematical Models, Simulation, and System Dynamics.

UNIT III   EVALUATION METHODS   9
Technology Choice and Evaluation - Methods of analysing alternate technologies, Techno-economic feasibility studies, Need for multi-criteria considerations such as, social, environmental, and political, Analytic hierarchy method, Fuzzy multi-criteria decision making, and other methods.

UNIT IV   TECHNOLOGY TRANSFER   9
Technology Transfer and Acquisition - Import regulations, Implications of agreements like Uruguay Round and WTO, Bargaining process, Transfer option, MOU-Technology Adoption and Productivity - Adopting technology-human interactions, Organisational redesign and re-engineering, Technology productivity.

UNIT V   TECHNOLOGY INNOVATION   9
Technology Absorption and Innovation - present status in India, Need for new outlook, Absorption strategies for acquired technology, creating new/improved technologies, Innovations. Technology Measurement- Technology Audit.

TOTAL: 45 PERIODS

TEXT BOOK
1.Richard C. Dorf, Technology Management Handbook, CRC,1999

REFERENCES
1. Joseph M. Putti, Management – A Functional Approach, McGraw Hill, 1997
2. Kenneth C. Lauden , MIS: Organisation and Technology, Prentice Hall, 1995
3. James A.Senn, Information technology in Business, Prentice Hall, 1995
4. Ronald J. Jordan, Security analysis and Portfolio Management, Prentice Hall, 1995
5 .Irvin M. Rubin, Organisational behavior an experimental approach, Prentice Hall, 1995
6.Gerard H. Gaynor, Handbook of Technology Management, McGraw-Hill Professional, 1996

IE3017	**SUPPLY CHAIN MANAGEMENT**	**L T 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, E-Business 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

**MG2021   MARKETING MANAGEMENT   L T P C
3 0 0 3**

OBJECTIVES:

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

UNIT I   MARKETING PROCESS   9

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

UNIT II   BUYING BEHAVIOUR AND MARKET SEGMENTATION   9

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

UNIT III   PRODUCT PRICING AND MARKETING RESEARCH   9

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

UNIT IV   MARKETING PLANNING AND STRATEGY FORMULATION   9

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

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

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

TOTAL: 45 PERIODS

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

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

ME2035   **ENTREPRENEURSHIP DEVELOPMENT**   **L T P C**
                                                             3 0 0 3

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

UNIT I ENTREPRENEURSHIP 9

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

UNIT II MOTIVATION 9

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

UNIT III BUSINESS 9

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

UNIT IV   FINANCING AND ACCOUNTING   9
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V   SUPPORT TO ENTREPRENEURS   9
Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

                                                          TOTAL: 45 PERIODS
TEXT BOOKS:

1. S.S.Khanka "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kuratko & Hodgetts, "Enterprenuership – Theory, process and practices", Thomson learning 6th edition.

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

IE3001   PRODUCTIVITY MANAGEMENT AND   L T P C
                 RE-ENGINEERING   3 0 0 3
OBJECTIVE:
- The purpose is to apprise the students on productivity improvement techniques for an organization and to create a system that response with flexibility of the changes through business process reengineering.

UNIT I   INTRODUCTION   3
Basic concept and meaning of Productivity – Significance of Productivity – Factors affecting Productivity – Productivity cycle, Scope of Productivity Engineering and Management.

UNIT II   PRODUCTIVITY MEASUREMENT AND EVALUATION   9
Productivity measurement in International, National and Industrial level – Total Productivity Model – Productivity measurement in Manufacturing and Service sectors – Performance Objective Productivity (PO) model – Need for Productivity Evaluation – Evaluation Methodology.

UNIT III   PRODUCTIVITY PLANNING AND IMPLEMENTATION   9
Need for Productivity Planning – Short term and long term productivity planning – Productivity improvement approaches, Principles -   Productivity Improvement techniques – Technology based, Material based, Employee based, Product based techniques – Managerial aspects of Productivity Implementation schedule, Productivity audit and control.

UNIT IV REENGINEERING PROCESS 15

Definition, Fundamentals of process reengineering – Principles, Methodology and guidelines for Organization Transformation, DSMCQ and PMP organization Transformation models – Process Improvement Models like PMI, Edosomwan, LMICIP and NPRDC Models.

UNIT V BPR TOOLS AND IMPLEMENTATION 9

Analytical and Process Tools and Techniques - Role of Information and Communication Technology in BPR – Requirements and steps in BPR Implementation – Case studies.

TOTAL : 45 PERIODS

REFERENCES:
1. Sumanth, D.J.Productivity Engineering and Management, TMH, New Delhi, 1990.
2. Edosomwan, J.A. Organizational Transformation and Process re- Engineering, British Cataloging in publications, 1996.
3. Premvrat, Sardana, G.D. and Sahay, B.S. Productivity Management - A systems approach, Narosa Publications, New Delhi, 1998.

IE3006 VALUE ENGINEERING AND PROJECT MANAGEMENT L T P C
                                                            3 0 0 3

OBJECTIVE:
To give a brief account of the value analysis and engineering tool for productivity improvement through project managemen

UNIT I VALUE ENGINEERING BASICS 9

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

UNIT II VALUE ENGINEERING JOB PLAN AND PROCESS 9

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

UNIT III PROJECT FORMULATION AND APPRAISAL 9

Project Management – An overview, Feasibility and Technical analysis, Marketing feasibility, Financial and Economic feasibility, Formulation of Detailed Project Reports (DPR).

UNIT IV PROJECT IMPLEMENTATION AND CONTROL 9

Project planning, Project organization, Tools and techniques of project management, Project management Information system, Human resources, Financial aspects.

UNIT V PROJECT COMPLETION AND EVALUATION 9

Monitoring and Control of project, Integrated project management control system, Managing transition from project to operations, project   review.

TOTAL: 45 PERIODS

REFERENCES:

1. Mudge, Arthur E. "Value Engineering"- A systematic approach, McGraw Hill, New York, 2000.
2. Martandtelsang, Industrial Engineering and Production Management" S.Chand and Company LTd., New Delhi, 2002.
3. Choudhury, S. "Project scheduling and monitoring in practice, South Asian Publishers, New Delhi, 2001.
4. Goodman, L.J. Project planning and Management – An integrated system for improving productivity, Van Norstand, New York, 2000.
5. Kerzner, H. "Project Management" A system for approach to planning, scheduling and controlling 2nd Rf/CBS publishers, Delhi, 2002.
6. P.Gopalakrishnan, Text book of Project Management, Macmillan, India, 2000.

MF3001	PRODUCT DESIGN AND DEVELOPMENT	L T 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 One Orwin, 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:
http://www.me.mit/.2.7444.

**PT3024   PACKAGING MATERIALS & TECHNOLOGY   L T P C
                                                              3 0 0 3**

OBJECTIVE:
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.

ME3021   ENERGY CONSERVATION AND MANAGEMENT   L T P C
                                                          3 0 0 3
AIM :
To instruct the importance of energy conservation in both thermal and electrical energy and its management for the better utilization of resources.

OBJECTIVES :
At the end of the course, the student expected to do
(i)   Understand and analyze the plant energy data
(ii)   Energy audit and suggest methodologies for energy savings
(iii)   Energy accounting and balance and
(iv)   Able to utilize the available resources in optimal way

PRE-REQUISITE : Nil

UNIT I   IMPORTANCE OF ENERGY CONSERVATION AND
**   MANAGEMENT   8**

World, national Energy consumption – environmental aspects – Energy prices, policies – Energy auditing : methodology, analysis, energy accounting – Measurements – Thermal and Electrical.

UNIT II   ELECTRICAL SYSTEMS   12

AC / DC current systems, Demand control, power factor correction, load management, Motor drives : motor efficiency testing, energy efficient motors, motor speed control – Lighting : lighting levels, efficient options, daylighting, timers, Energy efficient windows – electrical distribution systems – Transformers – Power quality – harmonic distortion.

UNIT III   THERMAL SYSTEMS   10

Boiler – efficiency testing, excess air control, Steam distribution & use – steam traps, condensate recovery, flash steam utilization, Thermal Insulation. Heat exchanger networking – concept of pinch, target settling, problem table approach.

UNIT IV   ENERGY CONSERVATION   8

Energy conservation in Pumps, Fans (flow control) and blowers, Compressed Air Systems, Refrigeration and air conditioning systems – Waste heat recovery recuperators, heat sheets, heat pipes, heat pumps.

UNIT V   ENERGY MANAGEMENT, ECONOMICS   7

Energy resource management – Energy Management information systems – Computerized energy management – Energy economics – discount rate, payback period, internal rate of Return, life cycle costing – Financing energy conservation Projects.

**   TOTAL : 45 PERIODS**

TEXT BOOKS:

1. L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.
2. O. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.

REFERENCES:

1. I.G.C. Dryden, "The Efficient Use of Energy" Butterworths, London, 1982
2. W.C. turner, "Energy Management Hand book" Wiley, New York, 1982.
3. W.R. Murphy and G. Mc KAY "Energy Management" Butterworths, London 1987.

IE3002   **SAFETY ENGINEERING AND MANAGEMENT**   **L T P C**
                                                                  3 0 0 3

OBJECTIVE:
To impart knowledge on safety engineering fundamentals and safety management practices

UNIT I   INTRODUCTION   9
Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.

UNIT II   CHEMICAL HAZARDS   9
Chemical exposure – Toxic materials – Radiation Ionizing and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

UNIT III   ENVIRONMENTAL CONTROL   9
Industrial Health Hazards – Environmental Control –Industrial Noise- Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.

UNIT IV   ENVIRONMENTAL CONTROL   9
System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment.

UNIT V   SAFETY REGULATIONS   9
Explosions – Disaster management – catastrophe control, hazard control , FactoriesAct, Safety regulations Product safety – case studies.

TOTAL: 45 PERIODS

REFERENCES
1. John V Grimaldi, Safety Management, AITB S Publishers (2003)
2. Safety Manual, EDEL Engineering Consultancy (2000)
3. David L.Goetsch, Occupational Safety and Health for Technologists, Engineers and Managers, Pearson Education Ltd. 5th Edition 2005.

IE3013   MAINTENANCE ENGINEERING AND MANAGEMENT   LT P C
                                                                  3 0 0 3

OBJECTIVE:
*   To cover maintenance strategies, associated models for application and evaluation in different types of industries

UNIT I   MAINTENANCE CONCEPT   8
Need for Maintenance – Maintenance management – Tero technology – Challenges of physical asset management – Scope of Maintenance department – Maintenance organization – Maintenance costs – Imperfect maintenance – Toyota maintenance concept – Maintenance policies: PM, CM, DOM, OM – Condition monitoring.

UNIT II   MAINTENANCE MODELS   10
Probability models in maintenance – Choice between PM and b/d maintenance – Optimal PM schedule and quality loss – Inspection decisions: Maximization of profit –

Minimization of downtime – Analysis of downtime – Repair time distribution: exponential, lognormal – System repair time – Maintainability prediction – Corrective maintenance downtime – Design for maintainability.

UNIT III   MAINTENANCE LOGISTICS   12

Maintenance planning – Maintenance scheduling – Priority systems – Proactive/reactive maintenance – Minimum/extensive maintenance – Work order form – Spare parts control: setting reorder point – Overall part availability – unique/interchangeable spares – Ebel graph – Capital spare – Maintenance resource requirements – Queuing theory applications: Optimal number of workshop machines – Optimal repair effort – Maintenance crew size – use of learning curves – simulation – Human factors in maintenance.

UNIT IV   REPLACEMENT MODELS   9

Component replacement decisions – Assumptions –Model for equipment whose operating cost increases with use – Preventive replacement age of item subject to breakdown – Preventive replacement interval/age: minimization of downtime, Capital equipment replacement decisions

UNIT V   ADVANCED MAINTENANCE   6

Total Productive Maintenance – Chronic and sporadic losses – Six big losses – Equipment effectiveness – Autonomous maintenance – Reliability Centered Maintenance – CMMS – Software maintenance.

TOTAL: 45 PERIODS

REFERENCES:

1. An introduction to Reliability and Maintainability Engineering –Charles E.Ebeling, Tata McGraw-Hill, New Delhi, 2003.
2. Maintenance, Replacement and Reliability –Andrew K.S.Jardine and Albert H.C.Tsang, Taylor & Francis, New York, 2006.
3. Autonomous maintenance in seven steps – Masaji Tajiri and Fumio Gotoh, Productivity Inc., Oregon, 1999.

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)