

**AFFILIATED INSTITUTIONS
ANNA UNIVERSITY, CHENNAI**

R - 2008

**B.E. INDUSTRIAL ENGINEERING AND MANAGEMENT
II TO VIII SEMESTERS CURRICULUM AND SYLLABI**

SEMESTER II

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

SEMESTER III

CODE	COURSE TITLE	L	T	P	C
THEORY					
IE3201	Work System Design	3	0	0	3
MA2211	Transforms and Partial Differential Equations	3	1	0	4
ME2201	Manufacturing Technology -I	3	0	0	3
ME3205	Mechanics of Machines	3	1	0	4
CE3204	Strength of Materials	3	0	0	3
IM3202	Operations Research - I	3	1	0	4
PRACTICAL					
ME2207	Manufacturing Technology Laboratory I	0	0	3	2
IM3203	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
ME2258	Manufacturing Technology Laboratory II	0	0	3	2
TOTAL		19	4	6	27

V SEMESTER

CODE	COURSE TITLE	L	T	P	C
THEORY					
IM3301	Management and Entrepreneurship	3	0	0	3
IE3302	Operations Research - II	3	1	0	4
IE3303	Statistical Quality Control	4	0	0	4
IM3304	Industrial Engineering	3	0	0	3
IE3305	Manufacturing Automation	3	0	0	3
	Elective I	3	0	0	3
PRACTICAL					
IM3307	Automation Laboratory	0	0	3	2
IM3308	Industrial Engineering Lab	0	0	2	1
IM3309	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
IM3314	Supply Chain Management	3	0	0	3
IM3315	Operations Management	3	0	0	3
	Elective - II	3	0	0	3
PRACTICAL					
IM3316	Production System Design Project	0	0	6	3
IM3317	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
IM3403	Management Information Systems	3	0	0	3
	Elective –III	3	0	0	3
	Elective – IV	3	0	0	3
PRACTICAL					
IM3404	Discrete Simulation Laboratory	0	0	3	2
IM3405	Comprehension	0	0	2	1
	TOTAL	18	1	5	22

VIII SEMESTER

CODE	COURSE TITLE	L	T	P	C
THEORY					
IM3411	Advanced Ergonomics	3	0	0	3
	Elective - V	3	0	0	3
	Elective - VI	3	0	0	3
PRACTICAL					
IM3412	Project work	0	0	12	6
	TOTAL	6	0	12	15

**LIST OF ELECTIVES FOR B.E. INDUSTRIAL ENGINEERING AND
MANAGEMENT**

ELECTIVE – I

CODE	COURSE TITLE	L	T	P	C
IM3005	<u>Advanced Optimization Techniques</u>	3	0	0	3
IE3009	<u>Computational Methods and Algorithms</u>	3	0	0	3
IE3010	<u>Decision Support and Intelligent Systems</u>	3	0	0	3
IE3011	<u>Evolutionary Optimization</u>	3	0	0	3
IE3012	<u>Systems Engineering</u>	3	0	0	3

ELECTIVE – II

CODE	COURSE TITLE	L	T	P	C
ME2029	<u>Design of Jigs, Fixtures and Press tools</u>	3	0	0	3
ME2353	<u>Finite Element Analysis</u>	3	1	0	4
MA2264	<u>Numerical Methods</u>	3	1	0	4

ELECTIVE – III

CODE	COURSE TITLE	L	T	P	C
IE3008	<u>Modeling of Manufacturing Systems</u>	3	0	0	3
ME2028	<u>Robotics</u>	3	0	0	3
IM3015	<u>World Class Manufacturing</u>	3	0	0	3
MF3404	<u>Flexible Manufacturing Systems</u>	3	0	0	3

ELECTIVE – IV

CODE	COURSE TITLE	L	T	P	C
IE3003	<u>Human Resources Management</u>	3	0	0	3
IE3007	<u>Technology Management</u>	3	0	0	3
IM3014	<u>Industrial Laws</u>	3	0	0	3
MG2021	<u>Marketing Management</u>	3	0	0	3
ME2035	<u>Entrepreneurship Development</u>	3	0	0	3

ELECTIVE – V

CODE	COURSE TITLE	L	T	P	C
IM3001	<u>Productivity Management and Re-engineering</u>	3	0	0	3
IM3004	<u>Industrial Engineering Applications in Service Sector</u>	3	0	0	3
IE3006	<u>Value Engineering and Project Management</u>	3	0	0	3
MF3001	<u>Product Design and development</u>	3	0	0	3
PT3024	<u>Packaging Materials and Technology</u>	3	0	0	3

ELECTIVE – VI

CODE	COURSE TITLE	L	T	P	C
ME3021	<u>Energy Conservation & Management</u>	3	0	0	3
IM3002	<u>Safety Engineering and Management</u>	3	0	0	3
IE3013	<u>Maintenance Engineering & Management</u>	3	0	0	3
GE2025	<u>Professional Ethics in Engineering</u>	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 parallelepipeds.

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.

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 T_c 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.Owren, ‘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).

REFERENCES

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeler, 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
(Common to EEE, EIE and ICE Branches)

L T P C
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 12
 (Qualitative Treatment only)

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 Edition, (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, Satyabranta 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 & MEASUREMENTS 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

LIST OF EXPERIMENTS

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

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

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using BaCl_2 vs Na_2SO_4
4. Potentiometric Titration (Fe^{2+} / KMnO_4 or $\text{K}_2\text{Cr}_2\text{O}_7$)
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.**

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**LIST OF EXPERIMENTS**

1. Verification of ohm's laws and kirchoff's laws.
2. Verification of Thevenin'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

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.

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 – CO₂ 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 – Percussion 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 Promoters 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 Wiley & 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.

OBJECTIVES:

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

UNIT I KINEMATIC OF MECHANICS 10

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

UNIT II GEARS AND GEAR TRAINS 9

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

UNIT III FRICTION 8

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

UNIT IV FORCE ANALYSIS 9

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

UNIT V BALANCING AND VIBRATION 9

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

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

TEXT BOOKS

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

REFERENCES

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

STANDARDS

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

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 hollow 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 - Lamé’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

OBJECTIVE

To learn the basics of deterministic optimization tools

UNIT I LINEAR PROGRAMMING**10**

Introduction - formulation of linear programming model - Graphical solution –solving LPP using simplex algorithm – Revised Simplex Method

UNIT II ADVANCES IN LPP –I**10**

Duality theory - Dual simplex method - Sensitivity analysis -- Transportation problems – Assignment problems- Traveling sales man problem -Data Envelopment Analysis

UNIT III ADVANCES IN LPP –II**6**

Integer programming – Multi objective optimization - Goal programming

UNIT IV NETWORK MODELS**12**

Maximal flow problems – Shortest route problem – Minimal spanning tree -. Project network -CPM – PERT – Crashing – project costing and control.

UNIT V DYNAMIC PROGRAMMING**7**

Elements of dynamic programming – state –stage-recursive equations – computational procedure – applications

TOTAL :45 PERIODS**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

OBJECTIVE

To gain hands on experience on working of general purpose machine tools and on various manufacturing processes.

UNIT I LATHE

- 1.1. Facing, plain turning and step turning
- 1.2. Taper turning using compound rest, Tailstock set over, etc
- 1.3. Single and Multi-start V thread, cutting and knurling
- 1.4. Boring and internal thread cutting.

UNIT II WELDING EXERCISES

- 2.1. Horizontal, Vertical and Overhead welding.
- 2.2. Gas Cutting, Gas Welding
- 2.3. Brazing - for demonstration purpose

UNIT III SHEET METAL WORK

- 3.1. Fabrication of sheet metal tray
- 3.2. Fabrication of a funnel

UNIT IV PREPARATION OF SAND MOULD

- 4.1. Mould with solid, split patterns
- 4.2. Mould with loose-piece pattern
- 4.3. Mould with Core

UNIT V PLASTIC MOULDING

- 5.1 Injection Moulding- for demonstration purpose

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS

1.	<i>Centre Lathe with accessories</i>	15
2.	<i>Welding</i>	
2.1	Arc welding machine	04
2.2	Gas welding machine	01
2.3	Brazing machine	01
3.	<i>Sheet Metal Work facility</i>	
3.1	Hand Shear 300mm	01
3.2	Bench vice	05
3.3	Standard tools and calipers for sheet metal work	05
4	Sand moulding Facility	
4.1	Moulding Table	05
4.2	Moulding boxes, tools and patterns	05
5	Plastic Moulding	
5.1	Injection Moulding Machine	01

IM3203

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

OBJECTIVE:

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

LIST OF EXPERIMENTS

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

TOTAL : 45 PERIODS

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.

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 understanding of the transport of mass, momentum and energy.
- The applications of the conservation laws to flow through 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 equation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS**12**

Laminar flow through circular conduits and circular annuli. Boundary layer concepts. Boundary layer thickness. Hydraulic and energy gradient. Darcy – Weisbach equation. Friction factor and Moody diagram. Commercial pipes. Minor losses. Flow through 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**

Homologous 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**

Reciprocating pumps, Indicator diagrams, Work saved by air vessels. Rotary 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.

OBJECTIVE:

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

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 12

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 12

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 12

Threaded fasteners - 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 12

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 12

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.

TUTORIAL = 15 L = 45 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.

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, 'A text 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 manufacturing engineering.

OBJECTIVES:

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

UNIT I BASIC CONCEPTS OF THERMODYNAMICS 12

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.

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.

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 financial 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**LT P C
0 0 3 2****AIM:**

To perform experiments on 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

ME2258 MANUFACTURING TECHNOLOGY LAB II**L T P C
0 0 3 2****OBJECTIVE**

To give a practical hands on exposure to students in the various metal cutting operations using commonly used machine tools

EXERCISES

1. Two or More Measurements in Metal Cutting Experiment (Example: Shear Angle, Cutting Force, Tool Wear etc.)
2. One or More Exercises in Shaper, Slotter, Planner, Drilling, Milling Machines (Example: Round to Square, Dovetail in shaper, Internal keyway cutting in Slotter, Round to square in Planner, Drilling, reaming and tapping in Drilling machine, Gear Milling and Keyway milling in Milling machine.)
3. Two or More Exercises in Grinding / Abrasive machining (Example: Surface Grinding, Cylindrical Grinding.)
4. Two or More Exercises in Assembly of Machined Components for different fits. (Example: Parts machined using Lathes, Shapers, Drilling, Milling, and Grinding Machines etc.)
5. One or More Exercises in Capstan or Turret Lathes
6. One or More Exercises in Gear Machining (Example: Gear Milling, Gear Hobbing etc.)

LIST OF EQUIPMENT
(For a batch of 30 students)

1.	Centre Lathes	-	2 Nos.
2.	Turret and Capstan Lathes	-	1 No
3.	Horizontal Milling Machine	-	1 No
4.	Vertical Milling Machine	-	1 No
5.	Surface Grinding Machine	-	1 No.
6.	Cylindrical Grinding Machine	-	1 No.
7.	Shaper	-	2 Nos.
8.	Slotter	-	1 No.
9.	Planner	-	1 No.
10.	Radial Drilling Machine	-	1 No.
11.	Tool Dynamometer	-	1 No
12.	Gear Hobbing Machine	-	1 No
13.	Tool Makers Microscope	-	1 No

TOTAL: 45 PERIODS

IM3301 MANAGEMENT AND ENTREPRENEURSHIP LT P C

3 0 0 3

UNIT I MANAGEMENT 9

Introduction – Meaning – nature and characteristics of Management, Scope and Functional areas of management – Management as a science, art of profession – Management & Administration – Roles of Management, Levels of Management, Development of Management Thought – early management approaches – Modern management approaches.

UNIT II PLANNING 9

Nature, importance and purpose of planning process – Objectives – Types of plans (Meaning Only) – Decision making – Importance of planning – steps in planning & planning premises – Hierarchy of plans.

UNIT III ORGANIZING AND STAFFING 9

Nature and purpose of organization – Principles of organization – Types of organization – Departmentation – Committees- Centralization Vs Decentralization of authority and responsibility – Span of control – MBO and MBE (Meaning Only) Nature and importance of staffing–Process of Selection & Recruitment (in brief).

UNIT IV DIRECTING & CONTROLLING 9

Meaning and nature of directing – Leadership styles, Motivation Theories, Communication – Meaning and importance – coordination, meaning and importance and Techniques of Co –Ordination. Meaning and steps in controlling – Essentials of a sound control system – Methods of establishing control (in brief).

UNIT V ENTREPRENEUR**9**

Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur - an emerging Class. Concept of Entrepreneurship – Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Principles of Management – P.C.Tripathi, P.N.Reddy – Tata McGraw Hill.
2. Dynamics of Entrepreneurial Development & Management – Vasant Desai – Himalaya Publishing House
3. Entrepreneurship Development – Poornima.M.Charantimath – Small Business Enterprises – Pearson Education – 2006 (2 & 4).

REFERENCES:

1. Management Fundamentals – Concepts, Application, Skill Development – Robers Lusier – Thomson – Entrepreneurship Development – S.S.Khanka – S.Chand & Co.
2. Management – Stephen Robbins – Pearson Education/PHI – 17th Edition, 2003.

IE3302**OPERATIONS RESEARCH – II****LT P C****3 1 0 4****OBJECTIVE**

To impart knowledge on some probabilistic optimization techniques

UNIT I DETERMINISTIC INVENTORY MODELS**12**

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**12**

Probabilistic inventory model – Reorder point model – multi product-Selective Inventory control.

UNIT III QUEUING THEORY**12**

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**12**

Replacement models – Money value, present worth factor and discount rate.

TOTAL: 60 PERIODS

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. Douglas 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.

**IM3304 INDUSTRIAL ENGINEERING L T P C
3 0 0 3**

UNIT I PRODUCTIVITY 7

Definition of productivity, individual enterprises, task of management Productivity of materials, land, building, machine and power. Measurement of productivity, factors affecting the productivity, productivity improvement programmes, wages and incentives (simple numerical problems)

UNIT II WORK STUDY 13

Definition, objective and scope of work study. Human factor in work study. Work study and management, work study and supervision, work study and worker.

INTRODUCTION TO METHOD STUDY: Definition, objective and scope of method study, activity recording and exam aids. Charts to record moments in shop operation – process charts, flow process charts, travel chart and multiple activity charts.(With simple problems)

UNIT III MICRO AND MEMO MOTION STUDY 8

Charts to record moment at work place – principles of motion economy, classification of moments two handed process chart, SIMO chart, and micro motion study. Development,definition and installation of the improved method, brief concept about synthetic motion studies.

UNIT IV INTRODUCTION TO WORK MEASUREMENT 8

Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling: need, confidence levels, sample size determinations, random observation, conducting study with the simple problems.

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.

IM3307

AUTOMATION LABORATORY

LT 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

IM3308

INDUSTRIAL ENGINEERING LAB

L T P C
0 0 2 1

METHOD STUDY

1. Recording Techniques: Preparing the following charts and diagrams (Minimum 3 Charts)
Outline process chart
Multiple Activity Chart
Flow process chart and Flow diagram
String diagram,
2. Experiments on the Application of principle of motion economy Two handed process chart
3. Exercises on conducting method study for assembling simple components and office work.
4. Development of Layout plans using SLP technique
5. Experiments on Line balancing.

WORK MEASUREMENT

6. Rating practice using walking simulator
7. Rating practice using pin board assembly
8. Rating practice for dealing a deck of cards
9. Rating practice for marble collection activity
10. Determining the standard time for simple operations using stopwatch time study
11. Exercises on estimating standard time using PMTS.
12. Determination of standard time using PDA device and time study software

13. Experiments on office work measurement through work sampling
14. Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
15. Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergometer Effect of Noise, Light, Heat on human efficiency in work environments.

REFERENCES:

1. Work Study - Ralph & Barnes
2. Introduction to Work Study - ILO

IM3309

TECHNICAL SEMINAR

**LT 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

IE3351

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 MANUFACTURING SYSTEMS L T P C 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.

JNIT 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

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.

UNIT I BUILDING A STRATEGIC FRAME WORK TO ANALYSE SUPPLY CHAINS 7

Supply chain stages and decision phases process view of a supply chain. Supply chain flows. Examples of supply chains. Competitive and supply chain strategies. Achieving strategic fit. Expanding strategic scope. Drivers of supply chain performance. Framework for structuring drivers – Inventory, Transportation, Facilities, Information. Obstacles to achieving fit. Case discussions.

UNIT II DESIGNING THE SUPPLY CHAIN NETWORK 10

Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.

FACILITY LOCATION AND NETWORK DESIGN

Models for facility location and capacity allocation. Impact of uncertainty on SCN – discounted cash flow analysis, evaluating network design decisions using decision using decision trees. Analytical problems.

UNIT III PLANNING AND MANAGING INVENTORIES IN A SUPPLY CHAIN 6

Review of inventory concepts. Trade promotions, Managing multi-echelon cycle inventory, safety inventory determination. Impact of supply uncertainty aggregation and replenishment policies on safety inventory. Optimum level of product availability; importance factors. Managerial levers to improve supply chain profitability.

UNIT IV SOURCING, TRANSPORTATION AND PRICING PRODUCTS 6

Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration.

SOURCING, TRANSPORTATION AND PRICING PRODUCTS

Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Designing transportation network. Trade-off in transportation design. Tailored transportation, Routing and scheduling in transportation. International transportation. Analytical problems. Role Revenue Management in the supply chain, Revenue management for: Multiple customer segments, perishable assets, seasonal demand, bulk and spot contracts.

UNIT V COORDINATION AND TECHNOLOGY IN THE SUPPLY CHAIN 6

Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships.

COORDINATION AND TECHNOLOGY IN THE SUPPLY CHAIN

The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of E-business in a supply chain, The E-business framework, E-business in practice. Case discussion.

EMERGING CONCEPTS 10

Reverse Logistics; Reasons, Activities, Role. RFID Systems; Components, applications, implementation. Lean supply chains, Implementation of Six Sigma in Supply Chains.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Supply Chain Management – 2001, Strategy, Planning & Operation. Sunil Chopra & Peter Meindl; Pearson Education Asia, ISBN: 81-7808-272-1.

REFERENCEBOOKS:

1. Supply Chain Redesign – Transforming Supply Chains into Integrated Value Systems -Robert B Handfield, Ernest L Nichols, Jr., 2002, Pearson Education Inc, ISBN: 81-297-0113-8
2. Modelling the Supply Chain -Jeremy F Shapiro, Duxbury;, 2002, Thomson Learning, ISBN 0-534-37363
3. Designing & Managing the Supply Chain -David Simchi Levi, Philip Kaminsky & Edith Simchi Levi;; Mc Graw Hill
4. Going Backwards Reverse Logistics Trends and Practices -Dr. Dale S. Rogers,Dr. Ronald S. Tibben-Lembke,University of Nevada, Reno, Center for Logistics Management.

IM3315**OPERATIONS MANAGEMENT****LT P C****3 0 0 3****UNIT I****6**

Operations Management Concepts: Introduction, Historical development, The trend: Information and Non-manufacturing systems, Operations management, Factors affecting productivity, International dimensions of productivity, The environment of operations, Production systems decisions- a look ahead.

UNIT II OPERATIONS DECISION MAKING**10**

Introduction, Management as a science, Characteristics of decisions, Framework for decision making, Decision methodology, Decision support systems, Economic models, Statistical models.

SYSTEM DESIGN AND CAPACITY

Introduction, Manufacturing and service systems, Design and systems capacity, Capacity planning.

UNIT III FORECASTING DEMAND**10**

Forecasting objectives and uses, Forecasting variables, Opinion and Judgemental methods, Time series methods, Exponential smoothing, Regression and correlation methods, Application and control of forecasts.

AGGREGATE PLANNING AND MASTER SCHEDULING: Introduction- planning and scheduling, Objectives of aggregate planning, Aggregate planning methods, Master scheduling objectives, Master scheduling methods.

UNIT IV MATERIAL AND CAPACITY REQUIREMENTS PLANNING**6**

Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities.

UNIT V SCHEDULING AND CONTROLLING PRODUCTION ACTIVITIES**13**

Introduction, PAC, Objectives and Data requirements, Scheduling strategy and guide lines, Scheduling methodology, priority control, capacity control.

SINGLE MACHINE SCHEDULING: Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule, minimizing the number of tardy jobs.

FLOW –SHOP SCHEDULING: Introduction, Johnson’s rule for ‘n’ jobs on 2 and 3 machines, CDS heuristic.

JOB-SHOP SCHEDULING: Types of schedules, Heuristic procedure, scheduling 2 jobs on ‘m’ machines.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Operations Management -Monks, J.G., McGraw-Hill International Editions, 1987.
2. Production and Operations Management -Pannerselvam. R., 2nd edition PHI.
3. Productions & operations management - Adam & Ebert.5th edition PHI

REFERENCE S:

1. Modern Production/Operations Management -Buffa, Wiely Eastern Ltd., 4th edition
2. Production and Operations Management, Chary, S.N., Tata-McGraw Hill., 3rd edition
3. Operations management - James Dilworth. PHI, 3rd edition
4. Operations Management -Lee J Karjewski and Larry P Ritzman,– strategy and Analysis, 6th Edn, Pearson Education Asia

IM3316 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:
 1. Forecasting and Aggregate Planning
 2. Materials Requirement Planning and Capacity Planning
 3. Transportation and Distribution of goods
 4. Group technology and Cellular manufacturing
 5. Production and Project Scheduling
 6. Quality Control
 7. Plant Layout Design
 8. Methods improvement in manufacturing and service organization

TOTAL: 90 PERIODS

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

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
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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. **RESENTATION 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
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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.	<p>Server</p> <ul style="list-style-type: none"> ○ PIV system ○ 1 GB RAM / 40 GB HDD ○ OS: Win 2000 server ○ Audio card with headphones (with mike) ○ JRE 1.3 	1 No.
2.	<p>Client Systems</p> <ul style="list-style-type: none"> ○ 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.

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, Yate’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. Douglas 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
UNIT I	INTRODUCTION	3 0 0 3
		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
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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
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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
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Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V	QUALITY SYSTEMS	9
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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.Besterfield, et al., "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.

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>

UNIT I FUNDAMENTALS OF INFORMATION SYSTEMS 12

Information systems in business, fundamentals of information systems solving business problems with information systems.

Business Information systems, Transaction processing systems, management information systems and decision support systems. Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.

UNIT II ISSUES IN MANAGING INFORMATION TECHNOLOGY 12

Managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with IT, security and ethical challenges in managing IT, social challenges of information technology.

UNIT III INTRODUCTION TO E-BUSINESS 8

E-commerce frame work, Media convergence, Consumer applications, Organization applications.

E-BUSINESS MODEL: Architectural frame work for E-commerce, Application services and transaction Models – B2C Transactions, B2B Transactions, Intra-Organisational Transactions. WWW Architecture: Client server structure of the web, e-Commerce architecture, Technology behind the web.

UNIT IV CONSUMER-ORIENTED E-COMMERCE 7

Consumer oriented Application: Finance and Home Banking, Home shopping, Home Entertainment, Mercantile Process Models, Consumers perspective, Merchants perspective.

UNIT V ELECTRONICS DATA INTERCHANGE (EDI) 6

EDI Concepts, Applications in business – components of international trade, Customs Financial EDI, Electronic fund transfer, Manufacturing using EDI, Digital Signatures and EDI.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Management Information systems- managing information technology in the internet worked enterprise- jams. A O'Brien - Tata McGraw Hill publishing company limited, 2002.
2. Management Information Systems - Laaudon & Laudon PHI ISBN 81-203-1282-1.1998.

REFERENCES:

1. Management Information systems- S. Sadogopan.PHI 1998Edn. ISBN 81-20311809
2. Information systems for modern management - G.R. Murdick PHI, 2nd Edition.

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**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**UNIT I INTRODUCTION** **9**

Historical background. Modern ergonomics, Future direction. Human Machine Systems – interfaces.

UNIT II ANATOMY, POSTURE AND BODY MECHANICS **9**

Muscle Functionin, Spine, Musculoskeletal problems in Sitting and Standing.

UNIT III ANTHROPOMETRIC PRINCIPLES **9**

Anthropometric Data – sample, equipment, analysis. Applications of Anthropometry in Design. Workstation design for standing and seated posture.

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 Kaufmann 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.

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.

ME2353

FINITE ELEMENT ANALYSIS

L T P C
3 1 0 4

INTRODUCTION (Not for examination) 5

Solution to engineering problems – mathematical modeling – discrete and continuum modeling – need for numerical methods of solution – relevance and scope of finite element methods – engineering applications of FEA

UNIT I FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS 5+3

Weighted residual methods –general weighted residual statement – weak formulation of the weighted residual statement –comparisons – piecewise continuous trial functions-example of a bar finite element –functional and differential forms – principle of stationary total potential – Rayleigh Ritz method – piecewise continuous trial functions – finite element method – application to bar element

UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS**8+4**

General form of total potential for 1-D applications – generic form of finite element equations – linear bar element – quadratic element – nodal approximation – development of shape functions – element matrices and vectors – example problems – extension to plane truss – development of element equations – assembly – element connectivity – global equations – solution methods – beam element – nodal approximation – shape functions – element matrices and vectors – assembly – solution – example problems

UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS**10+4**

Introduction – approximation of geometry and field variable – 3 noded triangular elements – four noded rectangular elements – higher order elements – generalized coordinates approach to nodal approximations – difficulties – natural coordinates and coordinate transformations – triangular and quadrilateral elements – iso-parametric elements – structural mechanics applications in 2-dimensions – elasticity equations – stress strain relations – plane problems of elasticity – element equations – assembly – need for quadrature formulae – transformations to natural coordinates – Gaussian quadrature – example problems in plane stress, plane strain and axisymmetric applications

UNIT IV DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD**8+4**

Introduction – vibrational problems – equations of motion based on weak form – longitudinal vibration of bars – transverse vibration of beams – consistent mass matrices – element equations – solution of eigenvalue problems – vector iteration methods – normal modes – transient vibrations – modeling of damping – mode superposition technique – direct integration methods

UNIT V APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS**6+3**

One dimensional heat transfer element – application to one-dimensional heat transfer problems – scalar variable problems in 2-Dimensions – Applications to heat transfer in 2-Dimension – Application to problems in fluid mechanics in 2-D

L=42, T=18, TOTAL: 60 PERIODS**TEXT BOOK:**

1. P.Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd. New Delhi, 2007. ISBN-978-203-2315-5

REFERENCE BOOKS:

1. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International Editions(Engineering Mechanics Series), 1993. ISBN-0-07-051355-4
2. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice-Hall of India, Eastern Economy Editions. ISBN-978-81-203-2106-9
3. David V.Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw-Hill Edition 2005. ISBN-0-07-239536-2
4. Cook, Robert.D., Plesha, Michael.E & Witt, Robert.J. "Concepts and Applications of Finite Element Analysis", Wiley Student Edition, 2004. ISBN-10 81-265-1336-5

Note: L- no. of lectures/week, T- no. of tutorials per week

AIM

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

OBJECTIVES

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

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

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

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

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

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

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

TEXT BOOKS

1. Veerarjan, T and Ramachandran, T. 'Numerical methods with programming in 'C' Second Edition, Tata McGraw-Hill Publishing.Co.Ltd. (2007).
2. Sankara Rao K, 'Numerical Methods for Scientists and Engineers' – 3rd edition 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, 001.
4. Buzacot and Shantikumar, “Queueing networks in Manufacturing”, Wiley Sons, 2000.
5. Reisig W, “System Design Using Petrinets”, Springer, 2000.

ME2028

ROBOTICS

**L T P C
3 0 0 3**

OBJECTIVES:

- To understand the basic concepts associated with the design and functioning and applications of Robots To study about the drives and sensors used in Robots
- To learn about analyzing robot kinematics and robot programming

UNIT I FUNDAMENTALS OF ROBOT 7

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Functions – Need for Robots – Different Applications

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 10

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of Drives End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

UNIT III SENSORS AND MACHINE VISION 10

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction: Edge detection, Segmentation Feature Extraction and Object Recognition - Algorithms. Applications – Inspection, Identification, Visual Servicing and Navigation.

UNIT V IMPEDIMENTS**9**

Bad plant design - Mismanagement of capacity - Production Lines - Assembly Lines – Whole Plant Associates - Facilitators - Teamsmanship - Motivation and reward in the age of continuous Improvement

TEXT BOOKS

1. By Richard B. Chase, Nicholas J. Aquilano, F. Robert Jacobs – “Operations Management for Competitive Advantage”, McGraw-Hill Irwin, ISBN 0072323159
2. Moore Ran, “Making Common Sense Common Practice: Models for Manufacturing Excellence”, Elsevier Multiworth
3. Narayanan V. K., “Managing Technology & Innovation for Competitive Advantage”, Pearson Education Inc.
4. Korgaonkar M. G., “Just In Time Manufacturing”, MacMillan Publishers India Ltd.,
5. Sahay B. S., Saxena K. B. C., Ashish Kumar, “World Class Manufacturing”, MacMillan Publishers

MF3404**FLEXIBLE MANUFACTURING SYSTEMS****LT P C
3 0 0 3****AIM:**

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

OBJECTIVES:

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

- Modern manufacturing systems
- To understand the concepts and applications of flexible manufacturing systems

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

Introduction to FMS– development of manufacturing systems – benefits – major elements – types of flexibility – FMS application and flexibility –single product, single batch, n – batch scheduling problem – knowledge based scheduling system.

UNIT II COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING SYSTEMS**9**

Introduction – composition of FMS– hierarchy of computer control –computer control of work center and assembly lines – FMS supervisory computer control – types of software specification and selection – trends.

UNIT III FMS SIMULATION AND DATA BASE**9**

Application of simulation–model of FMS–simulation software – limitation – manufacturing data systems–data flow–FMS database systems–planning for FMS database.

UNIT IV GROUP TECHNOLOGY AND JUSTIFICATION OF FMS**9**

Introduction – matrix formulation – mathematical programming formulation –graph formulation – knowledge based system for group technology – economic justification of FMS- application of possibility distributions in FMS systems justification.

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

TOTAL : 45 PERIODS

TEXT BOOK

1. Jha, N.K. "Handbook of flexible manufacturing systems", Academic Press Inc.,1991.

REFERENCES

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

IE3003 HUMAN RESOURCES 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****LT 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. Laudon, 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

IM3014

INDUSTRIAL LAWS

L T P C
3 0 0 3

UNIT I THE INDUSTRIAL DISPUTES ACT, 1947 9
Extent. Works Committee, Conciliation Officers, Board of Conciliation, Court of Inquiry, Labour Courts, Tribunals, National Tribunal. Procedure, power and duties of the authorities. Strikes and lockouts, layoffs and retrenchment, closure. Unfair labour practices, Penalties.

UNIT II THE TRADE UNION ACT 1926 12
Formation of Trade Unions, Collective bargaining capacity.

THE INDUSTRIAL EMPLOYMENT [STANDING ORDERS] ACT, 1946 (20 OF 1946):
Draft Standing Orders, conditions for certification of Standing Orders, Appeals, Register of Standing Orders. Temporary application of model standing orders.

UNIT III THE FACTORIES ACT, 1948 8
Health, Safety, Provisions relating to Hazardous Processes, Welfare, Working Hours of Adults, Employment of young persons, Annual Leave with wages. The Employees' Provident Fund & Miscellaneous Provisions Act, 1952 (10 of 1952). Employee's Provident Fund Schemes, Central Board, Employee's Pension Scheme, Employee's Deposit Linked Insurance Scheme, Contributions.

UNIT IV THE SALE OF GOODS ACT, 1930 (3 OF 1930) 8
Contract of Sale, Formalities of Contract, Subject Matter of Contract, the Price, Conditions and Warranties. Transfer of Property as between seller and buyer, Transfer of title.

UNIT V THE MONOPOLIES AND RESTRICTIVE TRADE PRACTICES ACT, 1969 (54 OF 1969) & THE COMPETITION ACT, 2002 8
Monopolies and Restrictive Trade Practices Commission, Unfair and Restrictive trade practices. The Competition Commission,

TEXT BOOKS:

1. Pramod Verma, "Management of Industrial Relations", Oxford and IBH Publishing Co., Mumbai.
2. C. Jagamohandas and Co., Mumbai – publications of Acts with short notes.
3. Taxman, Commercial Laws.
4. Taxman, Labour Laws.

REFERENCE:

1. Bare Acts and Bare Acts with Cases for each of these.

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 Entrepreneurial 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.

IM3004 INDUSTRIAL ENGINEERING APPLICATIONS IN SERVICE SECTOR L T P C
3 0 0 3

UNIT I INTRODUCTION TO SERVICE SECTOR 8

Various Services: i) Hotel ii) Health Care iii) Bank iv) Retail Marketing / Department Stores v) Urban bodies, vi) Education vii) Construction viii) Transport and Communication ix) Government. Content of Product Vs. Services.

UNIT II RESOURCES USED IN SERVICE SECTOR 12

a) Space b) Manpower c) Capital d) Material, e) Equipment f) Energy g) Transport and Communication h) Information I) Knowledge.

CRITICAL ASPECTS OF SERVICE SECTOR:

i) Customer Satisfaction ii) Cost reduction iii) Efficiency iv) Quality & Productivity of Service organisations, Measurement of these characteristics.

UNIT III APPLICATION OF INDUSTRIAL ENGINEERING TECHNIQUES TO THE SERVICE SECTOR 10

i) Data collection – Various charting techniques, Flow Diagram, work measurement – time study, activity sampling, self recording, etc. ii) Quantitative techniques. iii) Data analysis – Critical Examination / evaluation of data. iv) Work of simplification, form design. v) Computer application to collection, storage and retrieval of information / data.

UNIT IV USE OF COMPUTERS IN SERVICE ORGANIZATIONS 7

Plant, local area network, wide area network to Collect, store, retrieve, transmit information / data.

UNIT I FUTURE OF SERVICE SECTOR 8

Increasing role of service sector in National Economy. Management methods in Service Sector. Need for optimizing resources in Service Sector.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. J. Nevan Wright, Peter Race, "The Management of Service Operations", Thomson Learning
2. Anderson R. G.; "Organisation & Methods", N & E Hand book Series.
3. Cemach H. P.; "Workstudy in office"; Ambar Publications.

REFERENCES:

1. Gerard Blokdijk, Ivanka Menken, "Service Level Management Best Practice Handbook",
2. T. Benley, Holt Rinahan & Winston; "Management Service Handbook", Institute of Management Service
3. Fitzsimmons; Service Management; Mc Graw Hill Publications.
4. Salvendy Gavriel, "Handbook of industrial engineering: technology and operations management", John Willey and Sons Inc.

OBJECTIVE:

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

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. Martandtsang, "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.

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 GENERATION 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", McGraw-Hill International Edns. 1999.

REFERENCES

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

WEB REFERENCE BOOK

1. <http://www.me.mit/.2.7444>.

PT3024

PACKAGING MATERIALS & TECHNOLOGY

**LT P C
3 0 0 3**

OBJECTIVES:

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

UNIT I FUNDAMENTALS OF PACKAGING

6

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

UNIT II PACKAGING MATERIALS

11

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

UNIT III CONVERSION TECHNOLOGY

12

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

UNIT IV SPECIALITY PACKAGING

9

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

UNIT V TESTING

7

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

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. Gunilla Johnson, "Corrugated Board Packaging", PIRA International

ME3021

ENERGY CONSERVATION AND MANAGEMENT

**LT 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.

OBJECTIVE :

At the end of the course, the student expected to do

- Understand and analyze the plant energy data
- Energy audit and suggest methodologies for energy savings
- Energy accounting and balance and
- 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.

IM3002 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
Factories Act, 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 – 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

- 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)