



**ANNA UNIVERSITY CHENNAI  
CHENNAI - 600 025**

**UNIVERSITY DEPARTMENTS**

**REGULATIONS 2012**

**CURRICULA AND SYLLABI FOR  
I TO VIII SEMESTERS**

**B.E. INDUSTRIAL ENGINEERING  
(FULL TIME)**



**ANNA UNIVERSITY: CHENNAI 600 025**

**UNIVERSITY DEPARTMENTS**

**R-2012**

**B.E. INDUSTRIAL ENGINEERING**

**I – VIII SEMESTERS CURRICULA AND SYLLABI**

**SEMESTER I**

<b>CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>					
HS8151	Technical English - I	3	1	0	4
MA8151	Mathematics - I	3	1	0	4
PH8151	Engineering Physics	3	0	0	3
CY8151	Engineering Chemistry	3	0	0	3
GE8151	Computing Techniques	3	0	0	3
GE8152	Engineering Graphics	2	0	3	4
<b>PRACTICAL</b>					
PH8161	Physics Laboratory	0	0	2	1
CY8161	Chemistry Laboratory	0	0	2	1
GE8161	Computer Practices Laboratory	0	0	3	2
GE8162	Engineering Practices Laboratory	0	0	3	2
	<b>TOTAL</b>	<b>17</b>	<b>2</b>	<b>13</b>	<b>27</b>

**SEMESTER II**

<b>CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>					
HS8251	Technical English - II	3	1	0	4
MA8251	Mathematics - II	3	1	0	4
PH8251	Materials Science	3	0	0	3

GE8251	Engineering Mechanics	3	1	0	4
EE8202	Fundamentals of Electrical Engineering	3	0	0	3
ME8252	Manufacturing Technology – I	3	0	0	3
<b>PRACTICAL</b>					
EE8262	Electrical Engineering Laboratory	0	0	3	2
ME8262	Manufacturing Technology Lab - I	0	0	3	2
	<b>TOTAL</b>	<b>18</b>	<b>3</b>	<b>6</b>	<b>25</b>

### SEMESTER III

CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
MA8356	Probability and Statistics	3	1	0	4
CE8353	Strength of Materials	3	0	0	3
EC8352	Electronics Engineering	3	0	0	3
IE8301	Engineering Economy and Cost Estimation	3	0	0	3
IE8302	Facility Layout and Materials Handling	3	0	0	3
IE8303	Work System Design	3	0	0	3
<b>PRACTICAL</b>					
CE8362	Strength of Materials laboratory	0	0	3	2
EC8361	Electronics Engineering Laboratory	0	0	3	2
IE8311	Work System Design Laboratory	0	0	3	2
	<b>TOTAL</b>	<b>18</b>	<b>1</b>	<b>9</b>	<b>25</b>

### SEMESTER IV

CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
GE8351	Environmental Science and Engineering	3	0	0	3

CE8352	Fluid Mechanics and Machinery	3	0	0	3
IE8401	Operations Research-I	3	0	0	3
ME8451	Manufacturing Technology –II	3	0	0	3
ME8452	Mechanics of Machines	3	0	0	3
ME8453	Thermodynamics	3	1	0	4
<b>PRACTICAL</b>					
CE8413	Fluid Mechanics and Machinery Laboratory	0	0	3	2
ME8461	Manufacturing Technology Laboratory - II	0	0	3	2
	<b>TOTAL</b>	<b>18</b>	<b>1</b>	<b>6</b>	<b>23</b>

### SEMESTER V

CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
IE8501	Manufacturing Automation	3	0	0	3
IE8502	Operations Research - II	3	0	0	3
IE8503	Quality Control and Assurance	3	0	0	3
ME8553	Machine Design	3	1	0	4
E1	Elective - I	3	0	0	3
E2	Elective - II	3	0	0	3
<b>PRACTICAL</b>					
IE8511	Automation Lab	0	0	3	2
IE8512	Optimization Lab	0	0	3	2
MF8561	CAD Lab	0	0	3	2
	<b>TOTAL</b>	<b>18</b>	<b>1</b>	<b>9</b>	<b>25</b>

**SEMESTER VI**

<b>CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>					
MG8654	Total Quality Management	3	0	0	3
IE8601	Applied Ergonomics	3	0	0	3
IE8602	Production and Operations Management	3	0	0	3
IE8603	Reliability Engineering	3	0	0	3
E3	Elective - III	3	0	0	3
E4	Elective - IV	3	0	0	3
<b>PRACTICAL</b>					
HS8561	Employability Skills	0	0	2	1
IE8611	Ergonomics Lab	0	0	3	2
IE8612	Industrial Training/Mini Project	0	0	3	2
	<b>TOTAL</b>	<b>18</b>	<b>0</b>	<b>8</b>	<b>23</b>

**SEMESTER VII**

<b>CODE</b>	<b>COURSE TITLE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>THEORY</b>					
IE8701	Simulation Modeling and Analysis	3	0	0	3
IE8702	Supply Chain and Logistics Management	3	0	0	3
IE8755	Design of Experiments	3	0	0	3
E5	Elective - V	3	0	0	3
E6	Elective - VI	3	0	0	3
E7	Elective - VII	3	0	0	3
<b>PRACTICAL</b>					
IE8711	Comprehension	0	0	2	1
IE8712	Data Analytics Lab	0	0	3	2
IE8713	Discrete Simulation Lab	0	0	3	2
	<b>TOTAL</b>	<b>18</b>	<b>0</b>	<b>8</b>	<b>23</b>

### SEMESTER VIII

CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>					
E8	Elective - VIII	3	0	0	3
E9	Elective - IX	3	0	0	3
<b>PRACTICAL</b>					
IE8811	Project work	0	0	12	6
	<b>TOTAL</b>	<b>6</b>	<b>0</b>	<b>12</b>	<b>12</b>

**TOTAL NUMBER OF CREDITS: 183**

### ELECTIVES

SI.No.	Code	Course Title	L	T	P	C
1.	IE8001	Accounting and Finance for Management	3	0	0	3
2.	IE8002	Advanced Optimization Techniques	3	0	0	3
3.	IE8003	Applied Multi-Variate Statistical Analysis	3	0	0	3
4.	IE8004	Computational Methods and Algorithms	3	0	0	3
5.	IE8005	Decision Support and Intelligent Systems	3	0	0	3
6.	IE8006	Evolutionary Optimization	3	0	0	3
7.	IE8007	Information Systems Analysis and Design	3	0	0	3
8.	IE8008	Maintenance Engineering and Management	3	0	0	3
9.	IE8009	Metrology and Inspection	3	0	0	3
10.	IE8010	Modeling of Manufacturing Systems	3	0	0	3
11.	IE8011	Operations Scheduling	3	0	0	3
12.	IE8012	Product Design and Value Engineering	3	0	0	3
13.	IE8013	Productivity Management and Re-engineering	3	0	0	3
14.	IE8014	Project Management	3	0	0	3
15.	IE8015	Safety Engineering and Management	3	0	0	3

16.	IE8016	Systems Engineering	3	0	0	3
17.	IE8017	Technology Management	3	0	0	3
18.	IE8071	Human Resource Management	3	0	0	3
19.	MA8353	Numerical Methods	3	1	0	4
20.	GE8751	Engineering Ethics and Human Values	3	0	0	3
21.	MG8653	Principles of Management	3	0	0	3
22.	ME8076	Entrepreneurship Development	3	0	0	3
23.	ME8077	Marketing Management	3	0	0	3
24.	ME8751	Computer Integrated Manufacturing Systems	3	0	0	3
25.	MF8072	Electronics Manufacturing Technology	3	0	0	3
26.	MF8073	Flexible Manufacturing Systems	3	0	0	3
27.	MF8074	Industrial Robotics	3	0	0	3



**OBJECTIVES:**

- To enable all students of engineering and technology develop their basic communication skills in English.
- To give special emphasis to the development of speaking skills amongst the students of engineering and technology.
- To ensure that students use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading for pleasure.

**UNIT I**

Listening – Introducing learners to GIE - Types of listening - Listening to audio (verbal and sounds); Speaking – Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading – Skimming a reading passage – Scanning for specific information – Note-making; Writing – Free writing on any given topic (My favourite place / Hobbies / School life, etc.) – Sentence completion – Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar – Prepositions - Reference words – Wh-questions - Tenses (Simple); Vocabulary – Word formation – Word expansion (root words / etymology); E-materials – Interactive exercises for Grammar and Vocabulary – Reading comprehension exercises – Listening to audio files and answering questions.

**UNIT II**

Listening – Listening and responding to video lectures / talks; Speaking – Describing a simple process (filling a form, etc.) – Asking & answering questions – Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing – Biographical writing (place, people) - Lab descriptions (general/specific description of laboratory experiments) - Definitions - Recommendations; Grammar – Use of imperatives - Subject-verb agreement; Vocabulary – Compound words - Word Association; E-materials – Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

**UNIT III**

Listening – Listening to specific task - focused audio tracks; Speaking – Role-play – Simulation – Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading – Reading and interpreting visual material; Writing – Jumbled sentences - Coherence and cohesion in writing – Channel conversion (flowchart into process) - Types of paragraph (cause

and effect / compare & contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar – Tenses (Past) - Use of sequence words - Adjectives; Vocabulary – Different forms and uses of words, Cause and effect words; E-materials – Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

#### **UNIT IV**

Listening – Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions – Different forms of interviews – Speaking at different types of interviews; Reading – Making inference from the reading passage - Predicting the content of a reading passage; Writing – Interpreting visual materials (line graphs, pie charts etc.) – Essay writing – Different types of essays; Grammar – Adverbs – Tenses – future time reference; Vocabulary – Single word substitutes - Use of abbreviations and acronyms; E-materials – Interactive exercises for Grammar and Vocabulary – Sample interviews - film scenes – dialogue writing.

#### **UNIT V**

Listening – Listening to different accents, Listening to Speeches / Presentations, Listening to broadcast and telecast from Radio and TV; Speaking – Giving impromptu talks, Making presentations on given topics; Reading – Email communication – Reading the attachment files having a poem/joke/proverb - Sending their responses through email Writing – Creative writing, Poster making; Grammar – Direct and indirect speech; Vocabulary – Lexical items (fixed / semi fixed expressions); E-materials – Interactive exercises for Grammar and Vocabulary – Sending emails with attachment – Audio / video excerpts of different accents, - Interpreting posters.

**TOTAL: 60 PERIODS**

#### **TEXT BOOKS :**

1. Mindscapes: English for Technologists and Engineers, Orient Black Swan, 2012 .
2. S.P.Dhanavel, English and Communication skills for students of science and Engineering, Orient Black Swan, Chennai, 2011.

#### **REFERENCES :**

1. Pickett, Nell Ann, Ann A.Laster and Katherine E.Staples. “Technical English: Writing, Reading and Speaking”, New York: Longman, 2001.
2. Bailey, Stephen, “Academic Writing: A practical guide for students”, New York: Rutledge, 2011.

3. Morgan, David and Nicholas Regan, "Take-Off: Technical English for Engineering. Reading", Garnet Publishing Limited, 2008.
4. Thorn, Michael and Alan Badrick, "An Introduction to Technical English", Harlow: Prentice Hall Europe, 1993.
5. Rizvi, M.Ashraf, "Effective Technical Communication", New Delhi: Tata McGraw-Hill Publishing Company, 2007.

### **Extensive Readers**

1. Murthy, Sudha. Wise & Otherwise. New Delhi: Penguin Books India, 2006.
2. Gates, Bill and Collins Hemingway, "Business @ the Speed of Thought: Succeeding in the Digital Economy", New York: Warner Business Books, 2000.

### **Website Resources**

1. [www.uefap.com](http://www.uefap.com)
2. [www.eslcafe.com](http://www.eslcafe.com)
3. [www.listen-to-english.com](http://www.listen-to-english.com)
4. [www.owl.english.purdue.edu](http://www.owl.english.purdue.edu)
5. [www.chompchomp.com](http://www.chompchomp.com)

**MA8151**

**MATHEMATICS – I**

**L T P C**

**(Common to all branches of B.E. / B.Tech. Programmes in I Semester) 3 1 0 4**

### **OBJECTIVES:**

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

**UNIT I      MATRICES****9+3**

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

**UNIT II      INFINITE SERIES****9+3**

Sequences – Convergence of series – General properties – Series of positive terms – Tests of convergence (Comparison test, Integral test, Comparison of ratios and D’Alembert’s ratio test) – Alternating series – Series of positive and negative terms – Absolute and conditional convergence – Power Series – Convergence of exponential, logarithmic and Binomial Series.

**UNIT III      FUNCTIONS OF SEVERAL VARIABLES****9+3**

Limits and Continuity – Partial derivatives – Homogeneous functions and Euler’s theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

**UNIT IV      IMPROPER INTEGRALS****9+3**

Improper integrals of the first and second kind and their convergence – Evaluation of integrals involving a parameter by Leibnitz rule – Beta and Gamma functions – Properties – Evaluation of integrals using Beta and Gamma functions – Error functions.

**UNIT V      MULTIPLE INTEGRALS****9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of Solids – Change of variables in double and triple integrals – Area of a curved surface.

**TOTAL: 60 PERIODS****TEXT BOOKS:**

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.

## REFERENCES:

1. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
2. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
3. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education, New Delhi, 2nd Edition, 5th Reprint, 2009.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

**PH8151**

**ENGINEERING PHYSICS**  
**(Common to ALL Branches of B.E./B.Tech. Programmes)**

**L T P C**

**3 0 0 3**

## OBJECTIVE:

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

### **UNIT I      PROPERTIES OF MATTER**

**9**

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

### **UNIT II      ACOUSTICS AND ULTRASONICS**

**9**

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

### **UNIT III      THERMAL PHYSICS**

**9**

Thermal expansion – thermal stress – expansion joints – bimetallic strips – thermal conductivity – conduction in solids – Forbe's and Lees' disc methods – Rectilinear flow of heat through a rod – flow of heat through a compound materials – radial flow of heat through a spherical shell - thermal insulation of buildings – Laws of blackbody radiation: Kirchoffs law, Stephens

law, Wiens law, Raleigh-Jean law and Planks law (derivation). Laws of thermodynamics – Otto and diesel engines and their efficiency – entropy – entropy of Carnot's cycle – reverse Carnot's cycle – refrigerator.

#### **UNIT IV APPLIED OPTICS**

**9**

Interference – Michelson interferometer: construction, working, determination of wave length and thickness – anti-reflection coating – air wedge and its application – Lasers – Einstein's coefficients – CO<sub>2</sub>, Nd:YAG and semiconductor lasers - homo junction and hetro junction - construction and working – applications – Optical fibres – classification (index & mode based) – principle and propagation of light in optical fibres – acceptance angle and numerical aperture – fibre optic communication system – active and passive sensors.

#### **UNIT V SOLID STATE PHYSICS**

**9**

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

**TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

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

#### **REFERENCES:**

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

**CY8151**

**ENGINEERING CHEMISTRY**

**L T P C**

**(Common to all branches of Engineering and Technology)**

**3 0 0 3**

#### **UNIT I CHEMICAL THERMODYNAMICS**

**9**

Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius-

Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation – variation of chemical potential with temperature and pressure.

## **UNIT II POLYMER CHEMISTRY 9**

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

## **UNIT III KINETICS AND CATALYSIS 9**

Introduction – reaction velocity, factors affecting reaction velocity, rate constant, order of reaction, molecularity, pseudo molecular reactions, zero, first, second and third order reactions, reactions of fractional orders, determination of order of reactions. Catalysis: Auto catalysis - Enzyme Catalysis: Michaelis-Menton equation; factors affecting enzyme catalysis. Heterogeneous Catalysis: Types of adsorption isotherms: Langmuir–Hinselwood and Rideal–Eley Mechanism.

## **UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY 9**

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

## **UNIT V NANOCHEMISTRY 9**

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

### **TEXT BOOKS:**

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

## REFERENCES :

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

**GE8151**

**COMPUTING TECHNIQUES**

**L T P C**

**3 0 0 3**

### **UNIT I INTRODUCTION**

**8**

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

### **UNIT II C PROGRAMMING BASICS**

**10**

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

### **UNIT III ARRAYS AND STRINGS**

**9**

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

### **UNIT IV FUNCTIONS AND POINTERS**

**9**

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

### **UNIT V STRUCTURES AND UNIONS**

**9**

Introduction – Need for structure data type – Structure definition – Structure declaration –



Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

**TOTAL : 45 PERIODS**

**TEXTBOOKS:**

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

**REFERENCES:**

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

**GE8152**

**ENGINEERING GRAPHICS**

**L T P C**

**2 0 3 4**

**OBJECTIVES :**

To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

**Concepts and conventions (Not for Examination)**

**1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I PLANE CURVES AND FREE HAND SKETCHING**

**14**

**Basic Geometrical constructions, Curves used in engineering practices**

Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

## **Visualization concepts and Free Hand sketching: Visualization principles –**

Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects.

### **UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 14**

Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces.

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

### **UNIT III PROJECTION OF SOLIDS 14**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

### **UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 14**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

### **UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 15**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids- Prisms, pyramids and cylinders by visual ray method and vanishing point method.

### **COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3**

Introduction to drafting packages and demonstration of their use.

**TOTAL: 75 PERIODS**

#### **TEXT BOOK :**

1. N.D.Bhatt and V.M.Panchal, “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.

## REFERENCES:

1. K.R.Gopalakrishna., "Engineering Drawing" (Vol I&II combined) Subhas Stores Bangalore, 2007.
2. Luzzader, Warren.J., and Duff,John M.,," Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
3. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009
4. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited ,2008.
5. K. V.Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi,2008.

## PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

## SPECIAL POINTS APPLICABLE TO UNIVERSITY EXAMINATIONS ON ENGINEERING GRAPHICS:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**PH8161**

**PHYSICS LABORATORY**

**L T P C**

**(Common to all branches of B.E./B.Tech. Programmes)**

**0 0 2 1**

1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
2. Non – uniform bending – Determination of young's modulus
3. Lee's disc – Determination of thermal conductivity of a bad conductor

- |     |                      |   |
|-----|----------------------|---|
| 4.  | Potentiometer        | – Determination of thermo e.m.f. of thermocouple                              |
| 5.  | Air wedge            | – Determination of thickness of a thin sheet of paper                         |
| 6.  | i. Optical fibre     | – Determination of Numerical Aperture and acceptance angle                    |
|     | ii. Compact disc     | – Determination of width of the groove using laser                            |
| 7.  | Acoustic grating     | – Determination of velocity of ultrasonic waves in liquids                    |
| 8.  | Post office box      | – Determination of Band gap of a semiconductor                                |
| 9.  | Spectrometer         | – Determination of wavelength using grating                                   |
| 10. | Viscosity of liquids | – Determination of co-efficient of viscosity of a liquid by Poiseuille's flow |

**TOTAL : 30 PERIODS**

**CY8161**

**CHEMISTRY LABORATORY**

**LTPC**

**(Common to all branches of Engineering and Technology)**

**0 0 2 1**

1. Estimation of HCl using  $\text{Na}_2\text{CO}_3$  as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1,10-phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of poly vinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics – ester hydrolysis.
13. Corrosion experiment – weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

**TOTAL: 30 PERIODS**

**REFERENCES :**

1. A. L. Vogel, A text of quantitative inorganic analysis, ELBS London. 1995.
2. D.P. Shoemaker and C.W. Gardad, Experiments in physical chemistry, McGraw Hill, London, 2001.
3. American Public Health Association.

**GE8161****COMPUTER PRACTICES LABORATORY****L T P C  
0 0 3 2****LIST OF EXPERIMENTS:**

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

**TOTAL: 45 PERIODS****GE8162****ENGINEERING PRACTICES LABORATORY  
(Common to all Branches of B.E. / B.Tech. Programmes)****L T P C  
0 0 3 2****OBJECTIVE:**

To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

## **GROUP – A (CIVIL AND ELECTRICAL)**

### **1. CIVIL ENGINEERING PRACTICE**

**12**

#### **PLUMBING**

Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.

Laying pipe connection to the suction side of a pump – inlet.

Laying pipe connection to the delivery side of a pump – out let.

Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.

#### **WOOD WORK**

Sawing, planning and making common joints: T-Joint, Mortise and Tennon joint, Dovetail joint.

#### **STUDY**

Study of joints in door panels, wooden furniture

Study of common industrial trusses using models.

### **2. ELECTRICAL ENGINEERING PRACTICE**

**9**

Basic household wiring using switches, fuse, indicator – lamp etc.,

Preparation of wiring diagrams

Stair case light wiring

Tube – light wiring

Study of iron-box, fan with regulator, emergency lamp

## **GROUP – B (MECHANICAL AND ELECTRONICS)**

**15**

### **3. MECHANICAL ENGINEERING PRACTICE**

#### **WELDING**

Arc welding of butt joints, lap joints, tee joints.

Gas welding Practice.

Basic Machining

Simple turning, drilling and tapping operations.

Machine assembly Practice.

Study and assembling the following:

Centrifugal pump, mixies and air conditioners.

Demonstration on

- (a) Smithy operations like the production of hexagonal bolt.
- (b) Foundry operation like mould preparation for grooved pulley.

#### **4. ELECTRONIC ENGINEERING PRACTICE**

**9**

Soldering simple electronic circuits and checking continuity.

Assembling electronic components on a small PCB and testing.

Study of Telephone, FM radio, low-voltage power supplies.

**TOTAL: 45 PERIODS**

**HS8251**

**TECHNICAL ENGLISH II  
(FOR ALL BRANCHES OF B.E / B.TECH PROGRAMMES)**

**L T P C  
3 1 0 4**

#### **OBJECTIVES :**

- To make the students acquire listening and speaking skills meant for both formal and informal contexts.
- To help them develop their reading skills by exposing them to different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace situations.
- To make them acquire language skills at their own pace by using e-materials and language lab component.

## **UNIT I**

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on something, weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; Grammar - Regular & irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

## **UNIT II**

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his success, thanking one's friend / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercise on Grammar and vocabulary, Extensive reading activity (reading stories / novels from links), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

## **UNIT III**

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret etc.); Reading - Speed reading – reading passages with the time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading the articles from the journals - Format for the journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar & vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU materials – Attending a meeting and writing minutes.

## **UNIT IV**

Listening - Listening to a telephone conversation, Viewing a model interview (face-to-face, telephonic and video conferencing) and observing the practices; Speaking - Role play practice



in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping the interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar & Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

## **UNIT V**

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/ agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading Writing - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises - Pictures for discussion; Language Lab - Different models of group discussion

**TOTAL : 60 PERIODS**

## **TEXT BOOKS :**

1. “Mindscapes: English for Technologists and Engineers”, Orient Black Swan, 2012 .
2. S.P.Dhanavel, “English and Communication skills for students of science and Engineering”, Orient Black Swan, Chennai, 2011.

## **REFERENCES :**

1. Laws, Anne. Presentations. Hyderabad: Orient BlackSwan, 2000.
2. Lewis, Hedwig, “Body Language: A Guide for Professionals”. New Delhi: Sage Publications, 1998.
3. Naterop, Jean B. and Rod Revell, “Telephoning in English”. Cambridge: Cambridge University Press, 1987.
4. Rutherford, Andrea J, “Basic Communication Skills for Technology”, New Delhi: Pearson Education, 2001.
5. Ur, Penny, “Teaching Listening Comprehension”, Cambridge: Cambridge University Press, 1984.

## Extensive Readers

1. Abdul Kalam, A P J. "Ignited Minds: Unleashing the Power within India", New Delhi: Penguin Books India, 2002.
2. Parameswaran, Uma, "C.V.Raman: A Biography", New Delhi: Penguin Books India, 2011.

## Web Resources

1. [www.esl-lab.com](http://www.esl-lab.com)
2. [www.englishgrammar.org](http://www.englishgrammar.org)
3. [www.englishclub.com](http://www.englishclub.com)
4. [www.mindtools.com](http://www.mindtools.com)
5. [www.esl.about.com](http://www.esl.about.com)

**MA8251**

**MATHEMATICS II**

**LTPC**

**(Common to all branches of B.E. / B.Tech. Programmes in II Semester) 3 1 0 4**

## OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

## UNIT I DIFFERENTIAL EQUATIONS

**9+3**

Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

## UNIT II VECTOR CALCULUS

**9+3**

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral and volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

### **UNIT III ANALYTIC FUNCTION**

**9+3**

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions - Bilinear transformation.

### **UNIT IV COMPLEX INTEGRATION**

**9+3**

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

### **UNIT V LAPLACE TRANSFORMS**

**9+3**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

**TOTAL : 60 PERIODS**

#### **TEXT BOOKS:**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 2010.

#### **REFERENCES:**

1. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2007.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

**OBJECTIVE:**

To introduce the essential principles of materials science for mechanical and related Engineering applications.

**UNIT I MECHANICAL PROPERTIES 9**

Introduction to mechanical properties - tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.

**UNIT II PHASE DIAGRAMS 9**

Solid solutions - Hume Rothery's rules - free energy of solid solution - intermediate phases - The phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the level rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions - microstructural change during cooling.

**UNIT III FERROUS ALLOYS AND HEAT TREATMENT 9**

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructure of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's law - phase transformations - pearlitic transformations - T-T-T-diagram for eutectoid steel - bainitic and martensitic transformations - tempering of martensite - heat treatment of steels - annealing - normalizing - quenching and tempering - case hardening - induction, flame and laser hardening - carburizing, cyaniding, carbonitriding and nitriding.

**UNIT IV ELECTRONIC MATERIALS 9**

Classification of solids - energy bands - concept of Fermi level - conductor, semiconductor, insulator - Semiconductors: intrinsic, extrinsic - carrier concentration expression (qualitative) - compound semiconductors (qualitative) - dielectric materials - polarization mechanisms - dielectric breakdown - magnetic materials - ferromagnetic materials & hysteresis - ferrites - superconducting materials, properties, types and applications.

## **UNIT V NEW MATERIALS AND APPLICATIONS**

**9**

Introduction to Ceramics and its applications - Ceramic Fibres - Fibre reinforced Plastics – Fibre reinforced Metal – Metallic glasses – Shape memory alloys – Copper base alloys – Nickel – Titanium alloys – Relaxor- Ferroelectric materials – Electro and magneto rheological fluids - Sensors and Actuators – polymer semiconductos – photoconducting polymers – liquid crystals - Bio-sensors - Scintillation detectors (Position sensitive) –Bio materials – hydroxyapatite – PMMA – Silicone.

**TOTAL : 45 PERIODS**

### **TEXT BOOKS :**

1. Raghavan, V., “Materials Science and Engineering”, Prentice Hall of India, 2007.
2. Palanisamy, P.K., “Applied Materials Science”, Scitech, 2003.
3. Raghavan, V., “Physical Metallurgy”, Prentice Hall of India, 2002.

### **REFERENCES :**

1. Calister, W.D., “Materials Science and Engineering an Introduction”, John Wiley, 2003.
2. Rajendarn V and Marikani A, “Materials Science”, Tata McGraw Hill, 2006

**GE8251**

**ENGINEERING MECHANICS**

**LTPC**

**3 1 0 4**

### **OBJECTIVE :**

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

## **UNIT I BASICS AND STATICS OF PARTICLES**

**12**

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

## **UNIT II EQUILIBRIUM OF RIGID BODIES**

**12**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s

theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

**UNIT III PROPERTIES OF SURFACES AND SOLIDS 12**

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

**UNIT IV DYNAMICS OF PARTICLES 12**

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

**UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12**

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

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

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

**REFERENCES:**

1. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Edition, Pearson Education, 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., “Engineering Mechanics – Statics and Dynamics”, 4th Edition, Pearson Education, 2006.
3. J.L.Meriam and L.G.Kraige, “ Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2,Third Edition, John Wiley & Sons,1993.

4. Rajasekaran, S and Sankarasubramanian, G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
5. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
6. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi, 2008.

**EE8202**

**FUNDAMENTALS OF ELECTRICAL ENGINEERING**

**L T P C**

**3 0 0 3**

**AIM :**

To provide knowledge in the basic concepts of circuits, electrical machines and measurement techniques.

**OBJECTIVE :**

To impart knowledge on

- Electric circuit laws
- Principle of Electrical Machines
- Various measuring instruments

**UNIT I ELECTRIC CIRCUITS**

**9**

An introduction to electric circuits – series and parallel networks – Ohms Law – Kirchhoff's Law – Introduction to alternative voltage and current- waveform, RMS value, power, power factor.

**UNIT II DC MACHINES**

**9**

Introduction – DC machine construction – shunt, series and compound windings – motor & generator – EMF and torque equation – losses – efficiency – DC motors starter – speed control of DC motors.

**UNIT III TRANSFORMER AND THREE-PHASE CIRCUITS**

**9**

Introduction – transformer principle of operation – EMF equation of a transformer – transformer construction – transformer losses and efficiency – auto transformers. Three-phase supply – star connection – Delta connection – power in three-phase systems – measurement of power in three-phase systems – advantages.

**UNIT IV AC MACHINES****9**

Introduction – rotating magnetic field – synchronous field – construction of three-phase induction motors – principle of operation – slip – induction motor losses and efficiency – torque equation for an induction motor – induction motor torque speed characteristics – starting methods for induction motors – advantages of squirrel - cage induction motor – uses of three-phase induction motor – principles of operation of alternator.

**UNIT V MEASUREMENTS****9**

Classification of instruments – moving coil and moving iron ammeter and Voltmeter – Multimeters – dynamometer type Wattmeter– energy meter – megger – Instrument transformer (CT & PT)

**TOTAL : 45 PERIODS****TEXT BOOKS:**

1. Del Toro, “Electrical Engineering fundamentals”, Pearson Education, New Delhi, 2007
2. John Bird, “Electrical Circuit theory and technology”, Elsevier, First Indian Edition, 2006.
3. V.K Mehta and Rohit Mehta, “Principle of Electrical Engineering”, S Chand & Co, 2008

**REFERENCES**

1. Thereja.B.L., “Fundamentals of Electrical Engineering and Electronics”, S Chand & Co.Ltd., 2008.
2. Asfaq Hussain, “Electric Machines”, Dhanpat Rai & Co.

**ME8252****MANUFACTURING TECHNOLOGY – I****L T P C****3 0 0 3****OBJECTIVE:**

To introduce the students on the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

**UNIT I METAL CASTING PROCESSES****9**

Sand Casting – Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications – Moulding machines – Types and applications– Melting furnaces – Principle of special casting processes- Shell, investment – Ceramic mould – Pressure die casting – Centrifugal Casting - CO<sub>2</sub> process – Stir castings - Defects in Sand casting.



## **UNIT II JOINING PROCESSES**

**9**

Fusion welding processes – Type of Gas welding – Flame characteristics – Filler and Flux materials – Arc welding ,Electrodes , Coating and specifications – Principles and types of Resistance welding – Gas metal arc welding – 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 – Methods and process capabilities –Adhesive bonding, Types and applications.

## **UNIT III BULK DEFORMATION PROCESSES**

**9**

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

## **UNIT IV SHEET METAL PROCESSES**

**9**

Sheet metal characteristics – Typical shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods – Special forming processes- Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning – Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming.

## **UNIT V MANUFACTURE OF PLASTIC COMPONENTS**

**9**

Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – 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. Kalpakjian. S, “Manufacturing Engineering and Technology”, Pearson Education India Edition, 2006.
2. S. Gowri. P, Hariharan and A.Suresh Babu, “Manufacturing Technology” I, Pearson Education, 2008.

**REFERENCES:**

1. Roy. A. Lindberg, "Processes and materials of manufacture", PHI / Pearson education, 2006.
2. Hajra Chouldhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology, volume I and II", Media promoters and Publishers Private Limited, Mumbai, 1997.
3. Paul Degarma E, Black J.T and Ronald A. Kosher, Materials and Processes, in Manufacturing, Prentice – Hall of India, 8th Edition, 1997.
4. Sharma, P.C., "A Text book of production Technology", S.Chand and Co, Ltd., 2004.
5. P.N. Rao, "Manufacturing Technology Foundry, Forming and Welding", TMH, 2nd Edition, 2003.

**EE8262****ELECTRICAL ENGINEERING LABORATORY****L T P C****0 0 3 2****AIM :**

To provide the practical knowledge and control methods of electrical machines

**OBJECTIVE:**

To impart practical knowledge on

- I. Characteristics of different machines
- II. Method of speed control of machines
- III. Measurement of various electrical parameters.
  1. Study of Starters
  2. Power Measurements in Three-Phase Circuits
  3. Speed Control of DC Motor
  4. Load Test on DC Shunt Motor
  5. OCC & Load Test on DC Shunt Generator
  6. Load Test on DC series motor.
  7. OC and SC Test on Single- Phase Transformer
  8. Load Test on Single-Phase Transformer
  9. Load Test on Single-Phase Induction Motor
  10. Load Test on Three-Phase Induction Motor
  11. Load Characteristics of Alternator.

**TOTAL : 45 PERIODS**

**OBJECTIVE:**

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

**LIST OF EXPERIMENTS:**

Machining, Measurement and Machining time estimations of:

Taper Turning

External Thread cutting

Internal Thread Cutting

Eccentric Turning

Knurling

Square Head Shaping

Hexagonal Head Shaping

**TOTAL: 45 PERIODS**

**OBJECTIVES:**

To make the students acquire a sound knowledge in statistical techniques that model engineering problems. The Students will have a fundamental knowledge of the concepts of probability.

**UNIT I      RANDOM VARIABLES****9+3**

Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions – Functions of a random variable

**UNIT II      TWO-DIMENSIONAL RANDOM VARIABLES****9+3**

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**UNIT III TESTS OF SIGNIFICANCE****9+3**

Sampling distributions - Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances –  $\chi^2$ -test for goodness of fit – Independence of attributes – Non-parametric tests: Test for Randomness and Rank-sum test (Wilcoxon test).

**UNIT IV DESIGN OF EXPERIMENTS****9+3**

Completely randomized design – Randomized block design – Latin square design - 2- factorial design - Taguchi's robust parameter design.

**UNIT V STATISTICAL QUALITY CONTROL****9+3**

Control charts for measurements ( X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

**TOTAL: 60 PERIODS****TEXT BOOKS:**

1. Milton, J. S. and Arnold, J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, New Delhi, 4th Edition, 3rd reprint, 2008.
2. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers", pearson Education, Asia, 8th Edition, 2011.

**CE8353****STRENGTH OF MATERIALS****L T P C****3 0 0 3****OBJECTIVE:**

To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS****9**

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 TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9**

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 stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

**UNIT III TORSION 9**

Torsion formulation stresses and deformation in circular and hollow shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

**UNIT IV DEFLECTION OF BEAMS 9**

Double Integration method – Macaulay’s method – Area moment Theorems for computation of slopes and deflections in beams - Conjugate beam and strain energy – 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 and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lamé’s theory – Application of theories of failure.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Bansal, R.K., “Strength of Materials”, Laxmi Publications (P) Ltd., 2007.
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, 2001
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
4. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole, “Mechanics of Materials”, Tata Mcgraw Hill publishing Co. Ltd., New Delhi.

**OBJECTIVES:**

1. To introduce important analog electronic devices and their characteristics
2. To introduce concepts analog amplifiers and oscillators in discrete and IC form
3. To teach digital logic, related digital circuits and analog to digital and digital to analog conversions

**UNIT I SEMICONDUCTORS AND RECTIFIERS 9**

Classification of solids based on energy band theory, Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Half and Full wave rectifiers, Zener effect, Zener diode, Zener diode Characteristics, Zener diode as a regulator.

**UNIT II TRANSISTOR AND AMPLIFIERS 9**

Bipolar junction transistors – CB, CE, CC configurations and characteristics, Biasing circuits – Fixed bias, Voltage divider bias, CE amplifier, Concept of feedback, Negative feedback, voltage series feedback amplifier, Current series feedback amplifier.

**UNIT III FET AND POWER ELECTRONIC DEVICES 9**

FET – Configuration and characteristics, FET amplifier, Characteristics and simple applications of SCR, Diac, Triac and UJT.

**UNIT IV SIGNAL GENERATORS AND LINEAR ICs 9**

Positive feedback, Sinusoidal oscillators – RC phase shift, Hartley, Colpitts, Wein bridge oscillators, Operational amplifier – Adder, Inverting and Non-inverting amplifiers, integrator and differentiator, IC 555 based Astable and Monostable Multivibrators.

**UNIT V DIGITAL ELECTRONICS 9**

Boolean algebra, Logic Gates, , Half and Full adders, Decoder, Encoder, Multiplexer, Demultiplexer, Flip flops, Digital to Analog converters - R-2R and weighted resistor types, Analog to Digital converters - Successive approximation and Flash types.

**TOTAL : 45 PERIODS**

**TEXT BOOK:**

1. Malvino, "Electronic Principles", McGraw Book Co., 1993.

**REFERENCES:**

1. Grob. B and Schultz. M.E. "Basic Electronics", Tata Mcgraw Hill, 2003.
2. Thomas L. Floyd, "Electronics Devices", Pearson Education, 2002.
3. Thomas L. Floyd, "Digital Fundamentals", Pearson Education, 2003.
4. Millman, Halkias Jacob, Jit Christos and Satyabrata, "Electronic devices and Circuits", Tata McGraw Hill, 2nd Edition.

**IE8301****ENGINEERING ECONOMY AND COST ESTIMATION****L T P C****3 0 0 3****OBJECTIVES :**

- To study and understand the concept of Engineering Economics and apply in the real word.
- To gain knowledge in the field of cost estimation to enable the students to estimate the cost of various manufacturing processes.

**UNIT I INTRODUCTION TO MANAGERIAL ECONOMICS AND DEMAND ANALYSIS****9**

Definition of Managerial Economics - Nature and scope of Managerial Economics - Managerial Economics and other disciplines. Objectives of the firm - Factors influencing Managerial decisions - Basic concepts of Managerial Economics. Demand Analysis – Defining demand, Types of demand and Determinants of demand, Elasticity of demand and demand forecasting.

**UNIT II PRODUCTION AND COST ANALYSIS****9**

Production Analysis – Production function, Returns to a factor, Returns to scale, ISO quants and Least cost combination of inputs. Cost Analysis – Cost concepts, Determinants of cost, Short-run cost-output Relationship, Long-run cost output relationship, Economies and Diseconomies of scale and Estimating cost – Output Relationship.

**UNIT III PRICING****9**

Determinants of price – Pricing under different objectives – Pricing under different market structures – Price discrimination – Pricing of Joint products – Pricing methods in practice.

**UNIT IV ESTIMATION OF MATERIAL AND LABOUR COSTS 9**

Introduction to Estimation and Costing – Elements of costs – Allocation of overheads – Estimation of Material cost – Estimation of Labour cost.

**UNIT V ESTIMATION OF OPERATIONAL COST 9**

Estimation in Machine shop – Estimation in Sheet metal shop – Estimation in Forging shop – Estimation in welding shop – Estimation in Foundry shops.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Yogesh Maheshwari, “Managerial Economics”, second edition, PHI 2005.
2. T.R.Banga and S.C.Sharma, Mechanical Estimating and Costing, Khanna Publishers, 1988.

**REFERENCES:**

1. V.L.Mote, Samuel Paul and G.S.Gupta, Managerial Economics – concepts and cases, TMH, 40th reprint 2007.
2. A.Ramachandra Aryasri and V.V.Ramana Murthy, “Engineering Economics and Financial Accounting”, TMH, New Delhi, 2004.

**IE8302 FACILITY LAYOUT AND MATERIALS HANDLING L T P C  
3 0 0 3**

**OBJECTIVE:**

To explain the basic principles in facilities planning, location, layout designs and material handling systems

**UNIT I PLANT LOCATION 9**

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

**UNIT II FACILITY LAYOUT DESIGN 9**

Need for Layout study , Factors influencing plant layout ,Objectives of a good facility layout, Classification of layout , Layout procedure – Nadler’s ideal system approach, Immer’s basic





<b>UNIT I</b>	<b>PRODUCTIVITY</b>	<b>9</b>
Total time for a job or operation, total work content and ineffective time, – Production and Productivity - Productivity and standard of living, Factors affecting Productivity, Introduction to Productivity measurement Models.		
<b>UNIT II</b>	<b>METHODS ENGINEERING</b>	<b>9</b>
Methods Engineering-Steps -Tools and techniques, Motion study.		
<b>UNIT III</b>	<b>WORK MEASUREMENT</b>	<b>9</b>
Stop watch time study, performance rating, allowances, Development of Standard data, learning effect. Work measurement in Automated Processes. Computerised Labour standards.		
<b>UNIT IV</b>	<b>APPLIED WORK MEASUREMENT</b>	<b>9</b>
Work sampling, Group Timing Technique (GTT), predetermined time systems, types, Methods Time Measurement (MTM), Introduction to MOST standard, Wage incentive plans.		
<b>UNIT V</b>	<b>WORK DESIGN FOR OFFICE WORK</b>	<b>9</b>
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,2003.

**REFERENCES :**

1. Benjamin W.Niebel, Andris Freivalds, “Methods, standards and Work Design”, McGraw hill, Eleventh edition, 2002.
2. ILO, “Introduction to Work Study”, Oxford and IBH publishing , 2008
3. Maynard H.B, “Industrial Engineering Hand book”, McGraw-Hill,2008
4. Prem Vrat, G.D. Sardana and B.S. Sahay, Productivity Management – A Systems Approach, Narosa Publishing House, 1998

**OBJECTIVES:**

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 metal
3. Torsion test on mild steel rod
4. Impact test on metal specimen (Izod and Charpy)
5. Hardness test on metals (Rockwell and Brinell Hardness Tests)
6. Deflection test on metal beam
7. Compression test on helical spring
8. Deflection test on carriage spring

**TOTAL: 45 HOURS****REFERENCE:**

1. Relevant Indian Standards

1. VI Characteristics of PN Junction and Zener Diodes.
2. Characteristics of CE configuration of Transistor.
3. Characteristics of UniJunction Transistor.
4. Characteristics of FET.
5. Operational Amplifier Applications – Adder, Multiplier.
6. RC Oscillator
7. LC Oscillators
8. IC 555 Astable and Monostable multivibrators
9. Half and Full adders
10. RS , T and D FFs
11. BCD counter using IC 7490

**TOTAL: 45 PERIODS**

### **Equipment required**

1. Dual Regulated power supplies(0-30V) : 10 Nos
2. Function Generators (3 MHz) : 10Nos
3. CRO (30MHz) : 10 Nos
4. Diodes (1N4007) : 25
5. Zener diodes : 25
6. Transistors (BC107, BC 148) : 25
7. UJT (2N2636) : 25
8. FET (BFW10) : 25
9. Inductances and capacitances
10. OR, NOR and AND gate ICs : 25  
IC 7483,7486,7490 :25

**IE8311**

**WORK SYSTEM DESIGN LABORATORY**

**LTPC**

**0032**

### **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
  - a. Walking rating
  - b. Card dealing
5. Work sampling
6. MTM practice
7. Video Based Time Study

**TOTAL: 45 PERIODS**

**UNIT - I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****14**

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

Field study of common plants, insects, birds

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

**UNIT - II ENVIRONMENTAL POLLUTION****8**

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

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

**UNIT - III NATURAL RESOURCES****10**

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

and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

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

#### **UNIT - IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

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

#### **UNIT - V HUMAN POPULATION AND THE ENVIRONMENT 6**

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

**TOTAL : 45 PERIODS**

#### **TEXT BOOKS:**

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

#### **REFERENCES :**

1. R.K. Trivedi, “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, “Environmental Encyclopedia”, Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, “Environmental law”, Prentice hall of India Pvt. Ltd., New Delhi, 2007.
4. Rajagopalan, R, “Environmental Studies-From Crisis to Cure”, Oxford University Press, 2005.

**UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 8**

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, capillarity and surface tension. Flow characteristics – concept of control volume - application of control volume to continuity equation, energy equation and momentum equation.

**UNIT II FLOW THROUGH CIRCULAR CONDUITS 7**

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation – friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

**UNIT III DIMENSIONAL ANALYSIS 8**

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

**UNIT IV PUMPS 12**

Impact of jets - Euler's equation - Theory of rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps – working principle - work done by the impeller - performance curves - Reciprocating pump - working principle – indicator diagram – work saved by fitting air vessels – Rotary pumps – classification – comparison of working principle with other pumps – advantages.

**UNIT V TURBINES 10**

Classification of turbines – heads and efficiencies – velocity triangles – axial, radial and mixed flow turbines – Pelton wheel and Francis turbine - working principles - work done by water on the runner – draft tube - specific speed - unit quantities – performance curves for turbines – governing of turbines.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co, 2010.

2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House Pvt. Ltd. New Delhi, 2004.
3. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House. New Delhi, 2002.

#### REFERENCES:

1. Robert W.Fox, Alan T. Mc Donald, Philip J.Pritchard, "Fluid Mechanics and Machinery", ISBN 978-0-470-54755-7, 2011.

IE8401

OPERATIONS RESEARCH-I

L T P C

3 0 0 3

#### OBJECTIVE :

To learn the basics of deterministic optimization tools.

#### UNIT I     **LINEAR PROGRAMMING**     9

Introduction - Formulation of linear programming model - Graphical solution – Solving LPP using simplex algorithm – Revised Simplex Method.

#### UNIT II     **ADVANCES IN LPP – I**     9

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

#### UNIT III    **ADVANCES IN LPP – II**     9

Integer programming – Multi objective optimization: Goal programming–Introduction to Data Envelopment Analysis

#### UNIT IV    **NETWORK MODELS**     9

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

#### UNIT V     **DYNAMIC PROGRAMMING**     9

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

**TOTAL : 45 PERIODS**



## **TEXT BOOKS:**

1. G.Srinivasan., "Operations Research Principles and Applications", PHI, 2008.
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.
5. Hillier and Lieberman, "Introduction to Operations Research", TMH, 2000.

**ME8451**

**MANUFACTURING TECHNOLOGY – II**

**L T P C**

**3 0 0 3**

## **OBJECTIVES:**

To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching. To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming.

### **UNIT I THEORY OF METAL CUTTING**

**9**

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

### **UNIT II TURNING MACHINES**

**9**

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle : Swiss type, automatic screw type – multi spindle.

### **UNITIII RECIPROCATING, MILLING AND GEAR CUTTING MACHINES**

**9**

Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making : Drilling ,reaming,boring,Tapping, Milling operations-types of milling cutter –attachments- machining time calculations -,Gear cutting – forming and generation principle, gear milling , hobbing and gear shaping – micro finishing methods.

**UNIT IV ABRASIVE PROCESS AND BROACHING****9**

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding- micro finishing methods - Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

**UNIT V ADVANCED MANUFACTURING TECHNIQUES****9**

Numerical Control(NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micro machining – wafer machining

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Roy. A.Lindberg, "Process and materials of manufacture," PHI/Pearson Education fourth, Edition 2006.
2. Rao. P.N, "Manufacturing Technology," Metal Cutting and Machine Tools, Tata McGraw-Hill, New Delhi, 2003.

**REFERENCES**

1. Richerd R kibbe, John E. Neely, Roland O.Merges and Warren J.White, "Machine Tool Practices", Prentice Hall of India, 1998
2. "HMT – Production Technology", Tata Mc Graw Hill, 1998.
3. Hajra Choudhury, "Elements of Workshop Technology – Vol.II", Media Promoters.

**ME8452****MECHANICS OF MACHINES****L T P C****3 0 0 3****OBJECTIVES:**

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

**UNIT I KINEMATIC OF MECHANICS****9**

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 IN MACHINE ELEMENTS      9**

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes – Friction in vehicle propulsion and braking.

**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 isolation.

**TOTAL: 45 PERIODS**

**TEXT BOOK:**

1. Uicker J.J, Pennock G.R and Shigley J.E., “Theory of Machines and Mechanisms”, 3rd Edition, Oxford University Press, 2009.

**REFERENCES:**

1. Rattan S.S., “Theory of Machines”, 3rd Edition, Tata McGraw-Hill, 2009.
2. Bevan T., “Theory of Machines’, 3rd Edition, CBS Publishers and Distributors, 2005.
3. Cleghorn W. L., “Mechanisms of Machines”, Oxford University Press, 2005
4. Benson H.T., ”Principles of Vibrations”, Oxford University Press, 2nd Edition, 2007
5. Robert L.N, “Kinematics and Dynamics of Machinery”, Tata McGraw-Hill, 2009.
6. Allen S.H Jr., “Kinematics and Linkage Design”, Prentice Hall, 1961
7. Ghosh A. and Mallick A.K., “Theory of Mechanisms and Machines’, Affiliated East-West Pvt. Ltd., New Delhi, 1988.

8. Rao J.S. and Dukkipati R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
9. Hannah J. and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
10. Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros., 1996
11. Thomson W.T., Dahleh M.D. and Padmanabhan C., "Theory of Vibration with Application", 5th edition Pearson Education, 2011
12. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002.
13. Khurmi. R.S., "Theory of Machines", 14th Edition, S Chand Publications.

#### **STANDARDS:**

IS 2458: 2001, Vocabulary of Gear Terms – Definitions related to Geometry.

IS 3756: 2002, Method of Gear Correction – Addendum modification for External cylindrical gears with parallel axes.

IS 5267: 2002 Vocabulary of Gear Terms – Definitions Related to Worm Gear Geometry.

IS 12328: Part 1: 1988 Bevel Gear Systems Part – 1 Straight Bevel Gears.

IS 12328: 1988 Bevel Systems Part – 2 Spiral Bevel Gears.

**ME8453**

**THERMODYNAMICS**

**L T P C**

**3 1 0 4**

#### **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.

<b>UNIT II</b>	<b>FIRST AND SECOND LAW OF THERMODYNAMIC</b>	<b>12</b>
<p>First law of thermodynamics – Energy balance for closed systems and steady flow systems – Applications of First law of Thermodynamics – Energy balance for Unsteady flow processes – Second law of Thermodynamics – Entropy – Carnot principles – Change in Entropy – Entropy and irreversibility -Applications.</p>		
<b>UNIT III</b>	<b>HEAT ENGINES</b>	<b>15</b>
<p>Internal Combustion Engines – C.I and S.I Engines – Four Stroke and Two Stroke Engines – Gas Turbines - Boilers – Fire Tube Boiler &amp; Water Tube Boilers , Boiler Accessories and Components. Turbines – Impulse Turbine and Reaction Turbine , Turbine Components - Refrigeration Cycle – Vapour Compression &amp; Vapour Absorption System ,Gas Refrigeration System – Environmental friendly Refrigerants – Air Conditioning.</p>		
<b>UNIT IV</b>	<b>GASES AND VAPOUR MIXTURES</b>	<b>10</b>
<p>Ideal and Real gases – Vander waals equations – Reduced property – Compressibility chart -Properties of mixture of gases – Dalton’s law and Gibbs – Dalton law – Internal energy, Enthalpy and specific heats of gas mixtures.</p>		
<b>UNIT V</b>	<b>HEAT TRANSFER</b>	<b>11</b>
<p>Conduction – Plane Wall, Cylinder system, Composite Walls – Critical insulation thickness – Simple problems, fins convection – Free convection and forced convection – Flow over Flat plates and Flow through Pipes – Heat Exchangers - Radiation – Black Body, Grey Body Radiation.</p>		
		<b>TOTAL : 60 PERIODS</b>
<b>TEXT BOOKS:</b>		
<ol style="list-style-type: none"> <li>1. Cenegal Y.A. and Boles M.A., “Thermodynamics an Engineering Approach”, Tata McGraw hill, Fourth edition, 2004.</li> <li>2. Moran M.J. and Shapiro H.N., “Fundamentals of Engineering Thermodynamics”, John wiley &amp; Sons, Fourth Editon, 2000.</li> </ol>		
<b>REFERENCE BOOKS:</b>		
<ol style="list-style-type: none"> <li>1. Dhar P.L., “Engineering Thermodynamics – A Generalized Approach”, Elsevier, 2008.</li> <li>2. Rathakrishnan E., “Fundamentals of Engineering Thermodynamics”, Prentice Hall of India, Second Edition,</li> <li>3. Nag P.K., “Engineering Thermodynamics” ,Tata McGraw hill, Third edition, 2005</li> </ol>		

**OBJECTIVE:**

Students should be able to verify the principles studied in theory by performing the experiments in lab.

**A. Flow Measurement**

1. Calibration of Rotometer
2. Flow through Venturimeter
3. Flow through a circular Orifice
4. Determination of mean velocity by Pitot tube
5. Verification of Bernoulli's Theorem

**B. Losses in Pipes**

6. Determination of friction coefficient in pipes
7. Determination of losses due to bends, fittings and elbows

**C. Pumps**

8. Characteristics of Centrifugal pumps
9. Characteristics of Gear pump
10. Characteristics of Submersible pump
11. Characteristics of Reciprocating pump

**D. Turbines**

12. Characteristics of Pelton wheel turbine
13. Characteristics of Francis turbine

**E. Determination of Metacentric height**

14. Determination of Metacentric height

**TOTAL: 45 PERIODS**

**REFERENCE BOOKS:**

1. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2004.
2. Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2000.

3. Subramanya, K., "Flow in open channels", Tata McGraw - Hill pub. Co., 1992.
4. Subramanya, "K. Fluid mechanics", Tata McGraw- Hill pub. Co., New Delhi, 1992.

**ME8461**

**MANUFACTURING TECHNOLOGY LAB – II**

**L T P C**

**0 0 3 2**

**OBJECTIVES:**

To Study and acquire knowledge on various basic machining operations in special purpose machines and its applications in real life manufacture of components in the industry

**LIST OF EXPERIMENTS:**

1. Contour milling using vertical milling machine
2. Spur gear cutting in milling machine
3. Helical Gear Cutting in milling machine
4. Gear generation in hobbing
5. Gear generation in shaping
6. Spline Broaching
7. Plain Surface grinding
8. Cylindrical grinding
9. Tool angle grinding with tool and Cutter Grinder
10. Measurement of cutting forces in Milling /Turning Process
11. CNC Part Programming.

**TOTAL: 45 PERIODS**

**IE8501**

**MANUFACTURING AUTOMATION**

**L T P C**

**3 0 0 3**

**OBJECTIVE:**

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

**UNIT I MANUFACTURING OPERATIONS**

**9**

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

**UNIT II CONTROL TECHNOLOGIES 9**

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

**UNIT III TRANSFER LINES 9**

Automated production lines – applications, Analysis – with and without buffers, automated assembly systems, line unbalancing concept.

**UNIT IV NUMERICAL CONTROL AND ROBOTICS 9**

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

**UNIT V AUTOMATED HANDLING AND STORAGE 9**

Automated guided vehicle systems, AS/RS, Carousel storage, Automatic data capture - Bar code technology.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Mikell P.Groover, Automation, “Production Systems and Computer Integrated Manufacturing” PHI, 2008.
2. Mikell P.Groover, Emory W. Zimmers, Jr., “CAD/CAM: Computer - Aided Design and Manufacturing”, PHI, 2007.

**IE8502 OPERATIONS RESEARCH - II L T P C  
3 0 0 3**

**OBJECTIVE :**

To impart knowledge on some probabilistic optimization techniques.

**UNIT I DETERMINISTIC INVENTORY MODELS 9**

Purchase model with no shortages – Manufacturing model with no shortages – purchase model with shortages – Manufacturing model with shortages – Model with price breaks.



**UNIT II PROBABILISTIC INVENTORY MODELS****9**

Probabilistic inventory model – Reorder point model – Multiproduct-selective inventory control

**UNIT III QUEUING THEORY****9**

Queuing theory terminology – Single server, multi server, limited queue capacity, limited population capacity – Applications – Markov chains.

**UNIT IV DECISION THEORY****9**

Decision making under certainty – Decision making under risk – Decision making under uncertainty – Decision tree analysis – Introduction to MCDM; AHP. Game Theory – Two person zero sum games, pure and mixed strategies – Theory of dominance - Graphical Solution – Solving by LP.

**UNIT V NON-LINEAR PROGRAMMING****9**

Introduction to non-linear programming – Unconstrained extreme points – Constrained problems with equality constraints: Lagrangean method - Constrained problems with inequalities: Kuhn tucker conditions – Quadratic programming.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Ravindran A. ,Don T. Phillips,James J. Solberg “Operations Research: Principles And Practice”, Wiley India,2007
2. R.Panneerselvam, “Operations Research”, PHI,2006.

**REFERENCES:**

1. Hamdy A Taha, “Operations Research – An Introduction”, Prentice Hall India, 2003.
2. Ronald L Rardin, “Optimisation in Operations Research”, Pearson, 2003.
3. Hillier and Lieberman, “Introduction to Operations Research”, TMH, 2000.

**IE8503****QUALITY CONTROL AND ASSURANCE****L T P C****3 0 0 3****OBJECTIVES:**

1. To impart knowledge to enable the students to design and implement Statistical Process Control in any industry.
2. To design and implement acceptance sampling inspection methods in industry.

**UNIT I      QUALITY FUNDAMENTALS      9**

Importance of quality- evolution of quality- definitions of quality- dimensions of quality- quality control- quality assurance- areas of quality- quality planning- quality objectives and policies- quality costs- economics of quality- quality loss function- quality Vs productivity- Quality Vs reliability.

**UNIT II      CONTROL CHARTS FOR VARIABLES      9**

Process variation- preliminary decisions- control limits and their computation- construction and application of X bar, R and S charts- warning and modified control limits- process adjustment for trend,- Comparison of process variation with specification limits- O.C. curve for X bar chart.

**UNIT III      STATISTICAL PROCESS CONTROL      9**

Process stability- process capability study using control charts- capability evaluation- Cp, Cpk and Cpm – capability analysis using histogram and normal probability plot- machine capability study- gauge capability study- setting statistical tolerances for components and assemblies- individual measurement charts- X-chart, moving average and moving range chart, multi-vari chart.

**UNIT IV      CONTROL CHARTS FOR ATTRIBUTES      9**

Limitations of variable control charts- Control charts for fraction non-conforming- p and np charts, variable sample size, operating characteristic function, run length- Control chart for nonconformities (defects)- c, u, ku charts, demerits control chart- applications.

**UNIT V      ACCEPTANCE SAMPLING      9**

Need- economics of sampling- sampling procedure- single and double sampling- O.C. curves- Average outgoing quality- Average sample number- Average total inspection- Multiple and sequential sampling- Standard sampling plans- Military, Dodge-Roming, IS 2500.

**TOTAL: 45 PERIODS**

**TEXT BOOK:**

1. Douglas C. Montgomery, "Introduction to Statistical Quality Control", John Wiley & Sons, 2004.

**REFERENCES:**

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

**OBJECTIVES :**

- To familiarize 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 IN MACHINE MEMBERS****10**

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 -Factor of safety - theories of failure – Design based on strength and stiffness.

**UNIT II SHAFTS, COUPLINGS, JOINTS AND BEARINGS****8**

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

Threaded fasteners, Welded joints and riveted joints for structures, Sliding contact and rolling contact bearings (Simple problems)

**UNIT III ENERGY STORING ELEMENTS AND ENGINE COMPONENTS****9**

Various types of springs, optimization of helical springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

**UNIT IV DESIGN FOR FLEXIBLE ELEMENTS****9**

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

**UNIT V SPUR GEARS, HELICAL GEARS AND GEAR BOXES****9**

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations.

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box for machine tool applications – Variable speed gear box

**TOTAL: 60 PERIODS**

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

**TEXT BOOK:**

1. Bhandari V, “Design of Machine Elements”, 3rd Edition, Tata McGraw-Hill Book Co, 2010.

**REFERENCES:**

1. Sundararamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett, “Mechanical Engineering Design”, 8th Edition, Tata McGraw-Hill , 2008.
3. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine Design”, 4th Edition, Wiley, 2005.
4. Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, Tata McGraw-Hill Book Co.(Schaum’s Outline), 2010.
5. Bernard Hamrock, Steven Schmid, Bo Jacobson, “Fundamentals of Machine Elements”, 2nd Edition, Tata McGraw-Hill Book Co., 2006.
6. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
7. Ansel Ugural, “Mechanical Design – An Integral Approach, 1st Edition, Tata McGraw-Hill Book Co, 2003.
8. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, “Design of Machine Elements” 8th Edition, Printice Hall, 2003.

**STANDARDS:**

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

**OBJECTIVE:**

To give hands on experience on CNC programming on lathe and milling as well as PLC controller

1. Part programming for CNC Lathe- Starturn
2. Simulation and Machining Process in CNC Lathe – Starturn
3. Part programming for CNC Lathe- XLturn
4. Simulation and Machining Process in CNC Lathe – XLturn
5. Part programming for CNC Milling- StarMill PC
6. Simulation and Machining Process in CNC Milling- StarMill PC
7. Part programming for CNC Milling- XLMill
8. Simulation and Machining Process in CNC Milling -XLMill
9. Programming Exercise for Robots
10. Programming of PLC using Ladder Logic Diagram

**TOTAL : 45 PERIODS****OBJECTIVES:**

To give adequate exposure to applications of software packages in the area of Operations Research.

Problem Formulation, Solving Using C ,C++,Excel and Optimisation Package (TORA/Lindo/ Lingo)

LP Models

Transportation Problem

Assignment Problems

Maximal Flow

Minimal Spanning Tree

Shortest route

Project Management- PERT and CPM

Goal Programming

AHP and DEA

**TOTAL : 45 PERIODS**

**AIM:**

To understand and handle design problems in a systematic manner. To gain practical experience in handling 2D drafting and 3D modeling software systems and to apply CAD in real life applications.

**COMPUTER AIDED DESIGN (CAD)**

- 2D drawing Using AUTOCAD
- 3D Part modeling – protrusion, cut, sweep, draft, loft, blend, rib
- Editing – Move, Pattern, Mirror, Round, Chamfer
- Assembly – creating assembly from parts – assembly constraints
- Conversion of 3D solid model to 2D drawing - different views, sections, isometric view and dimensioning
- Introduction to Surface Modeling
- 3D modeling of machine elements like Flanged coupling, screw jack etc. (PRO-E)

**TOTAL: 45 PERIODS****AIM :**

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

**OBJECTIVES :**

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

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

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

**UNIT II TQM PRINCIPLES 9**

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

**UNIT III TQM TOOLS AND TECHNIQUES I 9**

The seven traditional tools of quality – New management tools – Lean and 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 AND TECHNIQUES II 9**

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

**UNIT V QUALITY SYSTEMS 9**

Need for ISO 9000- ISO 9001-2008 Quality Systems – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Quality Council – Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.

**TOTAL : 45 PERIODS**

**TEXT BOOK:**

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

**REFERENCE BOOKS:**

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

**OBJECTIVE:**

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

**UNIT I INTRODUCTION 9**

Brief history of human factors Engineering/Ergonomics – Interdisciplinary nature- Principles of Human factors Engineering- Biostatic and Biodynamic Mechanics.

**UNIT II HUMAN PERFORMANCE 9**

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

**UNIT III PHYSIOLOGICAL ASPECTS OF HUMAN AT WORK 9**

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

**UNIT IV WORK PLACE DESIGN 9**

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

**UNIT V OCCUPATIONAL HEALTH AND SAFETY 9**

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

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Bridger, R.S., "Introduction to Ergonomics", McGraw Hill, 1995.
2. Martin Helander, "A guide to Ergonomics of Manufacturing", TMH, 2006.

**REFERENCES:**

1. Mecormik, T.J., "Human Factors Engineering", TMH, 1990.



2. John Grimaldi, "Safety Management", A.I.B.S., 5th Edition, Hazard Control Technology 2003
3. Philips, Chandler A, "Human Factors Engineering", John Wiley and Sons, Inc. 2000

**IE8602**

**PRODUCTION AND OPERATIONS MANAGEMENT**

**L T P C**

**3 0 0 3**

**OBJECTIVE:**

To impart knowledge in the areas of production planning and control applicable to various types of manufacturing systems.

**UNIT I INTRODUCTION**

**5**

Overview of Production System, Objectives of Operation Management, Scope of Operations Management, Operations Management Frame work, Relationship of operations with other Functional areas, Manufacturing Vs Service sector, Operations Decision making, Production Design Process and Process choices

**UNIT II FORECASTING**

**12**

Need, Determinants of Demand, Demand Patterns, Measures of forecast error, Qualitative Forecasting Methods-Delphi techniques. Market Research, Nominal Group Technique Quantitative Forecasting methods – Moving Average Methods, Exponential Smoothing Methods, Regression methods, Monitoring and Control of Forecasts, Requirements and Selection of Good forecasting methods.

**UNIT III AGGREGATE PLANNING**

**10**

Role of aggregate Product planning, Managerial inputs to Aggregate planning, Pure and Mixed strategies, Mathematical Models for Aggregate planning – Transportation Method, Linear programming Formulation, Linear Decision Rues, Master Production Schedule(MPS), Procedure for developing MPS, MRP, Lot sizing methods of MRP, MRP Implementation issues, MRP – II.

**UNIT IV CAPACITY MANAGEMENT**

**8**

Measures of capacity, Factors affecting capacity, Capacity planning, Systematic approach to capacity planning, Long-term and short-term capacity decisions, Tools for capacity planning, Capacity Requirement planning- Business process outsourcing

**UNIT V PRODUCTION ACTIVITY CONTROL****10**

Objectives and Activities of Production Activity Control, Flow-shop, Intermittent flow shop, Job shop, Shop floor control – High volume Production Activity Control, Job-shop Production Activity Control.

**TOTAL: 45 PERIODS****REFERENCES:**

1. Seetharama L.Narasimhan, Dennis W.McLeavey, Peter J.Billington,“Production Planning And Inventory Control” , PHI, 2nd Edition, 2002.
2. Norman Gaither, Greg Frazier, Operations Management, Thomson Learning, 9th Edition, 2002.
3. Monks J.G, “Operations Management”, McGraw Hill, 1997
4. Panneerselvam. R, Production and operations Management,PHI,2005
5. Lee J.Krajewski, Larry P.Ritzman, “Operations Management Strategy and Analysis”, PHI, 6th Edition, 2003.

**IE8603****RELIABILITY ENGINEERING****L T P C****3 0 0 3****OBJECTIVE:**

To impart knowledge in reliability concepts, reliability estimation methods and reliability improvement methods

**UNIT I RELIABILITY CONCEPT****9**

Reliability definition –Reliability parameters-  $f(t)$ ,  $F(t)$  and  $R(t)$  functions- Measures of central tendency – Bath tub curve – A priori and posteriori probabilities of failure – Component mortality - Useful life.

**UNIT II LIFE DATA ANALYSIS****9**

Data classification – Non parametric methods: Ungrouped, Grouped, Complete, Censored data – Time to failure distributions – Probability plotting: Exponential, Weibull - Goodness of fit tests – Survival graphs.

**UNIT III RELIABILITY ESTIMATION****9**

Series parallel configurations – Parallel redundancy – m/n system – Complex systems: RBD approach – Baye’s method – Minimal path and cut sets - Fault Tree analysis – Standby system.

**UNIT IV RELIABILITY MANAGEMENT****8**

Reliability testing: Failure terminated test – Time terminated test – Upper and lower MTBFs – Sequential Testing – Reliability growth monitoring – Reliability allocation.

**UNIT V RELIABILITY IMPROVEMENT****10**

Analysis of downtime – Repair time distribution – Maintainability prediction – Measures of maintainability – Availability definitions – System Availability – Replacement decisions – Economic life.

**TOTAL: 45 PERIODS****REFERENCES:**

1. Charles E. Ebeling, "An Introduction to Reliability and Maintainability Engineering", TMH, 2000.
2. Roy Billington and Ronald N. Allan, "Reliability Evaluation of Engineering Systems", Springer, 2007.

**HS8561****EMPLOYABILITY SKILLS****L T P C**

**(COMMON TO ALL BRANCHES OF FIFTH OR SIXTH SEMESTER  
B.E / B.TECH PROGRAMMES)**

**0 0 2 1****OBJECTIVES :**

- To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
  - To help them improve their soft skills, including report writing, necessary for the workplace situations
1. Making presentations – introducing oneself – introducing a topic – answering questions – individual presentation practice
  2. Creating effective PPTs – presenting the visuals effectively
  3. Using appropriate body language in professional contexts – gestures, facial expressions, etc.
  4. Preparing job applications - writing covering letter and résumé
  5. Applying for jobs online - email etiquette
  6. Participating in group discussions – understanding group dynamics - brainstorming the topic
  7. Training in soft skills - persuasive skills – People skills - questioning and clarifying skills – mock GD

8. Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

**TOTAL: 30 PERIODS**

#### **REFERENCES :**

1. Dhanavel, S.P. 2010, “English and Soft Skills”, Hyderabad: Orient BlackSwan Ltd.
2. Corneilssen, Joep. How to Prepare for Group Discussion and Interview. New Delhi: Tata-McGraw-Hill, 2009.
3. D’Abreo, Desmond A, “Group Discussion and Team Building”, Mumbai: Better Yourself Books, 2004.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, “The ACE of Soft Skills”, New Delhi: Pearson, 2010.
5. Gulati, Sarvesh, “Corporate Soft Skills”, New Delhi: Rupa and Co. 2006.
6. Van Emden, Joan, and Lucinda Becker, “Presentation Skills for Students”, New York: Palgrave Macmillan, 2004.

#### **EXTENSIVE READERS**

1. Covey, Stephen R, “The 7 Habits of Highly Effective People”, New York: Free Press, 1989.
2. Bagchi, Subroto, “The Professional”, New Delhi: Penguin Books India, 2009.

#### **WEB RESOURCES**

1. [www.humanresources.about.com](http://www.humanresources.about.com)
2. [www.careerride.com](http://www.careerride.com)

**IE8611**

**ERGONOMICS LAB**

**L T P C**

**0 0 3 2**

#### **OBJECTIVE:**

To test the principles of human factors engineering in a laboratory

1. Effect of speed of walking on tread mill using heart rate and energy expenditure
2. Effect of workload on heart rate using Ergo cycle.
3. Evaluation of physical fitness using step test
4. Effect of work-rest schedule on physical performance (Ergo cycle / tread mill)
5. Development of anthropometric data for male and female.

6. Application of anthropometric data for the design of desk for students
7. Evaluation of physical facilities (chairs, tables etc.) Through comfort rating.
8. Evaluation of cognitive performance of individuals
9. Analysis of noise level in different environment
10. Study of Illumination of work places.

**TOTAL: 45 PERIODS**

**IE8612**

**INDUSTRIAL TRAINING / MINI PROJECT**

**L T P C**

**0 0 3 2**

The student has the option of undergoing either industrial training or can carry out a mini project.

**INDUSTRIAL TRAINING:**

The objective is to give an exposure to the industrial environment and learn how they function.

A minimum of 4 weeks of industrial training is required. He/she can undergo training either at a stretch or in two spells of a minimum of two weeks each. The training should have been completed in the immediate preceding one or two summers. A comprehensive report is to be submitted at the beginning of the VIIth semester. A certificate from the industry signed by an appropriate authority should be submitted along with the report. It will be evaluated by a two member committee constituted by the Head of the Department based on the report and oral examination.

**MINI PROJECT:**

The objective is to develop skill in applying industrial engineering techniques to real/ practical problems.

A student is expected to select a topic in the industrial engineering area such as Forecasting, production planning, scheduling, operations research, facilities planning and lay out, transportation and distribution, quality, supply chain, simulation etc. Identify a problem and collect necessary data and analyse using appropriate tool / technique. Data can be collected from industry or standard data sets available in literature can be used.

A comprehensive report is to be submitted towards the end of the VIIth semester. It will be evaluated by a two member committee constituted by the Head of the Department based on the report and oral examination.

**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 – Input Data Modeling - 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 Queing, Inventory, Replacement, Production etc., - Model validation and verification, Output analysis. Use of DOE tools.

**UNIT IV SIMULATION LANGUAGES 12**

Need for simulation Languages – Study of GPSS and introduction to ARENA.

**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 and Kelton W D, Simulation Modelling and analysis, Tata McGraw Hill, 2003.
4. David Kelton, Rondall P Sadowski and David T Sturrock, "Simulation with Arena", Mc Graw Hill, 2004
5. Thomas J Schriber, "Simulation Using GPSS", John Wiley, 2002.
6. <http://www.bcnn.net>

**OBJECTIVE:**

To teach the basic principles of supply chains and associated logistics management.

**UNIT I INTRODUCTION 5**

Role of Logistics and Supply chain Management: Scope and Importance- Evolution of Supply Chain -Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles.

**UNIT II SUPPLY CHAIN NETWORK DESIGN 10**

Role of Distribution in Supply Chain – Factors influencing Distribution network design –Design options for Distribution Network Distribution Network in Practice-Role of network Design in Supply Chain – Framework for network Decisions

**UNIT III LOGISTICS IN SUPPLY CHAIN 10**

Role of transportation in supply chain – factors affecting transportations decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation

**UNIT IV SOURCING AND COORDINATION IN SUPPLY CHAIN 10**

Role of sourcing supply chain supplier selection assessment and contracts- Design collaboration - sourcing planning and analysis -supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain

**UNIT V SUPPLY CHAIN AND INFORMATION TECHNOLOGY 10**

The role IT in supply chain-The supply chain IT frame work Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain –E-Business in supply chain

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Sunil Chopra, Peter meindl and Kalra, “Supply Chain Management , Strategy, Planning, and operation”, Pearson Education, 2010.

2. Srinivasan G.S, "Quantitative models in Operations and Supply Chain Management, PHI, 2010.

## REFERENCES

1. Jeremy F.Shapiro, "Modeling the supply chain", Thomson Duxbury, 2002.
2. David J.Bloomberg , Stephen Lemay and Joe B.Hanna, "Logistics", PHI 2002.
3. James B.Ayers, "Handbook of Supply chain management", St.Lucle press, 2000.

**IE8755**

**DESIGN OF EXPERIMENTS**

**L T P C**

**3 0 0 3**

## OBJECTIVES:

- To impart knowledge to design experiments to a problem situation using traditional experimental designs as well as Taguchi Methods.
- To develop skill to conduct experiments and analyze the data to determine the optimal process parameters that optimize the process.

### **UNIT I FUNDAMENTALS OF EXPERIMENTAL DESIGNS**

**9**

Hypothesis testing – single mean, two means, dependant/ correlated samples – confidence intervals, Experimentation – need, Conventional test strategies, Analysis of variance, F-test, terminology, basic principles of design, steps in experimentation – choice of sample size – Normal and half normal probability plot – simple linear and multiple linear regression, testing using Analysis of variance.

### **UNIT II SINGLE FACTOR EXPERIMENTS**

**9**

Completely Randomized Design- effect of coding the observations- model adequacy checking - estimation of model parameters, residuals analysis- treatment comparison methods- Duncan's multiple range test, Newman-Keuel's test, Fisher's LSD test, Tukey's test- testing using contrasts- Randomized Block Design – Latin Square Design- Graeco Latin Square Design – Applications.

### **UNIT III FACTORIAL DESIGNS**

**9**

Main and Interaction effects - Two and three factor full factorial designs- Fixed effects and random effects model - Rule for sum of squares and Expected Mean Squares-  $2^k$  Design with two and three factors- Yate's Algorithm- fitting regression model- Randomized Block Factorial Design - Practical applications.



**UNIT IV SPECIAL EXPERIMENTAL DESIGNS****9**

Blocking and Confounding in  $2^k$  Designs- blocking in replicated design-  $2^k$  Factorial Design in two blocks- Complete and partial confounding- Confounding  $2^k$  Design in four blocks- Two level Fractional Factorial Designs- one-half fraction of  $2^k$  Design, design resolution, Construction of one-half fraction with highest design resolution, one-quarter fraction of  $2^k$  Design- introduction to response surface methods, central composite design.

**UNIT V TAGUCHI METHODS****9**

Design of experiments using Orthogonal Arrays, Data analysis from Orthogonal experiments- Response Graph Method, ANOVA- attribute data analysis- Robust design- noise factors, Signal to noise ratios, Inner/outer OA design- case studies.

**TOTAL: 45 PERIODS****TEXT BOOKS :**

1. Krishnaiah K, and Shahabudeen P, "Applied Design of Experiments and Taguchi Methods", PHI, India, 2011.
2. Douglas C. Montgomery, "Design and Analysis of Experiments", John Wiley & sons, 2005.

**REFERENCE :**

1. Phillip J. Ross, "Taguchi Techniques for Quality Engineering", Tata McGraw-Hill, India, 2005.

**IE8711****COMPREHENSION****L T P C****0 0 2 1**

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**

**OBJECTIVE:**

To carry out exercises with the help of software packages in the areas of linear and multivariate regression, factor analysis, discriminant analysis, reliability and design of experiments

1. Determine the linear regression model for fitting a straight line and calculate the least squares estimates, the residuals and the residual sum of squares.
2. Determine the multivariate regression model for fitting the straight line.
3. Perform the Correlation analysis to determine the relationships among the variables.
4. Perform the factor analysis for the given set of model data using both Exploratory and Confirmatory methods and evaluate the model adequacy.
5. Determine which continuous variable is discriminate among the given group and determine which variable is the best predictor.
6. Determine the process is within the control or not by developing the control charts for attributes and variables and estimate the process capability.
7. Estimate the parameters (MTTF, MTBF, failure rate, bathtub curve etc) of components and systems to predict its reliability. (use Reliasoft)
8. Develop the single factor and two factor design of experiment model to predict the significance factor.
9. Develop  $2^k$  factorial and  $2^{k-p}$  fractional factorial experiment to determine the parameters which affect the system.

**TOTAL : 45 PERIODS**

Usage of Minitab for:

Linear and multivariate regression

Correlation

Factor analysis

Discriminant analysis

Control charts

Process capability

Factorial experiments

**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, Poker
- 4-5. Monte Carlo Simulation  
Random Walk Problem with graphical application  
Paper Boy Problem
- 6-7. Queuing Models  
Single, Multi Server
- 8-9 Other IE oriented Models  
Inventory, Replacement, Production system etc.
- 10-11. Use of Simulation Language/Package

**TOTAL : 45 PERIODS**

A project topic must be selected either from published lists or the students themselves may propose suitable topics in consultation with the faculty/guide. It can be a theoretical research project or industry oriented. The objective is to apply the principles/ techniques they have learnt to a new or existing problem situation leading to a solution. Generally it is a group project.

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

A project report is to be submitted towards the end of the semester. It will be evaluated jointly by the external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

**AIM**

To enable students to understand the accounting procedure, interpretation of financial accounting with cost account.

**UNIT I INTRODUCTION 9**

Basics of accounting – Management Accounting – Financial accounting – cost accounting – comparison of Financial accounting, cost accounting and management Accounting – generally accepted Accounting principles – Accounting standards – Accounting cycle.

**UNIT II FINANCIAL ACCOUNTING 9**

Salient features of Balance Sheet and Profit and Loss statement, cash flow and Fund flow analysis (Elementary), working capital management, ratio analysis – Depreciation.

**UNIT III COST ACCOUNTING 9**

Cost accounting systems : Job Costing, process costing, allocation of overheads, Activity based costing, variance analysis – marginal costing – Break even analysis.

**UNIT IV BUDGETING 9**

Requirements for a sound budget, fixed budget – preparation of sales and production budget, flexible budgets, zero based budgets and budgetary control.

**UNIT V FINANCIAL MANAGEMENT 9**

Investment decisions – Investment appraisal techniques – payback period method, accounting rate of return, net present value method, internal rate of return and profitability index method- cost of capital.

**TOTAL: 45 PERIODS**

**REFERENCES :**

1. Bhattacharya. S.K. and John Deardon, "Accounting for Management – Text and cases", Vikas publishing House, New Delhi, 1996.
2. James, C.Van Horne, "Fundamental of Financial Management" Dearson Education, 12th Edition, 2002
3. V.R.Palanivelu, "Accounting for Management", Lexmi Publication (P) Ltd., 2007.

**IE8002**

**ADVANCED OPTIMIZATION TECHNIQUES**

**L T P C**

**3 0 0 3**

**UNIT I      DECISION ANALYSIS**

**9**

Decision Trees, Utility theory, Game theory, MCDM – Goal programming, AHP and ANP; Markov Decision processes

**UNIT II      NON-LINEAR OPTIMIZATION - I**

**9**

Types of Non-linear programming problems, Unconstrained optimization, KKT conditions for constrained optimization, Quadratic programming

**UNIT III      NON-LINEAR OPTIMIZATION - II**

**9**

Separable programming, Convex programming, Non-convex programming, Geometric programming, Stochastic programming

**UNIT IV      NON-TRADITIONAL OPTIMIZATION - I**

**9**

An over view of Genetic Algorithms, Simulated annealing, Tabu search, Ant Colony Optimization

**UNIT V      NON-TRADITIONAL OPTIMIZATION - II**

**9**

Neural network based optimization, Optimization of Fuzzy systems

**TOTAL : 45 PERIODS**

**REFERENCES**

1. Hillier and Liberman, "Introduction to Operations Research", TMH, 2000.
2. Singiresu S Rao, "Engineering Optimization", Wiley, 1998.
3. Kalyanmoy Deb, "Optimization for Engineering Design", PHI, 2000.

**IE8003**

**APPLIED MULTI-VARIATE ANALYSIS**

**L T P C**

**3 0 0 3**

**OBJECTIVE:**

To impart knowledge on the applications of multivariate statistical analysis

**UNIT I      MULTIVARIATE METHODS**

**9**

An overview of multivariate methods, Multivariate normal distribution, Eigen values and Eigen vectors.

**UNIT II REGRESSION 9**

Simple Regression, and Correlation – Estimation using the regression line, correlation analysis, Multiple Regression and Canonical Correlation analysis – Inferences about population parameters.

**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.

**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.

**IE8004 COMPUTATIONAL METHODS AND ALGORITHMS L T P C  
3 0 0 3**

**OBJECTIVE**

A brief introduction to algorithmic design tools with some applications.

**UNIT I INTRODUCTION 5**

Review of C/C++ - writing and debugging large programs - Controlling numerical errors.

**UNIT II ALGORITHM DESIGN METHODS 12**

Greedy – Divide and conquer – Backtracking – Branch & bound – Heuristics- Meta heuristics

<b>UNIT III</b>	<b>BASIC TOOLS</b>	<b>12</b>
Structured approach – Networks – Trees – Data structures		
<b>UNIT IV</b>	<b>COMPUTATIONAL PERFORMANCE</b>	<b>6</b>
Time complexity – Space complexity – Algorithm complexity		
<b>UNIT V</b>	<b>APPLICATIONS</b>	<b>10</b>
Sorting – Searching - Networks – Scheduling – Optimization models – IE applications		
<b>TOTAL: 45 PERIODS</b>		

**REFERENCES:**

1. Goodman S F and 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, K Jeffrey D. Ullman and John E. Hopcroft, “Data Structures and Algorithms”, Addison-Wesley, 1993.

<b>IE8005</b>	<b>DECISION SUPPORT AND INTELLIGENT SYSTEMS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVE:**

To impart knowledge on basics of DSS and Knowledge based systems

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>5</b>
Managerial decision making, system modeling and support - preview of the modeling process-phases of decision making process.		
<b>UNIT II</b>	<b>ANALYSIS</b>	<b>10</b>
DSS components- Data warehousing, access, analysis, mining and visualization-modeling and analysis-DSS development.		
<b>UNIT III</b>	<b>TECHNOLOGIES</b>	<b>10</b>
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 Business Intelligent Systems", PHI, Eighth edition, 2010.
2. S S Mitra, "Decision support systems, tools and techniques", John Wiley, 1996.
3. Elain Rich and Kevin Knight, "Artificial intelligence", TMH,1993.

**IE8006** **EVOLUTIONARY OPTIMIZATION** **L T P C**  
**3 0 0 3**

**UNIT I** **9**  
 Conventional Optimization techniques, Overview of evolutionary computation, Historical branches of evolutionary computation

**UNIT II** **9**  
 Search operators, Selection schemes, Ranking methods, Importance of representation

**UNIT III** **9**  
 Evolutionary combinatorial optimization: evolutionary algorithms, Constrained optimization, Evolutionary multi-objective optimization.

**UNIT IV** **9**  
 Genetic programming – Steps, Search operators on trees, examples, Hybrid genetic algorithms, Combining choices of heuristics



## UNIT V

9

Pareto optimality, 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.
5. Ruhul sarker, Masoud Mohammadian, Yao, Evolutionary Optimization, Kluwers’s Academic Publishers, 2002.

**IE8007**

**INFORMATION SYSTEMS ANALYSIS AND DESIGN**

**L T P C**

**3 0 0 3**

### UNIT I OVERVIEW

6

Information concepts, System concepts, Examples of Information systems, Information Systems analysis overview, Information gathering – sources.

### UNIT II DATA FLOW DIAGRAMS and ER DIAGRAMS

10

System Requirements specifications, Feasibility analysis, Data flow diagrams – logical and physical DFDs, Process specification methods, Decision tables.

Logical database design – ER model, Normalizing relations; Data input methods; Structured Systems Analysis and Design.

### UNIT III MANAGEMENT INFORMATION SYSTEMS

10

Development of MIS, Choice of Information technology, Applications in manufacturing and service sector, Enterprise management systems.

### UNIT IV TECHNOLOGY and INFORMATION SYSTEMS

10

Database management systems, Object oriented technology, Client-server architecture, Local area network, network topology.

## **UNIT V APPLICATIONS**

**9**

Data warehouse design and implementation, Models of E-business, MIS and E-business, Web enabled business management, Introduction to ERP , Case studies.

**TOTAL : 45 PERIODS**

### **REFERENCES:**

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

**IE8008**

## **MAINTENANCE ENGINEERING AND MANAGEMENT**

**L T P C  
3003**

### **OBJECTIVE:**

To provide maintenance concepts and maintenance policies with maintenance management tools and techniques.

### **UNIT I MAINTENANCE CONCEPT**

**7**

Maintenance definition – Maintenance objectives – Maintenance challenges – Tero Technology –Maintenance costs - Scope of maintenance department.

### **UNIT II MAINTENANCE MODELS**

**11**

Proactive/reactive maintenance – Maintenance policies – Imperfect maintenance – PM versus b/d maintenance – Optimal PM schedule and product characteristics – Inspection decisions: Maximizing profit - Minimizing downtime – Replacement decisions.

### **UNIT III MAINTENANCE QUALITY**

**8**

Five zero concept – FMECA – Root cause analysis – Repair time distribution – Analysis of downtime – Maintainability prediction – Design for maintainability – RCM.

### **UNIT IV V MAINTENANCE MANAGEMENT**

**11**

Human factors – Maintenance staffing: Learning curves – Simulation – Optimal size of service facility – Optimal repair effort – Spare parts management – Maintenance planning – Maintenance scheduling.

**UNIT V TOTAL PRODUCTIVE MAINTENANCE****8**

TPM philosophy – Chronic and sporadic losses – Equipment defects – Six major losses – Overall equipment effectiveness – TPM pillars – Autonomous maintenance.

**TOTAL : 45 PERIODS****REFERENCES:**

1. Andrew K.S.Jardine & Albert H.C. Tsang, “Maintenance, Replacement and Reliability”. Taylor and Francis, 2006.
2. Bikas Badhury & S.K.Basu, “Tero Technology: Reliability Engineering and Maintenance Management”, Asian Books, 2003.
3. Seichi Nakajima, “Total Productive Maintenance”, Productivity Press, 1993.

**IE8009****METROLOGY AND INSPECTION****L T P C****3 0 0 3****OBJECTIVE:**

To impart knowledge about linear and angular measuring instruments.

**UNIT I LINEAR MEASUREMENT AND ANGULAR MEASUREMENT****12**

Accuracy, Precision, Readability, Sensitivity etc., Linear measuring instruments-vernier – micrometer-Gauge blocks- dial indicator-comparators – Angle standards – vernier bevel protractor-sine bar – autocollimator.

**UNIT II STANDARDS FOR LINEAR AND ANGULAR MEASUREMENTS****8**

Shop floor standards and their calibration, light interference, Method of coincidence, Slip gauge calibration, Measurement errors, Limits, fits, Tolerance, Gauges, Gauge design.

**UNIT III MEASUREMENT APPLICATION****8**

Measurement of screw threads and gears – Radius measurement – surface finish measurement -Measurement of straightness-flatness-parallelism – squareness- roundness – circularity

**UNIT IV MODERN CONCEPTS****8**

Image processing and its application in Metrology, Co-ordinate measuring machine, Types of CMM, Probes used, Application, Non-contact CMM using Electro-optical sensors for dimensional metrology.

**UNIT V INTRODUCTION TO MEASUREMENT SYSTEMS 9**

System configuration, basic characteristics of measuring devices, Displacement, force and torque measurement, standards, Calibration, Sensors, Basic principles and concepts of temperature, Pressure and flow measurement, Destructive testing – Nondestructive testing.

**TOTAL: 45 PERIODS**

**TEXT BOOK:**

1. Galyer J.F. and Shotbolt C.R, "Metrology for Engineers" ELBS, 1992.

**REFERENCES:**

1. Hune, K.J, "Engineering Metrology", Kalyani Publishers, India, 1980.
2. Robinson, S.L. and Miller R.K, "Automated Inspection and Quality Assurance", Marcel Dekker Inc. 1989.
3. Stout, K. "Quality Control in Automation", Prentice Hall, 1986.

**IE8010 MODELING OF MANUFACTURING SYSTEMS L T P C  
3 0 0 3**

**UNIT I INTRODUCTION 9**

Manufacturing systems types and concepts, manufacturing automation, performance measures types, classification and uses of manufacturing system models

**UNIT II FOCUSED FACTORIES 9**

Focused flow lines – Work cells- work centers, Group technology, Process planning types, General serial systems – Analysis of paced and unpaced lines, system effectiveness, impact of random processing times, FMS planning and scheduling – Part selection and loading problems.

**UNIT III MARKOV AND PETRINET MODELS 9**

Stochastic processes in manufacturing, Markov chain models – DTMC and CTMC, steady state analysis, Petrinets in manufacturing – Basic concepts, stochastic petrinets.

**UNIT IV QUEUING MODELS OF MANUFACTURING 9**

Basic queuing models, Queuing networks in manufacturing – Jackson and Gordon Newell, product form solution

**UNIT V LEAN SYSTEMS****9**

Characteristics of lean systems, Pull method of work flow, lot size reduction, Kanban system, Value stream mapping, JIT principles

**TOTAL : 45 PERIODS****REFERENCES:**

1. Ronald G Askin, "Modeling and Analysis of Manufacturing systems", Wiley & sons, 1993.
2. Viswanadham and Narahari, "Performance modeling of automated manufacturing systems", PHI, 1998
3. Nicholas J M, "Competitive Manufacturing Management", TMH, 2001.
4. Buzacot and Shantikumar, "Queueing networks in Manufacturing", Wiley Sons, 2000.
5. Reisig W, "System Design Using Petrinets", Springer, 2000.

**IE8011****OPERATIONS SCHEDULING****L T P C****3 0 0 3****OBJECTIVE:**

To impart knowledge on various scheduling algorithms applicable to single machine, parallel machines, flow shop and job shop models.

**UNIT I SCHEDULING THEORY****8**

Scheduling background - Scheduling function – Sequencing – Measures of performance – Scheduling theorems – Pure sequencing model assumptions.

**UNIT II SINGLE MACHINE SCHEDULING****10**

Hogdson's algorithm – Smith's application – Wilkerson-Irwin algorithm – Neighborhood search technique – Dynamic programming approach – Branch and Bound algorithm – Non simultaneous arrivals – Dependent job problems – Sequence dependent set up times.

**UNIT III PARALLEL MACHINE SCHEDULING****9**

Preemptive jobs: McNaughton's algorithm – Non preemptive jobs – Heuristic procedures – Minimizing weighted mean flow time: H1 & Hm heuristics – Dependent jobs: Hu's algorithm – Muntz Coffman algorithm.

**UNIT IV FLOW SHOP SCHEDULING 9**

Characteristics – Johnson’s algorithm – Extension of Johnson’s rule – Campbell Dudek Smith algorithm – Palmer’s method – Start lag, Sop lag – Mitten’s algorithm – Ignall Schrage algorithm – Despatch index heuristic.

**UNIT V JOB SHOP SCHEDULING 9**

Characteristics – Graphical tools – Jackson’s algorithm – Feasible, Semi-active and active schedules – Single pass approach – Non delay schedule – Priority dispatching rules – Heuristic schedule generation – Open shop scheduling- Scheduling in services.

**TOTAL: 45 PERODS**

**REFERENCES:**

1. Kenneth R.Baker, “Introduction to Sequencing and Scheduling”, John Wiley & Sons, New York, 2000.
2. Dilip R. Sule, “Industrial Scheduling”, PWS Publishing company, Boston, 1997.

**IE8012 PRODUCT DESIGN AND VALUE ENGINEERING L T P C  
3 0 0 3**

**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 IDENTIFYING CUSTOMER NEEDS and PRODUCT SPECIFICATIONS 9**

Product Development process – Product development organizations. Gather raw data – Interpret raw data- organize the needs into a hierarchy – Relative importance of the needs. Specifications – Refining specifications.

**UNIT IV CONCEPT GENERATION, SELECTION AND PRODUCT ARCHITECTURE 9**

Clarify the problem – Search internally – Search externally – Explore systematically. Concept Screening – Concept scoring. Product architecture – Implication of architecture – Establishing the architecture – Related system level design issues.

**UNIT V INDUSTRIAL DESIGN, PROTOTYPING AND ECONOMICS OF PRODUCT DEVELOPMENT 9**

Need for industrial design – Impact of industrial design – Industrial design process – Management of industrial design process – Assessing the quality of industrial design. Estimate the manufacturing cost – Reduce the component cost – Reduce the assembly cost – Reduce the support cost – Impact of DFM decisions on other factors. Principles of prototyping – Planning for prototypes. Elements of economic analysis – Base – Case financial model – Sensitivity analysis – Influence of the quantitative factors.

**TOTAL : 45 PERIODS**

**TEXT BOOKS:**

1. Karal, T. Ulrich Steven D. Eppinger, "Product Design and Development", McGraw Hill, International Editions, 2003.
2. Mudge, Arthur E. "Value Engineering"- A systematic approach, McGraw Hill, New York, 2000.

**REFERENCES:**

1. S. Rosenthal, "Effective Product Design and Development", Irwin, 1992.
2. Charles Gevirtz, "Developing New products with TQM", McGraw Hill, International Editions, 1994.

**IE8013 PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING L T P C 3003**

**OBJECTIVE:**

To introduce the basic principles of Productivity Models and the applications of Re-Engineering Concepts required for various organizations.

**UNIT I INTRODUCTION 9**

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

**UNIT II PRODUCTIVITY MEASUREMENT AND EVALUATION 9**

Productivity measurement in International, National and Industrial level – Total Productivity Model – Productivity measurement in Manufacturing and Service sectors – Performance Objective Productivity (POP) model – Need for Productivity Evaluation – Evaluation Methodology.

**UNIT III PRODUCTIVITY PLANNING AND IMPLEMENTATION 9**

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

**UNIT IV REENGINEERING PROCESS 9**

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

**UNIT V BPR TOOLS AND IMPLEMENTATION 9**

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

**TOTAL : 45 PERIODS**

**REFERENCES:**

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

**IE8014 PROJECT MANAGEMENT L T P C  
3003**

**UNIT I INTRODUCTION TO PROJECT MANAGEMENT AND PROJECT SELECTION 9**

Objectives of Project Management- Importance of Project Management- Types of Projects- Project Management Life Cycle- Project Selection – Feasibility study: Types of feasibility- Steps in feasibility study.



**UNIT II PROJECT PLANNING AND IMPLEMENTATION 9**

Project Scope- Estimation of Project cost – Cost of Capital – Project Representation and Preliminary Manipulations - Basic Scheduling Concepts - Resource Levelling – Resource Allocation.

**UNIT III PROJECT MONITORING AND CONTROL 9**

Setting a base line- Project management Information System – Indices to monitor progress. Importance of Contracts in projects- Teamwork in Project Management - Attributes of a good project team – Formation of effective teams – stages of team formation.

**UNIT IV PROJECT CLOSURE 9**

Project evaluation- Project Auditing – Phases of project Audit- Project closure reports- Guidelines for closeout reports.

**UNIT V SPECIAL TOPICS IN PROJECT MANAGEMENT 9**

Computers, e- markets and their role in Project management- Risk management- Environmental Impact Assessment. Case studies in Project management.

**TOTAL : 45 PERIODS**

**REFERENCES :**

1. Arun Kanda, "Project Management A Life Cycle Approach", Prentice Hall of India, 2011.
2. R.Panneerselvam and P.Senthilkumar, "Project Management", Prentice Hall of India, 2009.
3. R.B.Khanna, "Project Management", Prentice Hall of India, 2011.

**IE8015 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.

<b>UNIT II</b>	<b>CHEMICAL HAZARDS</b>	<b>9</b>
Chemical exposure – Toxic materials – Radiation Ionizing and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.		
<b>UNIT III</b>	<b>ENVIRONMENTAL CONTROL</b>	<b>9</b>
Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.		
<b>UNIT IV</b>	<b>HAZARD ANALYSIS</b>	<b>9</b>
System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment.		
<b>UNIT V</b>	<b>SAFETY REGULATIONS</b>	<b>9</b>
Explosions – Disaster management – catastrophe control, hazard control , Factories Act, Safety regulations Product safety – case studies.		
		<b>TOTAL : 45 PERIODS</b>

**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.

<b>IE8016</b>	<b>SYSTEMS ENGINEERING</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life-cycle phases, logical steps of systems engineering, Frame works for systems engineering.		
<b>UNIT II</b>	<b>SYSTEMS ENGINEERING PROCESSES</b>	<b>9</b>
Formulation of issues with a case study, Value system design, Functional analysis, Business Process Reengineering, Quality function deployment, System synthesis, Approaches for generation of alternatives.		

**UNIT III ANALYSIS OF ALTERNATIVES - I 9**

Cross-impact analysis, Structural modeling tools, System Dynamics models with case studies, Economic models: present value analysis – NPV, Benefits and costs over time, ROI, IRR; Work and Cost breakdown structure,

**UNIT IV ANALYSIS OF ALTERNATIVES – II 9**

Reliability, Availability, Maintainability, and Supportability models; Stochastic networks and Markov models, Queuing network optimization, Time series and Regression models, Evaluation of large scale models

**UNIT V DECISION ASSESSMENT 9**

Decision assessment types, Five types of decision assessment efforts, Utility theory, Group decision making and Voting approaches, Social welfare function; Systems Engineering methods for Systems Engineering 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.

**IE8017 TECHNOLOGY MANAGEMENT L T P C  
3 0 0 3**

**OBJECTIVES:**

Study of this subject provides an understanding of the Technology Management principles to the various organizations.

**UNIT I 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** **9**

Technology forecasting - Need, methodology and methods - Trend Analysis, Analogy, Delphi, Soft System Methodology, Mathematical Models, Simulation, and System Dynamics.

**UNIT III** **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** **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** **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**

**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
7. Richard C. Dorf, "Technology Management Handbook", CRC,1999

**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 and 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 – Employee retention.

**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.

**OBJECTIVES:**

To provide the mathematical foundations of numerical techniques for solving linear system, eigenvalue problems, interpolation, numerical differentiation and integration and the errors associated with them; To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

**UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9**

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

**UNIT II INTERPOLATION AND APPROXIMATION 9**

Interpolation with unequal intervals - Lagrange interpolation –Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method -Linear curve fitting.

**UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9**

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

**UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9**

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







**AIM :**

To learn the different principles and techniques of management in planning, organizing, directing and controlling.

**OBJECTIVES**

- To study the Evolution of Management
- To study the functions and principles of management
- To learn the application of the principles in an organization

**UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9**

Definition of Management –Science or Art – Manager Vs Entrepreneur- types of managers- managerial roles and skills –Evolution of Management –Scientific, human relations , system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management.

**UNIT II PLANNING 9**

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**UNIT III ORGANISING 9**

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

**UNIT IV DIRECTING 9**

Foundations of individual and group behaviour– Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

## **UNIT V CONTROLLING**

**9**

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

**TOTAL: 45 PERIODS**

### **TEXT BOOKS:**

1. Stephen P. Robbins and Mary Coulter, “ Management”, Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert, “Management”, Pearson Education, 6th Edition, 2004.

### **REFERENCES:**

1. Stephen A. Robbins and David A. Decenzo and Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
2. Robert Kreitner and Mamata Mohapatra, “ Management”, Biztantra, 2008.
3. Harold Koontz and Heinz Weihrich “Essentials of management” Tata McGraw Hill, 1998.
4. Tripathy PC and Reddy PN, “Principles of Management”, Tata Mcgraw Hill, 1999.

**ME8076**

**ENTREPRENEURSHIP DEVELOPMENT**

**L T P C**

**3 0 0 3**

### **OBJECTIVES:**

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 HOURS****TEXT BOOKS :**

1. S.S.Khanka, “Entrepreneurial Development” S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kurahko & 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.

**UNIT I INTRODUCTION 9**

Definition, Needs wants and Demands, Marketing Concepts, Environment, Mix, types, Philosophies, Selling Vs. Marketing, Consumer goods, Industrial goods, product hierarchy.

**UNIT II MARKETING PLANNING AND STRATEGY FORMULATION 9**

Value delivery process, Core Competencies, Strategy formulation and the marketing process - Strategy implementation – SWOT Analysis, Portfolio Analysis , BCG , GEC grids, Components Of a marketing plan.

**UNIT III BUYING BEHAVIOUR AND MARKET SEGMENTATION 9**

Building customer value, Consumer behavior – Influencing factors, motivation, perception, learning, buying decisions process. Segmentation - Levels, demographic, psychographic geographic and behavioural segmentation, process, patterns.

**UNIT IV PRODUCT PRICING AND MARKETING RESEARCH 9**

Pricing Objectives, decisions and methods, Pricing management, Marketing Research – Introduction, uses, system, process of marketing research.

**UNIT V ADVERTISING, SALES PROMOTION & DISTRIBUTION 9**

Advertising – objectives, types, developing Advertising campaign, Sales promotion, Retailing, Wholesaling, Market Logistics, Modern trends.

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Philip Kotler and Keller, "Marketing Management", Prentice Hall of India, XIII Edition, 2009.
2. Govindarajan, M., "Marketing Management - Concepts, Cases, Challenges and Trends", Prentice Hall of India, Second edition, 2007.

**REFERENCES :**

1. Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of India-1997.
2. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, XII Edition, 2000.
3. Ramasamy and Nama Kumari, "Marketing Environment: Planning, implementation and control - The Indian Context", 1990.

4. Czinkota and Kotabe, "Marketing Management", Thomson Learning, Indian edition 2007.
5. Adrain Palmer, "Introduction to Marketing Theory and Practice", Oxford University Press,I, 2004.
6. Steven J. Skinner, "Marketing", All India Publishers and Distributers Ltd., 1998.

**ME8751          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          COMPUTER-AIDED DESIGN          9**

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

**UNIT III          MANUFACTURING SUPPORT SYSTEMS          9**

Product design and CAD, CAD/CAM and CIM, Computer aided process planning- Variant and generative approaches, Concurrent engineering and design for manufacture, Lean production, Agile manufacturing.

**UNIT IV          FUNDAMENTALS OF COMMUNICATIONS          9**

Information, Communications matrix, Computer communications, Network architecture, Tools and techniques.

**UNIT V          DATABASE AND CIM MANAGEMENT          9**

Manufacturing data, database technology, Database management, Management of CIM – role, cost justification, expert systems

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Mickel P Groover, "Automation production systems and computer integrated manufacturing", PHI, second edition, 2008.
2. S.Kant Vajpayee, "Principles of Computer-Integrated Manufacturing", PHI, 2005.

**OBJECTIVES:**

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

**UNIT I INTRODUCTION TO ELECTRONICS MANUFACTURING 8**

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

**UNIT II COMPONENTS AND PACKAGING 9**

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

**UNIT III SURFACE MOUNT TECHNOLOGY PROCESS 12**

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

**UNIT IV INSPECTION AND TESTING 9**

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

**UNIT V REPAIR, REWORK, QUALITY AND RELIABILITY OF ELECTRONICS ASSEMBLIES**

**7**

Repair tools, methods, rework criteria and process, thermo-mechanical effects and thermal management, Reliability fundamentals, reliability testing, failure analysis, design for manufacturability, assembly, reworkability, testing, reliability, and environment.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

1. Puligandla Viswanadham and Pratap Singh, "Failure Modes and Mechanisms in Electronic Packages", Chapman and Hall, New York, 1997, ISBN 0-412-105591-8.
2. Totta P., Puttlitz K. and Stalter K., "Area Array Interconnection Handbook", Kluwer Academic Publishers, Norwell, MA, USA, 2001, ISBN 0-7923-7919-5.
3. Lee N.C., "Reflow Soldering Process and Trouble Shooting SMT,BGA,CSP and Flip Chip Technologies", Elsevier Science, 2001.
4. Zarrow P. and Kopp D. "Surface Mount Technology Terms and Concepts", Elsevier Science and Technology, 1997, ISBN 0750698756.
5. Harper C.A., "Electronic Packaging and Interconnection Handbook" Second Edition, McGraw Hill Inc., New York, 1997, ISBN 0-07-026694-8.
6. Martin B. and Jawitz W., "Printed Circuit board materials handbook", McGraw-Hill Professional, 1997.
7. Lau J.H., "Ball Grid Array Technology", McGraw-Hill Professional, 1997.
8. [www.ipc.org](http://www.ipc.org).

**MF8073**

**FLEXIBLE MANUFACTURING SYSTEMS**

**L T P C**

**3 0 0 3**

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

**9**

Introduction to FMS - Scope – Types – Benefits – Major elements – Types of flexibility – FMS application and flexibility - Optimization – Single product, N – product, single batch, N – Batch scheduling problem – Knowledge based scheduling system.





**OBJECTIVES :**

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
- To discuss about the various applications of robots, justification and implementation of robot.

**UNIT I      FUNDAMENTALS OF ROBOT      7**

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

**UNIT II      ROBOT DRIVE SYSTEMS AND END EFFECTORS      10**

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

**UNIT III      SENSORS AND MACHINE VISION      10**

Sensory Devices - Non optical - Position sensors - Optical position sensors - Velocity sensors- Proximity sensors - Contact and noncontact type - Touel and slip sensors - Force and torque sensors - AI and Robotics.

**UNIT IV      ROBOT KINEMATICS AND ROBOT PROGRAMMING      10**

Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional)-Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs.

**UNIT V      ROBOT CELL DESIGN, CONTROL AND ECONOMICS      8**

Work cell Control - Robot and machine Interface - Robot cycle time Analysis - Economic Analysis of Robots - Pay back Method, EUAC Method, Rate of Return Method.

**TOTAL : 45 PERIODS**

**TEXT BOOK :**

1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2001.

**REFERENCES :**

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987.
2. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992.
3. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995.
4. Richard D. Klafter., Thomas A. Chmielewski, Michael Negin, "Robotic Engineering: An Integrated Approach", PHI.,1989.