PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
I. Have a successful career in industries associated with Industrial, Management and any other Allied Engineering organizations’, or as an entrepreneur.
II. To enable the graduates to pursue higher education and research.
III. Be a competent leader/ consultant and provide solutions to the practical problems of any organization.

PROGRAMME OUTCOMES (POs):
After going through the four years of study, our Industrial Engineering Graduates will exhibit ability to:

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<td>Engineering knowledge</td>
<td>Apply knowledge of mathematics, basic science and engineering science.</td>
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<td>2</td>
<td>Problem analysis</td>
<td>Identify, formulate and solve engineering problems.</td>
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<td>3</td>
<td>Design/development of solutions</td>
<td>Design a system or process to improve its performance, satisfying its constraints.</td>
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<td>4</td>
<td>Conduct investigations of complex problems</td>
<td>Conduct experiments &amp; collect, analyze and interpret the data.</td>
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<td>5</td>
<td>Modern tool usage</td>
<td>Apply various tools and techniques to improve the efficiency of the system.</td>
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<td>The Engineer and society</td>
<td>Conduct themselves to uphold the professional and social obligations.</td>
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<td>7</td>
<td>Environment and sustainability</td>
<td>Design the system with environment consciousness and sustainable development.</td>
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<td>Ethics</td>
<td>Interact in industry, business and society in a professional and ethical manner.</td>
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<td>Individual and team work</td>
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<td>Communication</td>
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<td>Project management and finance</td>
<td>Implement cost effective and improved system.</td>
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<td>Life-long learning</td>
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## PEO / PO MAPPING

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### PROFESSIONAL ELECTIVES FOR INDUSTRIAL ENGINEERING

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### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills.

UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY & FRIENDS


UNIT II GENERAL READING AND FREE WRITING

Reading - comprehension-pre-reading-post reading - comprehension questions (multiple choice questions and /or short questions/ open-ended questions) - inductive reading - short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts). Writing - paragraph writing - topic sentence - main ideas - free writing, short narrative descriptions using some suggested vocabulary and structures. Listening - telephonic conversations. Speaking - sharing information of a personal kind - greeting - taking leave. Language development - degrees of comparison - pronouns - direct vs indirect questions. Vocabulary development - guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT

Reading - short texts and longer passages (close reading). Writing - understanding text structure - use of reference words and discourse markers - coherence - jumbled sentences. Listening - listening to longer texts and filling up the table - product description - narratives from different sources. Speaking - asking about routine actions and expressing opinions. Language development - degrees of comparison - pronouns - direct vs indirect questions. Vocabulary development - single word substitutes - adverbs.

UNIT IV READING AND LANGUAGE DEVELOPMENT

Reading - comprehension - reading longer texts - reading different types of texts - magazines. Writing - letter writing, informal or personal letters - e-mails - conventions of personal email. Listening - listening to dialogues or conversations and completing exercises based on them. Speaking - speaking about oneself - speaking about one’s friend. Language development - Tenses - simple present - simple past - present continuous and past continuous. Vocabulary development - synonyms - antonyms - phrasal verbs.

UNIT V EXTENDED WRITING


TOTAL: 60 PERIODS
OUTCOMES: At the end of the course, learners will be able to:

- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:


REFERENCES

3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student’s Book & Workbook) Cambridge University Press, New Delhi: 2005

MA8151 ENGINEERING MATHEMATICS – I

OBJECTIVES:
The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS 12
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

UNIT III INTEGRAL CALCULUS 12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12
UNIT V  
DIFFERENTIAL EQUATIONS  
12

TOTAL : 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following skills:
- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

TEXT BOOKS:
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:

PH8151  
ENGINEERING PHYSICS  
L T P C  
3 0 0 3

OBJECTIVES:
- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I  
PROPERTIES OF MATTER  
9
UNIT II  WAVES AND FIBER OPTICS

UNIT III  THERMAL PHYSICS

UNIT IV  QUANTUM PHYSICS

UNIT V  CRYSTAL PHYSICS
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of this course,
• the students will gain knowledge on the basics of properties of matter and its applications,
• the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
• the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
• the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
• the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I  WATER AND ITS TREATMENT  9

UNIT II  SURFACE CHEMISTRY AND CATALYSIS  9

UNIT III  ALLOYS AND PHASE RULE  9

UNIT IV  FUELS AND COMBUSTION  9

UNIT V  ENERGY SOURCES AND STORAGE DEVICES  9
Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H₂-O₂ fuel cell.

OUTCOMES:
- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.
TEXT BOOKS:

REFERENCES:

GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING

OBJECTIVES:
- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING
9
Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS
9
Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS
9
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES
9
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.
OUTCOMES:
Upon completion of the course, students will be able to
- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

REFERENCES:

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<tr>
<th>GE8152</th>
<th>ENGINEERING GRAPHICS</th>
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OBJECTIVES:
- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)
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 PLANES CURVES AND FREEHAND SKETCHING
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.
Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

TOTAL : 45 PERIODS
UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12
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 traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12
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.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12
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.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12
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 - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

OUTCOMES:
On successful completion of this course, the student will be able to
- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.

TOTAL: 90 PERIODS

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:
Upon completion of the course, students will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

Total: 60 Periods
OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)
1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young’s modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
(b) Determination of acceptance angle in an optical fiber.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.

1. Estimation of HCl using Na₂CO₃ 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.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:
- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30 PERIODS

TEXTBOOKS:
**OBJECTIVES:**
The Course prepares second semester Engineering and Technology students to:
- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

<table>
<thead>
<tr>
<th>UNIT I</th>
<th>INTRODUCTION TECHNICAL ENGLISH</th>
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<table>
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<tr>
<th>UNIT II</th>
<th>READING AND STUDY SKILLS</th>
<th>12</th>
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<tbody>
<tr>
<td>Listening - Listening to longer technical talks and completing exercises based on them - Speaking – describing a process - Reading – reading longer technical texts - identifying the various transitions in a text - paragraphing - Writing - interpreting charts, graphs - Vocabulary Development - vocabulary used in formal letters/emails and reports - Language Development - impersonal passive voice, numerical adjectives.</td>
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<th>UNIT III</th>
<th>TECHNICAL WRITING AND GRAMMAR</th>
<th>12</th>
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<tr>
<td>Listening - Listening to classroom lectures/ talks on engineering/technology - Speaking – introduction to technical presentations - Reading – longer texts both general and technical, practice in speed reading - Writing - Describing a process, use of sequence words - Vocabulary Development - sequence words - Misspelled words - Language Development - embedded sentences</td>
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<tr>
<th>UNIT IV</th>
<th>REPORT WRITING</th>
<th>12</th>
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<tr>
<th>UNIT V</th>
<th>GROUP DISCUSSION AND JOB APPLICATIONS</th>
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<tr>
<td>Listening - TED/Ink talks; Speaking – participating in a group discussion - Reading – reading and understanding technical articles - Writing – Writing reports - minutes of a meeting - accident and survey - Vocabulary Development - verbal analogies - Language Development - reported speech</td>
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**TOTAL : 60 PERIODS**

**OUTCOMES:** At the end of the course learners will be able to:
- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

**TEXT BOOKS:**
REFERENCES

Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.

MA8251 ENGINEERING MATHEMATICS – II

OBJECTIVES:
This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES

UNIT II VECTOR CALCULUS
Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTIONS
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions \( w = z + c, \frac{1}{z}, z^2 \) - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION

UNIT V LAPLACE TRANSFORMS

TOTAL: 60 PERIODS

OUTCOMES:
After successfully completing the course, the student will have a good understanding of the following topics and their applications:
• Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
• Gradient, divergence and curl of a vector point function and related identities.
• Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification.
• Analytic functions, conformal mapping and complex integration.
• Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS:

REFERENCES:

PH8251 (Common to courses offered in Faculty of Mechanical Engineering Except B.E. Materials Science and Engineering )

MATERIALS SCIENCE

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OBJECTIVES:
• To introduce the essential principles of materials science for mechanical and related engineering applications.

UNIT I PHASE DIAGRAMS
Solid solutions - Hume Rothery's rules – the phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

UNIT II FERROUS ALLOYS

UNIT III MECHANICAL PROPERTIES
UNIT IV   MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS  9

UNIT V   NEW MATERIALS  9

TOTAL :  45 PERIODS

OUTCOMES:
Upon completion of this course,
- the students will have knowledge on the various phase diagrams and their applications
- the students will acquire knowledge on Fe-Fe₃C phase diagram, various microstructures and alloys
- the students will get knowledge on mechanical properties of materials and their measurement
- the students will gain knowledge on magnetic, dielectric and superconducting properties of materials
- the students will understand the basics of ceramics, composites and nanomaterials.

TEXT BOOKS:

REFERENCES

BE8253   BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING  L T P C  3 0 0 3

OBJECTIVES:
To impart knowledge on
- Electric circuit laws, single and three phase circuits and wiring
- Working principles of Electrical Machines
- Working principle of various electronic devices and measuring instruments

UNIT I   ELECTRICAL CIRCUITS  9
UNIT II  AC CIRCUITS
Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits – Three phase loads - housing wiring, industrial wiring, materials of wiring

UNIT III  ELECTRICAL MACHINES
Principles of operation and characteristics of DC machines, Transformers (single and three phase), Synchronous machines, three phase and single phase induction motors.

UNIT IV  ELECTRONIC DEVICES & CIRCUITS

UNIT V  MEASUREMENTS & INSTRUMENTATION
Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical - , Classification of instruments - Types of indicating Instruments - multimeters – Oscilloscopes – three-phase power measurements– instrument transformers (CT and PT)

TOTAL : 45 PERIODS

OUTCOMES:
Ability to
- Understand electric circuits and working principles of electrical machines
- Understand the concepts of various electronic devices
- Choose appropriate instruments for electrical measurement for a specific application

TEXT BOOKS

REFERENCES
OBJECTIVES:
- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I   ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY
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
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
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
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

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT  6

TOTAL : 45 PERIODS

OUTCOMES:
- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS :

REFERENCES :

GE8292  ENGINEERING MECHANICS  L T P C
3 2 0 4

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

UNIT I  STATICS OF PARTICLES  9+6

UNIT II  EQUILIBRIUM OF RIGID BODIES  9+6
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  9+6

UNIT IV DYNAMICS OF PARTICLES  9+6

UNIT V FRICTION AND RIGID BODY DYNAMICS  9+6
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 : 45+30=75 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
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 & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

Buildings:
(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
   Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
   Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE

Welding:
(a) Preparation of butt joints, lap joints and T-joins by Shielded metal arc welding.
(b) Gas welding practice

Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:
(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

Machine assembly practice:
(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:
(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV ELECTRONICS ENGINEERING PRACTICE
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL
1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
   (e) Hand Drilling Machine 2 Nos
   (f) Jigsaw 2 Nos

MECHANICAL
1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.
ELECTRICAL

1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos
     (b) Digital Live-wire detector 2 Nos

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

BE8261 BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION L T P C
ENGINEERING LABORATORY 0 0 4 2

OBJECTIVE:
- To train the students in performing various tests on electrical drives, sensors and circuits.

LIST OF EXPERIMENTS:
1. Load test on separately excited DC generator
2. Load test on Single phase Transformer
3. Load test on Induction motor
4. Verification of Circuit Laws
5. Verification of Circuit Theorems
6. Measurement of three phase power
7. Load test on DC shunt motor.
8. Diode based application circuits
9. Transistor based application circuits
10. Study of CRO and measurement of AC signals
11. Characteristics of LVDT
12. Calibration of Rotometer
13. RTD and Thermistor

Minimum of 10 Experiments to be carried out :-

TOTAL: 60 PERIODS

OUTCOMES:
- Ability to determine the speed characteristic of different electrical machines
- Ability to design simple circuits involving diodes and transistors
- Ability to use operational amplifiers

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>D. C. Motor Generator Set</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>D.C. Shunt Motor</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Single Phase Transformer</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Single Phase Induction Motor</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Ammeter A.C and D.C</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>Voltmeters A.C and D.C</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>Watt meters LPF and UPF</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Resistors &amp; Breadboards</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Cathode Ray Oscilloscopes</td>
<td>4</td>
</tr>
</tbody>
</table>
MA8353 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

OBJECTIVES:
- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS
Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS
Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS

TOTAL : 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students should be able to:
- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
• Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

• Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

REFERENCES:

IE8351 WORK SYSTEM DESIGN

L T P C
3 0 0 3

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

UNIT I PRODUCTIVITY
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.

UNIT II METHODS ENGINEERING
Methods Engineering-Steps – Recording Tools and techniques - Design of work place layout - Motion study – micro motion study - THERBLINGs - cycle graph and chrono cycle graph - SIMO chart - Principles of motion economy.

UNIT III WORK MEASUREMENT

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

UNIT V WORK DESIGN FOR OFFICE WORK
Organization and methods (O & M) - Work measurement of office work - Work Analysis Techniques applied to support staff - Form design and Control.

TOTAL: 45 PERIODS
OUTCOME:
The Students should be able to measure productivity of a work system through work system design and apply various above mentioned techniques.

TEXT BOOKS:

REFERENCES:

ME8351 MANUFACTURING TECHNOLOGY – I

OBJECTIVE:
- To introduce 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
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 : Blast and Cupola Furnaces; Principle of special casting processes : Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting - CO2 process – Stir casting; Defects in Sand casting

UNIT II JOINING PROCESSES
Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.

UNIT III METAL FORMING PROCESSES

UNIT IV SHEET METAL PROCESSES
UNIT V MANUFACTURE OF PLASTIC COMPONENTS


TOTAL: 45 PERIODS

OUTCOMES:

CO1 Explain different metal casting processes, associated defects, merits and demerits
CO2 Compare different metal joining processes.
CO3 Summarize various hot working and cold working methods of metals.
CO4 Explain various sheet metal making processes.
CO5 Distinguish various methods of manufacturing plastic components.

TEXT BOOKS:


REFERENCES:


CE8395 STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS

OBJECTIVES:

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS


UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

UNIT III    TORSION
Torsion formulation stresses and deformation in circular and hollows 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
Double Integration method – Macaulay’s method – Area moment method 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
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses
and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –
Deformation in spherical shells – Lame’s theorem.

TOTAL: 45 PERIODS

OUTCOMES
Students will be able to
• Understand the concepts of stress and strain in simple and compound bars, the importance
  of principal stresses and principal planes.
• Understand the load transferring mechanism in beams and stress distribution due to
  shearing force and bending moment.
• Apply basic equation of simple torsion in designing of shafts and helical spring
• Calculate the slope and deflection in beams using different methods.
• Analyze and design thin and thick shells for the applied internal and external pressures.

TEXT BOOKS:

REFERENCES:
   Series, 2010.

ME8391    ENGINEERING THERMODYNAMICS

OBJECTIVE:
• To familiarize the students to understand the fundamentals of thermodynamics and to
  perform thermal analysis on their behavior and performance.
  (Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart
  and Psychrometric Chart permitted)

UNIT I    BASIC CONCEPTS AND FIRST LAW
Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach.
Path and point functions. Intensive and extensive, total and specific quantities. System and their
types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and
irreversible processes. Heat and work transfer, definition and comparison, sign convention.
Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics –
concept of temperature and thermal equilibrium– relationship between temperature scales –new
temperature scales. First law of thermodynamics –application to closed and open systems –
steady and unsteady flow processes.
UNIT II SECOND LAW AND AVAILABILITY ANALYSIS 9+6

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9+6

UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS 9+6

UNIT V GAS MIXTURES AND PSYCHROMETRY 9+6
Mole and Mass fraction, Dalton’s and Amagat’s Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

OUTCOMES:
Upon the completion of this course the students will be able to

CO1 Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.
CO2 Apply second law of thermodynamics to open and closed systems and calculate entropy and availability.
CO3 Apply Rankine cycle to steam power plant and compare few cycle improvement methods
CO4 Derive simple thermodynamic relations of ideal and real gases
CO5 Calculate the properties of gas mixtures and moist air and its use in psychrometric processes

TOTAL : 75 PERIODS

TEXT BOOKS :

REFERENCES:
OBJECTIVE:
- To Study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines etc. and to equip with the practical knowledge required in the core industries.

LIST OF EXPERIMENTS
Machining and Machining time estimations for:
1. Taper Turning
2. External Thread cutting
3. Internal Thread Cutting
4. Eccentric Turning
5. Knurling
6. Square Head Shaping
7. Hexagonal Head Shaping
8. Fabrication of simple structural shapes using Gas Metal Arc Welding
9. Joining of plates and pipes using Gas Metal Arc Welding/ Arc Welding /Submerged arc welding
10. Preparation of green sand moulds
11. Manufacturing of simple sheet metal components using shearing and bending operations.
12. Manufacturing of sheet metal components using metal spinning on a lathe

TOTAL: 60 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Demonstrate the safety precautions exercised in the mechanical workshop.
CO2 Make the workpiece as per given shape and size using Lathe.
CO3 Join two metals using arc welding.
CO4 Use sheet metal fabrication tools and make simple tray and funnel.
CO5 Use different moulding tools, patterns and prepare sand moulds.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Centre Lathes</td>
<td>7 Nos.</td>
</tr>
<tr>
<td>2</td>
<td>Horizontal Milling Machine</td>
<td>1 No</td>
</tr>
<tr>
<td>3</td>
<td>Vertical Milling Machine</td>
<td>1 No</td>
</tr>
<tr>
<td>4</td>
<td>Shaper</td>
<td>1 No</td>
</tr>
<tr>
<td>5</td>
<td>Arc welding transformer with cables and holders</td>
<td>2 Nos</td>
</tr>
<tr>
<td>6</td>
<td>Oxygen and acetylene gas cylinders, blow pipe and other welding outfit</td>
<td>1 No</td>
</tr>
<tr>
<td>7</td>
<td>Moulding table, Moulding equipments</td>
<td>2 Nos</td>
</tr>
<tr>
<td>8</td>
<td>Sheet metal forming tools and equipments</td>
<td>2 Nos</td>
</tr>
</tbody>
</table>

IE8361 WORK SYSTEM DESIGN LABORATORY

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

LIST OF EXPERIMENTS:
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. Methods Time Measurement
7. Video Based Time Study

TOTAL: 60 PERIODS

OUTCOME:
- Students should be able to design, analyse and apply the above mentioned techniques to measure productivity

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. Peg Board
2. Stop Watch with Pad
3. Set of Cards
4. Sampling beads
5. MTM Tables
7. Nut, Bolt and Washer Assembly Setup

CE8481 STRENGTH OF MATERIALS LABORATORY

OBJECTIVE:
- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

LIST OF EXPERIMENTS
1. Tension test on steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring

TOTAL: 60 PERIODS

OUTCOME:
- The students will have the required knowledge in the area of testing of materials and components of structural elements experimentally.

REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Equipment</th>
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<tbody>
<tr>
<td>1.</td>
<td>UTM of minimum 400 kN capacity</td>
<td>1</td>
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<tr>
<td>2.</td>
<td>Torsion testing machine</td>
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</tr>
<tr>
<td>3.</td>
<td>Izod impact testing machine</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Hardness testing machine Rockwell</td>
<td>1 each</td>
</tr>
<tr>
<td>Vicker's (any 2)</td>
<td>Brinnel</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>5. Beam deflection test apparatus</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6. Extensometer</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7. Compressometer</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8. Dial gauges</td>
<td>Few</td>
<td></td>
</tr>
<tr>
<td>9. Le Chatelier’s apparatus</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>10. Vicat’s apparatus</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>11. Mortar cube moulds</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

HS8381 INTERPERSONAL SKILLS/LISTENING & SPEAKING

OBJECTIVES: The Course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills.
- Make effective presentations.

UNIT I
Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II
Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III
Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

UNIT IV
Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V
Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL: 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:
REFERENCES

MA8391 PROBABILITY AND STATISTICS

OBJECTIVES:
- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES

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

UNIT III TESTING OF HYPOTHESIS
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

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

TOTAL : 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students will be able to:
- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
• Apply the concept of testing of hypothesis for small and large samples in real life problems.
• Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
• Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS:

REFERENCES:

CE8394 FLUID MECHANICS AND MACHINERY L T P C
4 0 0 4

OBJECTIVES
• The properties of fluids and concept of control volume are studied
• The applications of the conservation laws to flow through pipes are studied.
• To understand the importance of dimensional analysis
• To understand the importance of various types of flow in pumps.
• To understand the importance of various types of flow in turbines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 12
Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 12

UNIT III DIMENSIONAL ANALYSIS 12
Need for dimensional analysis – methods of dimensional analysis – Similitude – types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.
UNIT IV PUMPS
Impact of jets - Euler’s equation - Theory of roto-dynamic 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 - Rotary pumps - classification.

UNIT V TURBINES

OUTCOMES:
Upon completion of this course, the students will be able to
- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can analyse and calculate major and minor losses associated with pipe flow in piping networks.
- Can mathematically predict the nature of physical quantities
- Can critically analyse the performance of pumps
- Can critically analyse the performance of turbines.

TEXT BOOK:

REFERENCES:

ME8451 MANUFACTURING TECHNOLOGY – II

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
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
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:
OBJECTIVES:

- To study and understand the concept of Engineering Economics and apply it in the real world.
- 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  

UNIT II  PRODUCTION AND COST ANALYSIS  

UNIT III  PRICING  

UNIT IV  ESTIMATION OF MATERIAL AND LABOUR COSTS  

UNIT V  ESTIMATION OF OPERATIONAL COST  

OUTCOME:  
Students will be able to estimate cost of products, analyze product cost and suggest cost reduction measure.

TEXT BOOKS:  

REFERENCES:  

IE8491 OPERATIONS RESEARCH - I  
L T P C  
3 2 0 4  

OBJECTIVE:  
• To learn the basics of deterministic optimization methods.

UNIT I  LINEAR PROGRAMMING  

UNIT II  ADVANCES IN LINEAR PROGRAMMING – I  
UNIT III          ADVANCES IN LINEAR PROGRAMMING – II              9+6
Integer Programming – Branch and bound algorithm – Gomory’s cutting plane method-Additive
algorithm – mixed integer programming – Benders partitioning algorithm- Goal programming

UNIT IV          NETWORK ANALYSIS – I                                 9+6
Transportation problems :  Northwest corner rule , Least cost method , Voges’s approximation
method - stepping stone method - MODI method – Unbalanced transportation – Assignment
problem – Hungarian algorithm – Travelling salesman problem – project management

UNIT V          NETWORK ANALYSIS - II                                      9+6
Minimum spanning tree problem: prim’s algorithm, Kruskal’s algorithm - Shortest path problem:
Dijkstra’s algorithms, Floyd’s algorithm, systematic method - maximal flow problem :  Linear
programming model, Maximal-flow minimum-cut theorem - Maximal flow algorithm

TOTAL: 75 PERIODS

OUTCOMES:
Identify and develop operational research models from the verbal description of the real system.
  • Understand and use the mathematical tools that are needed to solve optimization
    problems.
  • Develop a report that describes the model and the solving technique, analyze the results
    and propose recommendations in language understandable to the decision-making
    processes in Management Engineering.

TEXT BOOKS:

REFERENCES:

PR8451          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 understand the importance of balancing and vibration.

UNIT I          KINEMATICS OF MACHINES          9
Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain
kinematics analysis in simple mechanisms – velocity and acceleration polygons – Cam and
followers – classifications – displacement diagrams - layout of plate cam profiles – derivatives of
followers motion

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.
UNIT III  FRICION
Types of friction – Friction Drives -friction in screw threads – bearings – Friction clutches – Belt drives

UNIT IV  BALANCING AND MECHANISM FOR CONTROL
Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines -Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines- Governors and Gyroscopic effects..

UNIT V  VIBRATION

TOTAL: 45 PERIODS

OUTCOMES:
Student will be able to
- Understand the principles in the formation of mechanisms and their kinematics.
- Understand the construction features of Gears and Gear Trains.
- Understand the effect of friction in different machine elements.
- Understand the importance of balancing.
- Understand the importance of Governors and Gyroscopic effects.
- Understand the importance of vibration.

TEXT BOOKS:

REFERENCES:

CE8462  FLUID MECHANICS AND MACHINERY LABORATORY

OBJECTIVES:
- Upon Completion of this subject, the students can able to have hands on experience in flow measurements using different devices.
- Also perform calculation related to losses in pipes and also perform characteristic study of pumps, turbines etc.,

LIST OF EXPERIMENTS
1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

OUTCOMES:
- Ability to use the measurement equipments for flow measurement
- Ability to do performance trust on different fluid machinery

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Orifice meter setup</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Venturi meter setup</td>
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</tr>
<tr>
<td>3</td>
<td>Rotameter setup</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Pipe Flow analysis setup</td>
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</tr>
<tr>
<td>5</td>
<td>Centrifugal pump/submergible pump setup</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Reciprocating pump setup</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Gear pump setup</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Pelton wheel setup</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Francis turbine setup</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Kaplan turbine setup</td>
<td>1</td>
</tr>
</tbody>
</table>

TOTAL: 60 PERIODS

ME8462 MANUFACTURING TECHNOLOGY LABORATORY – II

OBJECTIVE:
- 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 machine
5. Gear generation in gear shaping machine
6. Plain Surface grinding
7. Cylindrical grinding
8. Tool angle grinding with tool and Cutter Grinder
9. Measurement of cutting forces in Milling / Turning Process
10. CNC Part Programming

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Use different machine tools to manufacturing gears
CO2 Ability to use different machine tools to manufacturing gears.
CO3 Ability to use different machine tools for finishing operations
CO4 Ability to manufacture tools using cutter grinder
CO5 Develop CNC part programming

TOTAL: 60 PERIODS
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Turret and Capstan Lathes</td>
<td>1 No each</td>
</tr>
<tr>
<td>2</td>
<td>Horizontal Milling Machine</td>
<td>2 No</td>
</tr>
<tr>
<td>3</td>
<td>Vertical Milling Machine</td>
<td>1 No</td>
</tr>
<tr>
<td>4</td>
<td>Surface Grinding Machine</td>
<td>1 No</td>
</tr>
<tr>
<td>5</td>
<td>Cylindrical Grinding Machine</td>
<td>1 No</td>
</tr>
<tr>
<td>6</td>
<td>Radial Drilling Machine</td>
<td>1 No</td>
</tr>
<tr>
<td>7</td>
<td>lathe Tool Dynamometer</td>
<td>1 No</td>
</tr>
<tr>
<td>8</td>
<td>Milling Tool Dynamometer</td>
<td>1 No</td>
</tr>
<tr>
<td>9</td>
<td>Gear Hobbing Machine</td>
<td>1 No</td>
</tr>
<tr>
<td>10</td>
<td>Tool Makers Microscope</td>
<td>1 No</td>
</tr>
<tr>
<td>11</td>
<td>CNC Lathe</td>
<td>1 No</td>
</tr>
<tr>
<td>12</td>
<td>CNC Milling machine</td>
<td>1 No</td>
</tr>
<tr>
<td>13</td>
<td>Gear Shaping machine</td>
<td>1 No</td>
</tr>
<tr>
<td>14</td>
<td>Centerless grinding machine</td>
<td>1 No</td>
</tr>
<tr>
<td>15</td>
<td>Tool and cutter grinder</td>
<td>1 No</td>
</tr>
</tbody>
</table>

IE8591 MANUFACTURING AUTOMATION

OBJECTIVES:
- To give a brief exposure to automation principles and control technologies.
- To introduce the concept of fixed automation using transfer lines.
- To train the students in the programmable automation such as CNC and industrial robotics.
- To provide knowledge on the use of automated material handling, storage and data capture

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

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

UNIT IV NUMERICAL CONTROL AND ROBOTICS

UNIT V AUTOMATED HANDLING AND STORAGE
Automated guided vehicle systems, AS/RS, Carousel storage, Automatic data capture - Bar code technology.

TOTAL: 45 PERIODS
OUTCOMES:
- Ability to understand the requirements of automation in manufacturing systems.
- Knowledge in the techniques of machinery automation, shop floor automation.
- Selection of material handling systems for automated industries.
- Gaining basic knowledge in CAD systems.

TEXT BOOK:

REFERENCE:

IE8592 OPERATIONS RESEARCH - II

OBJECTIVE:
To impart knowledge about dynamic programming, inventory models, waiting line models, Decision and game theory techniques.

UNIT I DETERMINISTIC INVENTORY MODELS 9+6
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+6
Probabilistic inventory model – Single period model – A lot size, Reorder point model – Variable lead time - Multiproduct-selective inventory control

UNIT III QUEUING THEORY 9+6
Queueing theory terminology – Single server, multi server, limited queue capacity, limited population capacity

UNIT IV DECISION AND GAME THEORY 9+6
Decision making under certainty – Decision making under risk – Decision making under uncertainty – Decision tree analysis - Game Theory – Two person zero sum games, pure and mixed strategies – Theory of dominance - Graphical Solution – Solving by LP

UNIT V DYNAMIC PROGRAMMING 9+6

TOTAL: 75 PERIODS

OUTCOMES:
- Have the ability to classify, formulate, and solve operations research problems.
- Have knowledge of operations research areas such as probabilistic modeling, applied statistics, mathematical programming, simulation, and decision analysis to directly support decision and policy making activities.

TEXT BOOKS:
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

UNIT II HUMAN PERFORMANCE

UNIT III PHYSIOLOGICAL ASPECTS OF HUMAN AT WORK

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

OUTCOME:
The Student should apply ergonomic principles to design workplaces for the improvement of human performance and implement latest occupational health and safety to the work place.

TEXT BOOKS:

REFERENCES:
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

(Use of P S G Design Data Book is permitted)

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9
Introduction to the design process - factors 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 – curved beams – crane hook and ‘C’ frame-

UNIT II SHAFTS AND COUPLINGS 9
Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

UNIT III TEMPORARY AND PERMANENT JOINTS 9
Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9
Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT V BEARINGS 9
Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the influence of steady and variable stresses in machine component design.
CO2 Apply the concepts of design to shafts, keys and couplings.
CO3 Apply the concepts of design to temporary and permanent joints.
CO4 Apply the concepts of design to energy absorbing members, bearings and connecting rod.
CO5 Apply the concepts of design to bearings.

TEXT BOOKS:

REFERENCES:

AN8681 AUTOMATION LABORATORY

OBJECTIVES:
To give hands on experience on
- CNC programming on Lathe and Milling Machine
- Programming of Robotics
- Programming of PLC

1. Part programming and Machining of Simple Turning using CNC Lathe
2. Part programming and Machining of Taper Turning using CNC Lathe
3. Part programming and Machining using Multiple Turning cycle in CNC Lathe
4. Part programming and Simulation of Thread Cutting using CNC Lathe
5. Part programming and Machining of Contour using CNC Milling Machine
6. Part programming and Machining of Circular Pocket using CNC Milling Machine
7. Part programming and Machining of Rectangular Pocket using CNC Milling Machine
8. Part programming and Machining using Mirroring Cycle in CNC Milling Machine
9. Programming Exercise for Robots
10. Programming of PLC using Ladder Logic Diagram

OUTCOMES:
Students will be able to
1. Perform CNC programming using G-code and M-code. S2
2. Perform programming for controlling the robots. S2
3. Perform programming PLC using ladder Logic Diagram.S2

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
1. CNC Lathe
2. CNC Milling Machine
3. Pick and Place Robot
4. PLC Trainer

TOTAL: 60 PERIODS
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. Analysis of noise level in different environment
9. Study of Illumination of work places.
10. Evaluation of physical fitness using metabolic Analyzer.

OUTCOME:
- Ability to design the industry with ergonomics consideration

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS
1. Tread mill with Heart rate measurement and Energy Expenditure Measurement
2. Ergo Cycle with Heart rate measurement and Energy Expenditure Measurement
3. Step Test Arrangement
4. Sound Meter
5. LUX meter

IE8512 TECHNICAL SEMINAR - I
To enrich the communication skills of the student and presentations of technical topics of interest, this course is introduced. In this course, a student has to present three Technical papers or recent advances in engineering/technology that will be evaluated by a Committee constituted by the Head of the Department.

TOTAL: 30 PERIODS

IE8692 OPERATIONS SCHEDULING
OBJECTIVE:
- To impart knowledge on various scheduling algorithms applicable to single machine, parallel machines, flow shop and job shop models.

UNIT I SCHEDULING THEORY

UNIT II SINGLE MACHINE SCHEDULING
UNIT III PARALLEL MACHINE SCHEDULING

UNIT IV FLOW SHOP SCHEDULING

UNIT V JOB SHOP SCHEDULING

OUTCOME:
• Students will be able to design, analyse and implement single machine, parallel machine, flow shop, job shop scheduling techniques

REFERENCES:

TOTAL: 45 PERIODS
OUTCOME:
The Student must apply and optimize reliability for time independent and time dependent failure models through various testing methods for various manufacturing amnesty process

TEXT BOOKS:

REFERENCES:

IE8691 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

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

UNIT III COMPUTERISED LAYOUT PLANNING

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

UNIT V MATERIAL HANDLING AND PACKAGING
Objectives and benefits of Material handling, Relationship between layout and Material handling, Principles of material handling, Unit load concept, Classification of material handling equipments, Equipment selection, Packaging.

TOTAL: 45 PERIODS

OUTCOME
Students must analyse, design and apply layout principles for layout product, material handling and packaging.
IE8693 PRODUCTION PLANNING AND CONTROL

OBJECTIVES:

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION
Objectives and benefits of planning and control-Functions of production control-Types of production job- batch and continuous-Product development and design-Marketing aspect - Functional aspects Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II WORK STUDY
Method study, basic procedure-Selection-Recording of process - Critical analysis, Development Implementation- Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING
Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning Steps in process planning-Quantity determination in batch production-Machine capacity, balancing Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING
Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling Batch production scheduling-Product sequencing – Production Control systems-Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC
Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TOTAL: 45 PERIODS
OUTCOMES:
- Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control
- They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

TEXT BOOKS:

REFERENCES:
7. Samson Eilon, “Elements of Production Planning and Control”, Universal Book Corp. 1984

MG8591 PRINCIPLES OF MANAGEMENT

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<tr>
<th>L</th>
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<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

OBJECTIVE:
- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

UNIT II PLANNING

UNIT III ORGANISING
UNIT IV DIRECTING
9

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.

OUTCOME:
- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

REFERENCES:

IE8661 PRODUCTION SYSTEM DESIGN PROJECT
0 0 4 2

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

Projects shall be assigned in the following areas:
- Quality Control
- Reliability engineering
- Forecasting and Aggregate Planning
- Materials Requirement Planning and Capacity Planning
- Transportation and Distribution of goods
- Group technology and Cellular manufacturing
- Production and Project Scheduling
- Plant Layout Design
- Work System Design and Time Study
- Methods improvement in manufacturing and service organisation

TOTAL: 60 PERIODS
OBJECTIVE:
To give adequate exposure to applications of software packages in the areas of Applied Statistics, Operations Research and Reliability

LIST OF EXPERIMENTS
1. Mean, Median, Mode, measures of dispersion
2. Look up tables, Statistics
3. Data analysis

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

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

TOTAL: 60 PERIODS

OUTCOME:
- Ability to use software packages in the area of statistical analysis operation research and reliability predictions.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
1. Personal computers with following software, Language and packages
   a. MS Excel
   b. TORA
   c. LINDO
   d. C or Other equivalent Language.

HS8581 PROFESSIONAL COMMUNICATION

OBJECTIVES: The course aims to:
- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I
Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

UNIT II
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations
UNIT III
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying –GD strategies- activities to improve GD skills

UNIT IV
Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

UNIT V
Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

OUTCOMES: At the end of the course Learners will be able to:
• Make effective presentations
• Participate confidently in Group Discussions.
• Attend job interviews and be successful in them.
• Develop adequate Soft Skills required for the workplace

Recommended Software
1. Globearena
2. Win English

REFERENCES:

IE8791 DESIGN OF EXPERIMENTS L T P C
3 0 0 3

AIM:
This course aims to introduce students how to statistically plan, design and execute industrial experiments for process understanding and improvement in both manufacturing and service environments

OBJECTIVES:
• To demonstrate knowledge and understanding of Classical Design of Experiments (DOE)
• To demonstrate knowledge and understanding of Taguchi’s approach
• To develop skills to design and conduct experiments using DOE and Taguchi’s approach
• To develop competency for analysing 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

UNIT III  FACTORIAL DESIGNS
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- Yates’s Algorithm- fitting regression model- Randomized Block Factorial Design - Practical applications.

UNIT IV  SPECIAL EXPERIMENTAL DESIGNS
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
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

OUTCOMES:
- To understand the fundamental principles of Classical Design of Experiments
- To apply DOE for process understanding and optimisation
- To describe the Taguchi’s approach to experimental design for process performance robustness
- To apply Taguchi based approach to evaluate quality

TEXT BOOK:

REFERENCES:

IE8751  SIMULATION MODELING AND ANALYSIS

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

UNIT I  INTRODUCTION
Systems – Modelling – Types – Systems components – Simulation basics
UNIT II  RANDOM NUMBERS / VARIATES

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

UNIT IV  SIMULATION LANGUAGES
Need for simulation Languages – Modules of Simulation Package, Functions – Input- Reports - Study of GPSS.

UNIT V  CASE STUDIES USING SIMULATION
Case studies in Queuing, Inventory, Replacement and Production

OUTCOME
• Will be able to analyse, models and simulate experiments to meet real world system and evaluate the performance.

TEXT BOOKS:

REFERENCES:

MG8791  SUPPLY CHAIN MANAGEMENT  L T P C
3 0 0 3

OBJECTIVE:
• To provide an insight on the fundamentals of supply chain networks, tools and techniques.

UNIT I  INTRODUCTION
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

UNIT III  LOGISTICS IN SUPPLY CHAIN

UNIT IV  SOURCING AND COORDINATION IN SUPPLY CHAIN
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

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

OUTCOME:
- The student would understand the framework and scope of supply chain networks and functions.

TEXT BOOK:

REFERENCES:

IE8761 DISCRETE SIMULATION LABORATORY

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

LIST OF 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. Monte Carlo Simulation : Random Walk Problem
5. Monte Carlo Simulation : Paper vendor problem
6. Single Server Queuing Model
7. Multi Server Queuing Model
8. Alternate service queueing model
9. Inventory Model
10. Use of Simulation Language : Servers in series queueing system
11. Use of Simulation Model : Queue with balking

TOTAL: 30 PERIODS

OUTCOME:
Ability to prepare computer based discrete system

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
1. Personal computers with following software, Language and packages
   a. C or Other equivalent Language
   b. GPSS
IE8711 TECHNICAL SEMINAR-II L T P C 0 0 2 1

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

TOTAL: 30 PERIODS

IE8891 SAFETY ENGINEERING AND MANAGEMENT L T P C 3 0 0 3

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

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

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

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

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

UNIT V SAFETY REGULATIONS 9

TOTAL: 45 PERIODS

OUTCOME:
Students must be able to identify and prevent chemical, environmental mechanical, fire hazard through analysis and apply proper safety techniques on safety engineering and management.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To impart knowledge to enable the students to design and implement Statistical Process Control in any industry.
- To design and implement acceptance sampling inspection methods in industry.

UNIT I  QUALITY FUNDAMENTALS  9
Importance of quality- evolution of quality- definitions 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

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

OUTCOME:
- Able to implement statistical process control and acceptance sampling procedures in manufacturing environment to improve quality of processes / products

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.
The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 300 PERIODS

OUTCOME:
- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

MG8071 MAINTENANCE ENGINEERING AND MANAGEMENT

OBJECTIVES:
- To create an awareness for the need for maintenance.
- To impart the basic concepts in maintenance management and various maintenance policies.

UNIT I MAINTENANCE CONCEPT

UNIT II MAINTENANCE POLICIES
Planned vs unplanned maintenance-Preventive maintenance vs Breakdown maintenance-Predictive maintenance-Corrective maintenance-Opportunistic maintenance-Design out maintenance-Condition Based Maintenance (CBM)- Analysis of downtime-Repair time distribution (exponential, lognormal)- MTTR-System repair time-Maintainability prediction.

UNIT III MAINTENANCE LOGISTICS

UNIT IV FAULT DIAGNOSIS

UNIT V TOTAL PRODUCTIVE MAINTENANCE

TOTAL: 45 PERIODS
OUTCOME:
- The students would gain knowledge on maintenance logistics, fault diagnosis and TP M.

TEXT BOOK:

REFERENCES:

IE8077  MULTI-VARIATE STATISTICAL 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
Review of basic matrix operations and random vectors, Eigen values and Eigen vectors. An overview of multivariate methods, Multivariate normal distribution.

UNIT II  REGRESSION  9
Inferences about population parameters - Simple Regression, and Correlation – Estimation using the regression line, correlation analysis, Multiple Regression– Logistic Regression - Canonical Correlation analysis-Multivariate analysis of variance.

UNIT III  FACTOR ANALYSIS  9
Principal components analysis – Objectives, estimation of principal components, testing for independence of variables, Factor analysis model – Method of estimation – Factor rotation – Factor Scores

UNIT IV  DISCRIMINANT ANALYSIS  9
Discriminant analysis – Classification with two multi Variate normal populations- Evaluating classification function – Classification with several populations – Fishers Method for Discriminating among several Populations.

UNIT V  CLUSTER ANALYSIS  9
Cluster analysis – Clustering methods, Hierarchical clustering methods – Single Linkage, Complete Linkage, Average Linkage, Ward's Hierarchical Clustering Method, Non Hierarchical Clustering methods - K-means Method, Validation and profiling of clusters

TOTAL: 45 PERIODS

OUTCOME:
- Can apply the multivariate, regression, factor, discriminent and cluster analysis techniques for statistical analysis.

TEXT BOOK:
REFERENCES:

MG8891 HUMAN RESOURCE MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
- To acquaint students with the issues related to staffing, training, performance and compensation of Human Resources.

UNIT I INTRODUCTION TO HUMAN RESOURCE MANAGEMENT

UNIT II HUMAN RESOURCE PLANNING

UNIT III TRAINING AND EXECUTIVE DEVELOPMENT
Types of training and Executive development methods – purpose – benefits.

UNIT IV EMPLOYEE COMPENSATION

UNIT V PERFORMANCE EVALUATION AND CONTROL

OUTCOME:
- To understand the process of effective Human Resource Management.

TEXT BOOKS:

REFERENCES:
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
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
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
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
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
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

OUTCOMES:
- Perform fabrication of PCBs and use of mounting technology for electronic assemblies.
- Perform quality inspection on the PCBs

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To gain knowledge about nonlinear and multi-objective optimization models.
- To get exposure to meta heuristic algorithms.

UNIT I  RANDOM PROCESS  9
Modeling the process – steady state probabilities - Reducible Markov chains – Absorbing Markov chains – Ergodic Markov chains

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
Meta Heuristics like Genetic Algorithms, Simulated annealing, Tabu search, Ant Colony Optimization with applications to Industrial Engineering.

UNIT V  NON-TRADITIONAL OPTIMIZATION - II  9

TOTAL: 45 PERIODS

OUTCOMES:

- Solve a nonlinear problem through its linear approximation.
- Solve a multi-objective problem through weighted and constrained methods.
- Acquire an idea about the various direct and indirect search methods.

TEXT BOOKS:

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

UNIT I
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

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

UNIT IV
Technology Transfer 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

OUTCOMES:
Upon completion of the course, students will be able to
- Have clear understanding of managerial functions like planning, organizing, staffing, leading and controlling
- Have same basic knowledge on international aspect of management

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To introduce the students different models used to describe the manufacturing systems and use of them for effective operations of manufacturing industries.

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

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

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

TOTAL : 45 PERIODS

OUTCOME:
The Student must be able to apply the principles behind focused factory, Markov and Petrinet Models, Queuing models, lean system to model modern manufacturing systems.

TEXT BOOKS:

REFERENCES:

OBJECTIVE:
- To introduce different evolutionary optimization techniques for the problems related to the manufacturing systems

UNIT I  CONVENTIONAL OPTIMIZATION
Conventional Optimization techniques, Overview of evolutionary computation, Historical branches of evolutionary computation

UNIT II  SEARCH OPERATORS, SELECTION SCHEMES, RANKING METHODS, IMPORTANT OF REPRESENTATION
UNIT III
Evolutionary combinatorial optimization: evolutionary algorithms, Constrained optimization, Evolutionary multi-objective optimization.

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

UNIT V
Pareto optimality, Analysis of evolutionary algorithms

OUTCOME:
• The students will be able to make decisions in the semi structured and unstructured problem situations.

REFERENCES:

IE8079 SYSTEMS ENGINEERING L T P C 3 0 0 3

OBJECTIVE:
• To introduce system engineering concepts to design the manufacturing system for optimum utilization of source for effective functioning.

UNIT I INTRODUCTION
Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life-cycle phases, logical steps of systems engineering, Frame works for systems engineering.

UNIT II SYSTEMS ENGINEERING PROCESSES
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
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,

OUTCOMES:
- The Student must be able to apply systems engineering principles to make decision for optimization.
- Hence an understanding of the systems engineering discipline and be able to use the core principles and processes for designing effective system.

TEXT BOOK:

REFERENCES:

GE8075  INTELLECTUAL PROPERTY RIGHTS  L T P C 3 0 0 3

OBJECTIVE:
- To give an idea about IPR, registration and its enforcement.

UNIT I  INTRODUCTION  9
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO – TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II  REGISTRATION OF IPRs  10
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III  AGREEMENTS AND LEGISLATIONS  10

UNIT IV  DIGITAL PRODUCTS AND LAW  9

UNIT V  ENFORCEMENT OF IPRs  7
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:
- Ability to manage Intellectual Property portfolio to enhance the value of the firm.
TEXT BOOKS

REFERENCES

GE8073 FUNDAMENTALS OF NANOSCIENCE

OBJECTIVE:
To learn about basis of nanomaterial science, preparation method, types and application

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

UNIT II GENERAL METHODS OF PREPARATION
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS

UNIT IV CHARACTERIZATION TECHNIQUES

UNIT V APPLICATIONS

TOTAL : 45 PERIODS
OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS:

REFERENCES:
REFERENCES:

IE8072   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    REVIEW OF A LANGUAGE
Review of C/C++ - writing and debugging large programs - Controlling numerical errors.

UNIT II   ALGORITHM DESIGN METHODS
Greedy – Divide and conquer – Backtracking – Branch & bound – Heuristics- Meta heuristics

UNIT III  BASIC TOOLS
Structured approach – Networks – Trees – Data structures

UNIT IV   COMPUTATIONAL PERFORMANCE
Time complexity – Space complexity – Algorithm complexity

UNIT V    APPLICATIONS
Sorting – Searching - Networks – Scheduling – Optimization models – IE applications

TOTAL: 45 PERIODS

OUTCOME:
• Student must be able to design algorithm computational tools used in manufacturing process.

TEXT BOOK:

REFERENCES:

ME8095   DESIGN OF JIGS, FIXTURES AND PRESS TOOLS   L T P C
         3 0 0 3

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

UNIT I    LOCATING AND CLAMPING PRINCIPLES:
Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements –
principles of location – Locating methods and devices – Redundant Location – Principles of
clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill
bushes and Jig buttons – Tolerances and materials used.
UNIT II JIGS AND FIXTURES 9
Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES 9

UNIT IV BENDING AND DRAWING DIES 9

UNIT V FORMING TECHNIQUES AND EVALUATION 9
Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke.

TOTAL: 45 PERIODS

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

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Summarize the different methods of Locating Jigs and Fixtures and Clamping principles
CO2 Design and develop jigs and fixtures for given component
CO3 Discuss the press working terminologies and elements of cutting dies
CO4 Distinguish between Bending and Drawing dies.
CO5 Discuss the different types of forming techniques

TEXT BOOKS:

REFERENCES:
1. ASTME Fundamentals of Tool Design Prentice Hall of India.
IT8075 SOFTWARE PROJECT MANAGEMENT

OBJECTIVES:
- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization's strategic goals.

UNIT I PROJECT EVALUATION AND PROJECT PLANNING

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT

UNIT IV PROJECT MANAGEMENT AND CONTROL

UNIT V STAFFING IN SOFTWARE PROJECTS

OUTCOMES:
At the end of the course, the students should be able to:
- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
- Learn staff selection process and the issues related to people management.

TOTAL 45 PERIODS

83
TEXT BOOK:

REFERENCES

GE8074 HUMAN RIGHTS L T P C
3 0 0 3

OBJECTIVE:
- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

TOTAL : 45 PERIODS

OUTCOME :
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:
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

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

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

OUTCOMES:
The Student must be able to:
- Measure and evaluate productivity
- Plan and implement various productivity techniques.
- Reengineer the process for improving the productivity
- Implement BPR tools for improving the productivity.

TEXT BOOKS:

REFERENCES:
IE8074  INDUSTRIAL ROBOTICS  L T P C  3 0 0 3

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.

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<td>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.</td>
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<td>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.</td>
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<td>Work cell Control - Robot and machine Interface - Robot cycle time Analysis - Economic Analysis of Robots - Pay back Method, EUAC Method, Rate of Return Method.</td>
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TOTAL: 45 PERIODS

OUTCOME:
The Student must be able to design automatic manufacturing cells with robotic control using the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming.

TEXT BOOK :

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

UNIT I VALUE ENGINEERING BASICS
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
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

UNIT IV CONCEPT GENERATION, SELECTION AND PRODUCT ARCHITECTURE

UNIT V INDUSTRIAL DESIGN, PROTOTYPING AND ECONOMICS OF PRODUCT DEVELOPMENT

TOTAL: 45 PERIODS

OUTCOMES:
The Student will be able to:
CO1: Explain the basic concepts of Value Engineering.
CO3: Prepare a product specification and the product development plan from the customer requirement.
CO4: Explain the concepts in concept generation selection and product architecture.
CO5: Explain the quality and reliability studies in electronics Manufacturing Industries.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To facilitate the understanding of Quality Management principles and process.

UNIT I  INTRODUCTION  9

UNIT II  TQM PRINCIPLES  9
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - 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 - 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 - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V  QUALITY MANAGEMENT SYSTEM  9

TOTAL: 45 PERIODS

OUTCOME:
- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

REFERENCES:
4. ISO 9001-2015 standards
OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR).
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

UNIT I INTRODUCTION TO DISASTERS

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.
TEXT BOOKS:

REFERENCES
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

MF8691 FLEXIBLE MANUFACTURING SYSTEMS L T P C 3 0 0 3

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

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

UNIT II COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING SYSTEMS 9

UNIT III FMS SIMULATION AND DATA BASE 9

UNIT IV GROUP TECHNOLOGY AND JUSTIFICATION OF FMS 9

UNIT V APPLICATIONS OF FMS AND FACTORY OF THE FUTURE 9

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to perform Planning, Scheduling and control of Flexible Manufacturing systems
- Perform simulation on software’s use of group technology to product classification

TEXT BOOK
REFERENCES:

MG8892 MARKETING MANAGEMENT

OBJECTIVE:
To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation. The course will enable a student to take up marketing as a professional career.

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

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION
Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION

TOTAL: 45 PERIODS

OUTCOME:
- The learning skills of Marketing will enhance the knowledge about Marketer’s Practices and create insights on Advertising, Branding, Retailing and Marketing Research.

TEXT BOOKS:
REFERENCES:
1. Ramasamy and Nama kumari, “Marketing Environment: Planning, implementation and control
   the Indian context”, 1990.
   2004.
7. Graeme Drummond and John Ensor, "Introduction to marketing concepts", Elsevier, Indian

MG8091 ENTREPRENEURSHIP DEVELOPMENT L T P C
            3 0 0 3

OBJECTIVE:
• To develop and strengthen entrepreneurial quality and motivation in students and to impart
  basic entrepreneurial skills and understanding to run a business efficiently and effectively.

UNIT I ENTREPRENEURSHIP
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur
Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating,
Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship
Development Programs – Need, Objectives.

UNIT III BUSINESS
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
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of

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

TOTAL: 45 PERIODS

OUTCOME:
• Upon completion of the course, students will be able to gain knowledge and skills needed
  to run a business successfully.

TEXT BOOKS :
1. Khanka S.S., “Entrepreneurial Development” S.Chand & Co. Ltd.,Ram Nagar, New Delhi,
   2013.
OBJECTIVES:

- To review and clarify the fundamental terms, concepts and theories associated with Decision Support Systems, computerized decision aids, expert systems, group support systems and executive information systems.
- To discuss and develop skills in the analysis, design and implementation of computerized Decision Support Systems.
- To examine the uses of various mathematical models, heuristics and simulation as a sub-system of DSS.
- To understand that most Decision Support Systems are designed to support rather than replace decision makers and the consequences of this perspective for designing DSS.

UNIT I

INTRODUCTION

Managerial decision making, system modeling and support - preview of the modeling processes - phases of decision making process.

UNIT II

ANALYSIS

DSS components - Data warehousing, access, analysis, mining and visualization - modeling and analysis - DSS development.

UNIT III

TECHNOLOGIES

Group support systems - Enterprise DSS - supply chain and DSS - Knowledge management methods, technologies and tools.

UNIT IV

EXPERT SYSTEMS

Artificial intelligence and expert systems - Concepts, structure, types - Knowledge acquisition and validation - Difficulties, methods, selection.

UNIT V

SEMANTIC NETWORKS

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

OUTCOME:

- The students will be able to make decisions in the semi-structured and unstructured problem situations.

TEXT BOOKS:

OBJECTIVE:
- To enable the students to create an awareness on Engineering Ethics and Human Values to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I  HUMAN VALUES

UNIT II  ENGINEERING ETHICS

UNIT III  ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV  SAFETY, RESPONSIBILITIES AND RIGHTS

UNIT V  GLOBAL ISSUES

TOTAL: 45 PERIODS

OUTCOME:
- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

REFERENCES:
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and

Web sources:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org