ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
REGULATIONS - 2017
B.E. INDUSTRIAL ENGINEERING AND MANAGEMENT
CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVE (PEOs):
   I. To develop students to start career as an effective engineer by applying skills to create roadmap for success and development in Industries
   II. To enrich the knowledge of students to Create, Extend, Execute and manage new flexible system by breakdown complex.
   III. To train the students with capability to manage man, machine, money and materials for the development of industry.
   IV. To train the students with ability to easily adapt on changes and demand with modern technological and global.
   V. To train the students with moral to maintain elevated standards on professional and disciplines.
   VI. To train the students with extensive skills on problem solving for the development of industries on high risk demands.

2. PROGRAMME OUTCOME (POs):

After going through the 4 years of study, Industrial engineering and management graduates will exhibit ability to:

1. Propose a scheme, module or procedure to fulfill required needs enclosed by practical limitation such as manufacturability, maintainability, financial, environmental.
2. Complete tasks and projects on schedule through the effective use of time management, teamwork that encourage innovation, active in problems identification, and troubleshooting for successful resolution of problems towards the achievement of set goals and objectives.
3. Propose and carry out experiments, in addition to analyze and understand the data.
4. The extensive learning essential to know the impact of engineering explanations in a worldwide, profitable, environmental, and public context.
5. An ability to design, develop, implement, and improve integrated systems that includes people, materials, information, equipment and energy.
6. Exhibit independence in the pursuits of continuous professional development.
7. Communicate effectively and efficiently with diverse individuals and teams, all levels of industries, suppliers, customers and employees.
8. Apply quality systems, principles, concepts and utilize appropriate mathematical, measurement and statistical tools and technology to improve processes, product quality, and to enhance the productivity.
9. Incorporate safety awareness, principles and practices in every aspect of work and as a way of life, including machine safety, chemical safety, and personal/employee protection.
PEO / PO Mapping:

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## SEMESTER COURSE WISE PEO MAPPING

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ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.E. INDUSTRIAL ENGINEERING AND MANAGEMENT
REGULATIONS - 2017
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS CURRICULA AND SYLLABI
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**TOTAL**

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**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE =183**
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### PROFESSIONAL ELECTIVES FOR INDUSTRIAL ENGINEERING AND MANAGEMENT

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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 12

UNIT II GENERAL READING AND FREE WRITING 12
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) - register - 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 - prepositions, conjunctions. Vocabulary development - guessing meanings of words in context.

UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12
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 12
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 12

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

UNIT V  DIFFERENTIAL EQUATIONS

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  9

UNIT III  THERMAL PHYSICS  9

UNIT IV  QUANTUM PHYSICS  9

UNIT V  CRYSTAL PHYSICS  9
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:

CY8151 ENGINEERING CHEMISTRY

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

UNIT II SURFACE CHEMISTRY AND CATALYSIS

UNIT III ALLOYS AND PHASE RULE
Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.
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.

TOTAL: 45 PERIODS

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  L T P C
3 0 0 3

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
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
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
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, merge sort, histogram.

UNIT V FILES, MODULES, PACKAGES
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

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

TEXT BOOKS:

REFERENCES:
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  PLANE CURVES AND FREEHAND SKETCHING  7+12

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 .

TOTAL: 90 PERIODS

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.
TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:

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

GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

OBJECTIVES:
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS
1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton’s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

OUTCOMES:
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

BS8161 PHYSICS AND CHEMISTRY LABORATORY
(Common to all branches of B.E. / B.Tech Programmes)

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 Na$_2$CO$_3$ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenantherline / 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.

UNIT I INTRODUCTION TECHNICAL ENGLISH 12

UNIT II READING AND STUDY SKILLS 12
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.

UNIT III TECHNICAL WRITING AND GRAMMAR 12
Listening- Listening to classroom lectures/ talksls 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

UNIT IV REPORT WRITING 12

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12
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

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 \( w = z + c, \frac{1}{z}, cz, \frac{1}{z^2} \) - 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 MATERIALS SCIENCE (Common to courses offered in Faculty of Mechanical Engineering Excerpt B.E. Materials Science and Engineering )

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

UNIT V  NEW MATERIALS

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
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

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) 

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
GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING

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 – solid 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

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

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

TEXTBOOKS:

REFERENCES:
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 \hspace{1cm} STATICS OF PARTICLES \hspace{1cm} 9+6


UNIT II \hspace{1cm} EQUILIBRIUM OF RIGID BODIES \hspace{1cm} 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 \hspace{1cm} PROPERTIES OF SURFACES AND SOLIDS \hspace{1cm} 9+6


UNIT IV \hspace{1cm} DYNAMICS OF PARTICLES \hspace{1cm} 9+6


UNIT V \hspace{1cm} FRICTION AND RIGID BODY DYNAMICS \hspace{1cm} 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.

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:

GE8261 ENGINEERING PRACTICES LABORATORY

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-joints 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
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

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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>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>
<tr>
<td>10</td>
<td>Dual Regulated power supplies</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>A.C. Signal Generators</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>Transistors (BJT, JFET)</td>
<td>-</td>
</tr>
</tbody>
</table>
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  12
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  12

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  12
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  12

UNIT V  Z-TRANSFORMS AND DIFFERENCE EQUATIONS  12

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

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

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

UNIT II METHODS ENGINEERING 9
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 9

UNIT IV APPLIED WORK MEASUREMENT 9
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 9
Organization and methods (O & M) - Work measurement of office work - Work Analysis Techniques applied to support staff - Form design and Control.

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

TOTAL: 45 PERIODS
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:
1. Explain different metal casting processes, associated defects, merits and demerits
2. Compare different metal joining processes.
3. Summarize various hot working and cold working methods of metals.
4. Explain various sheet metal making processes.
5. 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.

IE8491  OPERATIONS RESEARCH - I

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

UNIT I  LINEAR PROGRAMMING
Introduction to Operations Research – assumptions of linear programming problems - Formulations
of linear programming problem – Graphical method. Solutions to LPP using simplex algorithm – Two
phase method – Big M method

UNIT II  ADVANCES IN LINEAR PROGRAMMING – I
Revised simplex method - primal dual relationships – Dual simplex algorithm – Sensitivity analysis –
changes in RHS value – changes in Coefficient of constraint – Adding new constraint – Adding new
variable.
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

UNIT V NETWORK ANALYSIS - II 9+6

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:

ME8361 MANUFACTURING TECHNOLOGY LABORATORY – I L T P C
0 0 4 2

OBJECTIVES:
- 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
1. Demonstrate the safety precautions exercised in the mechanical workshop.
2. Make the workpiece as per given shape and size using Lathe.
3. Join two metals using arc welding.
4. Use sheet metal fabrication tools and make simple tray and funnel.
5. 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>
</tr>
</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></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 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

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>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTM of minimum 400 kN capacity</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Torsion testing machine</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Izod impact testing machine</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Hardness testing machine</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Rockwell Vicker’s Brinell</td>
<td>(any 2)</td>
</tr>
<tr>
<td>5</td>
<td>Beam deflection test apparatus</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Extensometer</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Compressometer</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Dial gauges</td>
<td>Few</td>
</tr>
<tr>
<td>9</td>
<td>Le Chatelier’s apparatus</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Vicat’s apparatus</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Mortar cube moulds</td>
<td>10</td>
</tr>
</tbody>
</table>
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

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 1 2

UNIT III DIMENSIONAL ANALYSIS 1 2
Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.
UNIT IV  PUMPS

UNIT V  TURBINES

TOTAL: 60 PERIODS

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  L  T  P  C
3  0  0  3

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

UNIT I  THEORY OF METAL CUTTING
Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools– nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.
UNIT II TURNING MACHINES 9
Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle : Swiss type, automatic screw type – multi spindle:

UNIT III SHAPER, MILLING AND GEAR CUTTING MACHINES 9

UNIT IV ABRASIVE PROCESS AND BROACHING 9
Abrasive processes: grinding wheel – specifications and selection, types of grinding process—cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT V CNC MACHINING 9

OUTCOMES:
Upon the completion of this course the students will be able to
1. Explain the mechanism of material removal processes.
2. Describe the constructional and operational features of centre lathe and other special purpose lathes.
3. Describe the constructional and operational features of shaper, planner, milling, drilling, sawing and broaching machines.
4. Explain the grinding and other super finishing processes apart from gear manufacturing processes.
5. Summarize numerical control of machine tools and write a part program.

TEXT BOOKS:

REFERENCES:
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
Queuing 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:

REFERENCES:
OBJECTIVES:

- To study and understand the concept of Engineering Economics and apply 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  9

UNIT II  PRODUCTION AND COST ANALYSIS  9

UNIT III  PRICING  9

UNIT IV  ESTIMATION OF MATERIAL AND LABOUR COSTS  9

UNIT V  ESTIMATION OF OPERATIONAL COST  9

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
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.

TOTAL: 60 Periods

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>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Rotameter setup</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Pipe Flow analysis setup</td>
<td>1</td>
</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>
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>
OBJECTIVES:
• Strengthen the reading skills of students of engineering.
• Enhance their writing skills with specific reference to technical writing.
• Develop students’ critical thinking skills.
• Provide more opportunities to develop their project and proposal writing skills.

UNIT I
Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension-Read and recognize different text types-Predicting content using photos and title Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

UNIT II
Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples-Write an opinion paragraph

UNIT III
Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques-Writing- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV
Reading- Genre and Organization of Ideas- Writing- Email writing- resumes – Job application- project writing-writing convincing proposals.

UNIT V
Reading- Critical reading and thinking- understanding how the text positions the reader- identify Writing- Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:
• Write different types of essays.
• Write winning job applications.
• Read and evaluate texts critically.
• Display critical thinking in various professional contexts.

TEXT BOOKS:
REFERENCES

IE8892 STATISTICAL QUALITY CONTROL

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

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

UNIT III STATISTICAL PROCESS CONTROL
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
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
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:

IE8551 APPLIED ERGONOMICS L T P C 3 0 0 3

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

UNIT I INTRODUCTION

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

TOTAL: 45 PERIODS

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:

IE8591 MANUFACTURING AUTOMATION L T P C
3 0 0 3

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 9
Automation in production systems, principles and strategies, Product/production relationships, Production concepts and mathematical models, manufacturing economics.

UNIT II CONTROL TECHNOLOGIES 9
Automated systems – elements, functions, levels, Continuous Vs discrete control, Computer process control, Sensors, Actuators, ADC, DAC, Programmable logic controllers – ladder logic diagrams.

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

UNIT IV NUMERICAL CONTROL AND ROBOTICS 9

UNIT V AUTOMATED HANDLING AND STORAGE 9
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:
REFERENCES:

MG8591 PRINCIPLES OF MANAGEMENT

L T P C
3 0 0 3

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
9

UNIT II PLANNING
9

UNIT III ORGANISING
9

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.

TOTAL: 45 PERIODS

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:

AN8681 AUTOMATION LABORATORY L T P C

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

TOTAL: 60 PERIODS

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
OBJECTIVE:
- To introduce the concepts of ergonomics design

LIST OF EXPERIMENTS
- Effect of speed of walking on treadmill using heart rate and energy expenditure
- Effect of workload on heart rate using Ergo cycle.
- Evaluation of physical fitness using step test
- Effect of work-rest schedule on physical performance (Ergo cycle / tread mill)
- Development of anthropometric data for male and female.
- Application of anthropometric data for the design of desk for students
- Evaluation of physical facilities (chairs, tables etc.) through comfort rating.
- Analysis of noise level in different environments
- Study of Illumination at work places.
- Design of plant layout using Muther’s systematic layout planning
- Testing the goodness of fit for the given quality characteristic of component using normal/ Poisson / Binomial/ Uniform distribution.
- Assessment of process capability of the given manufacturing process using process capability indices.
- Construction of control chart for variable/attribute quality characteristic
- Construction of OC curve(Beads experiment)

TOTAL : 45 PERIODS

OUTCOME:
- Ability to do ergonomics design of industry considering human and environmental factors.

LIST OF EQUIPMENT 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
7. Personal computer with C or equivalent language, MS Excel.
8. Sampling Beads

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:

IM8601 MANAGEMENT ACCOUNTING AND FINANCIAL MANAGEMENT

OBJECTIVE:
• To enable students to understand accounting mechanism and interpretation of financial statements and to comprehend nuances involved in costing, preparation of budgets and making investment decisions.
UNIT I  INTRODUCTION  9
comparison of Financial accounting, cost accounting and management Accounting – generally
accepted Accounting principles – Accounting standards – Accounting cycle.

UNIT II  FINANCIAL ACCOUNTING  9
Salient features of Balance Sheet and Profit and Loss statement, cash flow and Fund flow analysis
(Elementary), working capital management, ratio analysis – Depreciation.

UNIT III  COST ACCOUNTING  9
Cost accounting systems : Job Costing, process costing, allocation of overheads, Activity based
costing, variance analysis – marginal costing – Break even analysis.

UNIT IV  BUDGETING  9
Requirements for a sound budget, fixed budget – preparation of sales and production budget, flexible
budgets, zero based budgets and budgetary control.

UNIT V  FINANCIAL MANAGEMENT  9
Investment decisions – Investment appraisal techniques – payback period method, accounting rate of
return, net present value method, internal rate of return and profitability index method-cost of capital.

TOTAL: 45 PERIODS

OUTCOME:
- Upon successful completion of the course, students will acquire the ability to prepare and interpret
  financial statements, draft budgets and make sound investment decisions.

TEXT BOOKS:
   Delhi, 2011.

REFERENCES:
1. Jan Williams, "Financial and Managerial Accounting –The basis for business decisions", Tata
2. Horngren, Surdem, Stratton, Burgstahler, Schatzberg, "Introduction to Management Accounting",
   PHI Learning, 2011.

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

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

UNIT IV SPECIAL EXPERIMENTAL DESIGNS
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:
OBJECTIVE:
- To impart knowledge in reliability concepts, reliability estimation methods and reliability improvement methods

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

UNIT II  LIFE DATA ANALYSIS

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

UNIT IV  RELIABILITY MANAGEMENT

UNIT V  RELIABILITY IMPROVEMENT

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

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To give an overview of decision making in manufacturing and service operations.

UNIT I INTRODUCTION  

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

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

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

UNIT V PRODUCTION ACTIVITY CONTROL  
Objectives and Activities of Production Activity Control, Flow-shop, Intermittent flow shop, Job shop, Control.

OUTCOME:  
- Recognize and apply appropriate basic analytical techniques related to decision making in forecasting, aggregate planning, capacity planning and production control.

TEXT BOOKS:  

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

UNIT I VALUE ENGINEERING BASICS 9+6
Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function – Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

UNIT II VALUE ENGINEERING JOB PLAN AND PROCESS 9+6
Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

UNIT III PROJECT FORMULATION AND APPRAISAL 9+6

UNIT IV PROJECT IMPLEMENTATION AND CONTROL 9+6
Project planning, Project organization, Tools and techniques of project management, Project management Information system, Human resources, Financial aspects.

UNIT V PROJECT COMPLETION AND EVALUATION 9+6
Monitoring and Control of project, Integrated project management control system, Managing transition from project to operations, project review.

TOTAL:75 PERIODS

OUTCOME
- The Student must be able to apply the value engineering principles to plan execute and manage projects.

TEXT BOOKS:

REFERENCES
IE8661 PRODUCTION SYSTEM DESIGN PROJECT

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

IE8662 STATISTICAL APPLICATIONS AND OPTIMIZATION LABORATORY

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.

IM8611 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

MG8791 SUPPLY CHAIN MANAGEMENT

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:

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
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.

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

TEXT BOOKS:

REFERENCES:

IE8761  DISCRETE SIMULATION LABORATORY  L T P C
0 0 2 1

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 queuing 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

IM8711  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

MG8892  MARKETING MANAGEMENT  L T P C
        3 0 0 3

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  9
Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

UNIT II  BUYING BEHAVIOUR AND MARKET SEGMENTATION  9
Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.

UNIT III  PRODUCT PRICING AND MARKETING RESEARCH  9
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV  MARKETING PLANNING AND STRATEGY FORMULATION  9
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.
UNIT V  ADVERTISING, SALES PROMOTION AND DISTRIBUTION  9

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:

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  9

UNIT II  HUMAN RESOURCE PLANNING  9

UNIT III  TRAINING AND EXECUTIVE DEVELOPMENT  9
Types of training and Executive development methods – purpose – benefits.

UNIT IV  EMPLOYEE COMPENSATION  9

UNIT V  PERFORMANCE EVALUATION AND CONTROL  9

TOTAL: 45 PERIODS

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

REFERENCES:

IM8811 PROJECT WORK

OBJECTIVES:
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 work 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.

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.

TOTAL: 300 PERIODS

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
9

### UNIT IV FAULT DIAGNOSIS
9

### UNIT V TOTAL PRODUCTIVE MAINTENANCE
9

**TOTAL: 45 PERIODS**

**OUTCOME:**
- The students would gain knowledge on maintenance logistics, fault diagnosis and TPM.

**TEXT BOOK:**

**REFERENCES:**

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**IE8692 OPERATIONS SCHEDULING**

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

**UNIT I SCHEDULING THEORY**
9

**UNIT II SINGLE MACHINE SCHEDULING**
9
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:

IM8001 SERVICES OPERATIONS MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:
- To give the students a general understanding to how a business operations, both manufacturing and service.
- To help develop decision making and problem solving
- To develop a specific knowledge in operation issue.
- To provide a service of frame works, tools and techniques to allow students to analyse and develop solution to business operational problems.

UNIT I INTRODUCTION TO SERVICES
Manufacturing and Services, Definition of Service, Characteristic of Service, Nature of Services, Importance of Activity, Impact of technology

UNIT II GLOBALIZATION AND STRATEGY
Types of Globalized Services, Outsourcing, issues in Globalization, Service strategies

UNIT III OPERATIONS ISSUES
Forecasting, Inventory, capacity Planning, Scheduling

UNIT IV SERVICE QUALITY AND PRODUCTIVITY
Importance of Quality, Models for Service Quality, GAPS model, issues in productivity measurement, Work measurement
UNIT V    TOOLS FOR SERVICES
Data Envelopment Analysis, Queuing models, Vehicle Routing models

TOTAL: 45 PERIODS

OUTCOME:
The Student must be able to apply
- Principles and statistics behind globalization for multinational organization operation service and productivity quality.

REFERENCES:

IE8077    MULTI-VARIATE STATISTICAL ANALYSIS

OBJECTIVE:
To impart knowledge on the applications of multivariate statistical analysis

UNIT I    MULTIVARIATE METHODS
Review of basic matrix operations and random vectors, Eigen values and Eigen vectors. An overview of multivariate methods, Multivariate normal distribution.

UNIT II    REGRESSION
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
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
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
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.
IE8071 ADVANCED OPTIMIZATION TECHNIQUES

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

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

UNIT II NON-LINEAR OPTIMIZATION - I
Types of Non-linear programming problems, unconstrained optimization, KKT conditions for constrained optimization, Quadratic programming

UNIT III NON-LINEAR OPTIMIZATION - II
Separable programming, Convex programming, Non-convex programming, Geometric programming, Stochastic programming

UNIT IV NON-TRADITIONAL OPTIMIZATION - I
Meta Heuristics like Genetic Algorithms, Simulated annealing, Tabu search, Ant Colony Optimization with applications to Industrial Engineering.

UNIT V NON-TRADITIONAL OPTIMIZATION - II

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

TOTAL : 45 PERIODS

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 FOCUSSED 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:
IE8073  EVOLUTIONARY OPTIMIZATION  L  T  P  C
3  0  0  3

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

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

UNIT II
Search operators, Selection schemes, Ranking methods, Importance 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.

TEXT BOOKS:

REFERENCES:
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, Frameworks 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

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

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

TOTAL: 45 PERIODS

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:

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

UNIT I  INTRODUCTION
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
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

UNIT IV  DIGITAL PRODUCTS AND LAW

UNIT V  ENFORCEMENT OF IPRs
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
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
9
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
12

UNIT IV  CHARACTERIZATION TECHNIQUES
9

UNIT V  APPLICATIONS
7

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:
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:

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  9

UNIT IV  DESIGNING PRODUCT LAYOUT  9
Line balancing - Objectives, Line balancing techniques – Largest Candidate rule- Kilbridge and Wester method- RPW method- COMSOAL.

UNIT V  MATERIAL HANDLING AND PACKAGING  9
Objectives and benefits of Material handling, Relationship between layout and Material handling, Principles of material handling, Unit load concept, Classification of material handling equipments, Equipment selection, Packaging.

OUTCOME:
Students must analyse, design and apply layout principles for layout product, material handling and packaging.

TEXT BOOK:

REFERENCES:

IE8075  METROLOGY AND INSPECTION  L T P C
3 0 0 3

OBJECTIVE:
To impart knowledge about linear and angular measuring Instruments.

UNIT I  LINEAR MEASUREMENT AND ANGULAR MEASUREMENT  9

UNIT II  STANDARDS FOR LINEAR AND ANGULAR MEASUREMENTS  9
Shop floor standards and their calibration, light interference, Method of coincidence, Slip gauge calibration, Measurement errors, Limits, fits, Tolerance, Gauges, Gauge design.

UNIT III  MEASUREMENT APPLICATION  9

UNIT IV  MODERN CONCEPTS  9
Image processing and its application in Metrology, Co-ordinate measuring machine, Types of CMM, Probes used, Application, Non-contact CMM using Electro-optical sensors for dimensional metrology.
UNIT V INTRODUCTION TO MEASUREMENT SYSTEMS

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

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to use various linear and angular measuring instruments.
- Ability to measure linear, angular and surface profile using CMM.
- Understanding various non-destructive techniques.

TEXT BOOKS:


REFERENCES:


IE8891 SAFETY ENGINEERING AND MANAGEMENT

OBJECTIVE:

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

UNIT I INTRODUCTION

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

UNIT II CHEMICAL HAZARDS

Chemical exposure – Toxic materials – Radiation Ionizing and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

UNIT III ENVIRONMENTAL CONTROL

Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.

UNIT IV HAZARD ANALYSIS

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

UNIT V SAFETY REGULATIONS


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:

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

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

REFERENCES:
OBJECTIVE:

- To give the students general knowledge on information systems, related issues and use of information technology to solve the issue for global business progress.

UNIT I  FUNDAMENTALS OF INFORMATION SYSTEMS
Information systems in business, fundamentals of information systems solving business problems with information systems. Business Information systems, Transaction processing systems, management information systems and decision support systems. Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.

UNIT II  ISSUES IN MANAGING INFORMATION TECHNOLOGY
Managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with IT, security and ethical challenges in managing IT, social challenges of information technology.

UNIT III  INTRODUCTION TO E-BUSINESS

UNIT IV  CONSUMER-ORIENTED E-COMMERCE

UNIT V  ELECTRONICS DATA INTERCHANGE (EDI)
EDI Concepts, Applications in business – components of international trade, Customs Financial EDI, Electronic fund transfer, Manufacturing using EDI, Digital Signatures and EDI.

TOTAL: 45 PERIODS

OUTCOMES:

- To develop an integrative knowledge of the Information Technology applied for management in organization
- Understand how modern Information Technology is shaping the operation of business environment
- Communicate effectively on Management Information System issues.

TEXT BOOKS:

REFERENCES:
OBJECTIVES

- To teach the students the laws that govern the functioning of the Industries in a systematic way.
- To teach the Students the important appeals different laws pertaining to the industrial activities.

UNIT I  THE INDUSTRIAL DISPUTES ACT, 1947

UNIT II  THE TRADE UNION ACT 1926

UNIT III  THE FACTORIES ACT, 1948

UNIT IV  THE SALE OF GOODS ACT, 1930 (3 OF 1930)

Monopolies and Restrictive Trade Practices Commission, Unfair and Restrictive trade practices. The Competition Commission

OUTCOMES:

- Ability to discuss and demonstrate knowledge of the industrial law
- Ability to explain industrial dispute act 1947
- Ability to implement the trade union act.
- Ability to implement factories act, sales and goods act.

TEXT BOOKS:
3. Taxman, Commercial Laws.

REFERENCE:
1. Bare Acts and Bare Acts with Cases for each of these
OBJECTIVES:
- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
- To discuss about the various applications of robots, justification and implementation of robot.

UNIT I  FUNDAMENTALS OF ROBOT

UNIT II  ROBOT DRIVE SYSTEMS AND END EFFECTORS

UNIT III  SENSORS AND MACHINE VISION
Sensory Devices - Non optical - Position sensors - Optical position sensors - Velocity sensors Proximity sensors - Contact and noncontact type - Touel and slip sensors - Force and torque sensors - AI and Robotics.

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

UNIT V  ROBOT CELL DESIGN, CONTROL AND ECONOMICS
Work cell Control - Robot and machine Interface - Robot cycle time Analysis - Economic Analysis of Robots - Pay back Method, EUAC Method, Rate of Return Method.

TOTAL: 45 PERIODS

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

UNIT I INTRODUCTION
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

UNIT III PRODUCTIVITY PLANNING AND IMPLEMENTATION
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

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

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:
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 stake-holders- 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.

TOTAL: 45 PERIODS

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

IM8004 ENERGY CONSERVATION AND MANAGEMENT

OBJECTIVES:
At the end of the course, the student is expected to
• Understand and analyse the energy data of industries
• Carryout energy accounting and balancing
• Conduct energy audit and suggest methodologies for energy savings and
• Utilize the available resources in optimal ways

UNIT I INTRODUCTION

UNIT II ELECTRICAL SYSTEMS

UNIT III THERMAL SYSTEMS

UNIT IV ENERGY CONSERVATION IN MAJOR UTILITIES
Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT V ECONOMICS
Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of this course, the students can analyse the energy data of industries.
• Can carry out energy accounting and balancing
• Can suggest methodologies for energy savings

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 INTRODUCTION

UNIT II CONCEPT GENERATION AND SELECTION

UNIT III PRODUCT ARCHITECTURE

UNIT IV INDUSTRIAL DESIGN
UNIT V    DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT
Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs –
Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes –
Economic Analysis – Understanding and representing tasks – baseline project planning – accelerating
the project – project execution.

OUTCOME:
• The student will be able to design some products for the given set of applications; also the
knowledge gained through prototyping technology will help the student to make a prototype of
a problem and hence product design and development can be achieved.

TEXT BOOK:

REFERENCES:
Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book.
Wesley Publishing, New york, NY.

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

UNIT II COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING
SYSTEMS
Introduction – composition of FMS– hierarchy of computer control –computer control of work center
and assembly lines – FMS supervisory computer control – types of software specification and
selection – trends.

UNIT III FMS SIMULATION AND DATA BASE
Application of simulation – model of FMS– simulation software – limitation – manufacturing data

UNIT IV GROUP TECHNOLOGY AND JUSTIFICATION OF FMS
Introduction – matrix formulation – mathematical programming formulation –graph formulation –
knowledge based system for group technology – economic justification of FMS- application of
possibility distributions in FMS systems justification.
UNIT V APPLICATIONS OF FMS AND FACTORY OF THE FUTURE


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:

MG8091 ENTREPRENEURSHIP DEVELOPMENT

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

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

UNIT IV FINANCING AND ACCOUNTING
UNIT V  SUPPORT TO ENTREPRENEURS  9

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 :

REFERENCES :

GE8076 PROFESSIONAL ETHICS IN ENGINEERING  L T P C 3 0 0 3

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  10

UNIT II  ENGINEERING ETHICS  9

UNIT III  ENGINEERING AS SOCIAL EXPERIMENTATION  9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV  SAFETY, RESPONSIBILITIES AND RIGHTS  9
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:

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