PROGRAMME EDUCATIONAL OBJECTIVES:
Bachelor of Mechanical Engineering curriculum is designed to impart Knowledge, Skill and Attitude on the graduates to
1. Have a successful career in Mechanical Engineering and allied industries.
2. Have expertise in the areas of Design, Thermal, Materials and Manufacturing.
3. Contribute towards technological development through academic research and industrial practices.
4. Practice their profession with good communication, leadership, ethics and social responsibility.
5. Graduates will adapt to evolving technologies through life-long learning.

PROGRAMME OUTCOMES
1. An ability to apply knowledge of mathematics and engineering sciences to develop mathematical models for industrial problems.
2. An ability to identify, formulates, and solve complex engineering problems. with high degree of competence.
3. An ability to design and conduct experiments, as well as to analyze and interpret data obtained through those experiments.
4. An ability to design mechanical systems, component, or a process to meet desired needs within the realistic constraints such as environmental, social, political and economic sustainability.
5. An ability to use modern tools, software and equipment to analyze multidisciplinary problems.
6. An ability to demonstrate on professional and ethical responsibilities.
7. An ability to communicate, write reports and express research findings in a scientific community.
8. An ability to adapt quickly to the global changes and contemporary practices.

PEO / PO Mapping

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**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 184**
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<td>Mechatronics Laboratory</td>
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# Professional Electives for B.E. Mechanical Engineering

## Semester VI, Elective I

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### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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### SUMMARY

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<th>SL. NO.</th>
<th>SUBJECT AREA</th>
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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
Reading- longer texts- close reading –Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-Listening – listening to talks-conversations- Speaking – participating in conversations- short group conversations-Language development-modal verbs- present/ past perfect tense - Vocabulary development-collocations- fixed and semi-fixed expressions

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

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


UNIT III INTEGRAL CALCULUS

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

UNIT I  PROPERTIES OF MATTER

UNIT II  WAVES AND FIBER OPTICS

UNIT III  THERMAL PHYSICS

UNIT IV  QUANTUM PHYSICS

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

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
UNIT IV  FUELS AND COMBUSTION  9

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

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

TEXT BOOKS:

REFERENCES:

GE8151  PROBLEM SOLVING AND PYTHON PROGRAMMING  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, mergesort, 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:  
GE8152  ENGINEERING GRAPHICS  L T P C  2 0 4 4

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
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.
Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACE  6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS  5+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES  5+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  6+12
Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

OUTCOMES:
On successful completion of this course, the student will be able to
- familiarize with the fundamentals and standards of Engineering graphics
- perform freehand sketching of basic geometrical constructions and multiple views of objects.
- project orthographic projections of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- visualize and to project isometric and perspective sections of simple solids.
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 Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

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

TOTAL: 30 PERIODS

TEXTBOOKS:

HS8251

TECHNICAL ENGLISH

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

UNIT II READING AND STUDY SKILLS
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-vocabularyused in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING AND GRAMMAR
Listening- Listening to classroom lectures/ talks/ on engineering/technology -Speaking – introduction to technical presentations- Speaking- – describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences

UNIT IV REPORT WRITING
Listening- Listening to documentaries and making notes. Speaking – mechanics of presentations- Speaking – introduction to technical presentations- Speaking- – describing a process, use of sequence words- Vocabulary Development- finding suitable synonyms-paraphrasing-. Language Development-

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS
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-

TOTAL : 60 PERIODS

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

TEXT BOOKS:

REFERENCES

Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.
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 $w = z + c, cz, z^2$ - Bilinear transformation.

UNIT IV  COMPLEX INTEGRATION

UNIT V  LAPLACE TRANSFORMS

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 :

MATERIALS SCIENCE
(3 0 0 3)
PH8251
(L T P C)
(3 0 0 3)
 Except 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 9

UNIT V NEW MATERIALS 9

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

TEXT BOOKS:

REFERENCES

BE8253 BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING L T P C
OBJECTIVES:
To impart knowledge on
• Electric circuit laws, single and three phase circuits and wiring
• Working principles of Electrical Machines
• Working principle of Various electronic devices and measuring instruments

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

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

UNIT IV ELECTRONIC DEVICES & CIRCUITS

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

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

TEXT BOOKS

REFERENCES
OBJECTIVES:

- To study the nature and facts about environment.
- To find 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 14

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

UNIT II  ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – 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 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.
UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT


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:
UNIT II EQUILIBRIUM OF RIGID BODIES  9+6
Free body diagram – Types of supports – Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon’s theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS  9+6

UNIT IV DYNAMICS OF PARTICLES  9+6

UNIT V FRICTION AND RIGID BODY DYNAMICS  9+6
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 45+30=75 PERIODS

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

TEXT BOOKS:

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

GROUP A (CIVIL & MECHANICAL)

I  CIVIL ENGINEERING PRACTICE  13

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  18

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  13
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  16
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:

1. 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  
6. Hearth furnace, anvil and smithy tools  
7. Moulding table, foundry tools  
8. Power Tool: Angle Grinder  
9. Study-purpose items: centrifugal pump, air-conditioner  

ELECTRICAL
1. Assorted electrical components for house wiring  
2. Electrical measuring instruments  
3. Study purpose items: Iron box, fan and regulator, emergency lamp  
4. Megger (250V/500V)  
5. Power Tools: (a) Range Finder  
   (b) Digital Live-wire detector  

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

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

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

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

Minimum of 10 Experiments to be carried out :-

TOTAL: 60 PERIODS
OUTCOMES:
- Ability to determine the speed characteristic of different electrical machines
- Ability to design simple circuits involving diodes and transistors
- Ability to use operational amplifiers

1. 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>

MA8353 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

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

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

UNIT II FOURIER SERIES

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

UNIT V   Z - TRANSFORMS AND DIFFERENCE EQUATIONS

TOTAL : 60 PERIODS

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

TEXT BOOKS :

REFERENCES :

ME8391   ENGINEERING THERMODYNAMICS

OBJECTIVE:
- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.
  (Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)
UNIT I BASIC CONCEPTS AND FIRST LAW 9 + 6

UNIT II SECOND LAW AND AVAILABILITY ANALYSIS 9 + 6

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

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

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

TOTAL : 75 PERIODS

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

TEXT BOOKS :
REFERENCES:

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

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

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

UNIT II FLOW THROUGH CIRCULAR CONDUITS 12
Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-
Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation -friction
factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS 12
Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude -
Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV PUMPS 12
Impact of jets - Euler’s equation - Theory of roto-dynamic machines – various efficiencies- velocity
components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle
- work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary
pumps –classification.

UNIT V TURBINES 12
Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow
turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by
water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines
– governing of 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:

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 9
Sand Casting : Sand Mould – Type of patterns - Pattern Materials – Pattern allowances –Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Melting furnaces : 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 9
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 9
UNIT IV SHEET METAL PROCESSES

UNIT V MANUFACTURE OF PLASTIC COMPONENTS

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

TEXT BOOKS:

REFERENCES:

EE8353 ELECTRICAL DRIVES AND CONTROLS

OBJECTIVES:
- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives

UNIT I INTRODUCTION
Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors
UNIT II   DRIVE MOTOR CHARACTERISTICS
Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

UNIT III   STARTING METHODS
Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

UNIT IV   CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES
Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

UNIT V   CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES
Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

TOTAL: 45 PERIODS

OUTCOME:
• Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

TEXT BOOKS:

REFERENCES:

ME8361   MANUFACTURING TECHNOLOGY LABORATORY – I

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

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

TOTAL: 60 PERIODS
OUTCOMES:

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

CO1 Demonstrate the safety precautions exercised in the mechanical workshop.
CO2 Make the workpiece as per given shape and size using Lathe.
CO3 Join two metals using arc welding.
CO4 Use sheet metal fabrication tools and make simple tray and funnel.
CO5 Use different moulding tools, patterns and prepare sand moulds.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</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>1 No</td>
</tr>
<tr>
<td>4</td>
<td>Shaper</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Arc welding transformer with cables and holders</td>
<td>2 Nos</td>
</tr>
<tr>
<td>6</td>
<td>Oxygen and acetylene gas cylinders, blow pipe and other welding outfit</td>
<td>1 No</td>
</tr>
<tr>
<td>7</td>
<td>Moulding table, Moulding equipments</td>
<td>2 Nos</td>
</tr>
<tr>
<td>8</td>
<td>Sheet metal forming tools and equipments</td>
<td>2 Nos.</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To make the students understand and interpret drawings of machine components
- To prepare assembly drawings both manually and using standard CAD packages
- To familiarize the students with Indian Standards on drawing practices and standard components
- To gain practical experience in handling 2D drafting and 3D modeling software systems.

UNIT I DRAWING STANDARDS & FITS AND TOLERANCES
12

UNIT II INTRODUCTION TO 2D DRAFTING
16
- Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing.
- Bearings - Bush bearing, Plummer block
- Valves – Safety and non-return valves.

UNIT III 3D GEOMETRIC MODELING AND ASSEMBLY
32
- Couplings – Flange, Universal, Oldham’s, Muff, Gear couplings
- Joints – Knuckle, Gib & cotter, strap, sleeve & cotter joints
- Engine parts – Piston, connecting rod, cross-head (vertical and horizontal), stuffing box, multi-plate clutch
- Miscellaneous machine components – Screw jack, machine vice, tail stock, chuck, vane and gear pump

TOTAL: 60 PERIODS

Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D / 3D CAD software

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Follow the drawing standards, Fits and Tolerances
CO2 Re-create part drawings, sectional views and assembly drawings as per standards

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- To validate the principles studied in theory by performing experiments in the laboratory

LIST OF EXPERIMENTS
1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Study of DC & AC Starters

TOTAL: 60 PERIODS

OUTCOME:
- Ability to perform speed characteristic of different electrical machine

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>DC Shunt motor</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>DC Series motor</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>DC shunt motor-DC Shunt Generator set</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>DC Shunt motor-DC Series Generator set</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Single phase transformer</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Three phase alternator</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Three phase synchronous motor</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Three phase Squirrel cage Induction motor</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Three phase Slip ring Induction motor</td>
<td>1</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
OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- 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 solving algebraic and transcendental equations.
- To introduce the numerical techniques of solving algebraic and transcendental equations.
- To introduce the numerical techniques of solving algebraic and transcendental equations.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I  TESTING OF HYPOTHESIS  12
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 II  DESIGN OF EXPERIMENTS  12
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT III  SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS  12

UNIT IV  INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION  12
Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson’s 1/3 rules.

UNIT V  NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS  12

TOTAL : 60 PERIODS

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

- 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.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.
TEXT BOOKS:

REFERENCES:

ME8492  KINEMATICS OF MACHINERY L T P C
3 0 0 3

OBJECTIVES:
- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I  BASICS OF MECHANISMS 9

UNIT II  KINEMATICS OF LINKAGE MECHANISMS 9

UNIT III  KINEMATICS OF CAM MECHANISMS 9
UNIT IV GEARS AND GEAR TRAINS

UNIT V FRICTION IN MACHINE ELEMENTS
Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Discuss the basics of mechanism
CO2 Calculate velocity and acceleration in simple mechanisms
CO3 Develop CAM profiles
CO4 Solve problems on gears and gear trains
CO5 Examine friction in machine elements

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

ME8451 MANUFACTURING TECHNOLOGY – II

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

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

UNIT III   SHAPER, MILLING AND GEAR CUTTING MACHINES

UNIT IV   ABRASIVE PROCESS AND BROACHING
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

TOTAL : 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1  Explain the mechanism of material removal processes.
CO2  Describe the constructional and operational features of centre lathe and other special purpose lathes.
CO3  Describe the constructional and operational features of shaper, planner, milling, drilling, sawing and broaching machines.
CO4  Explain the types of grinding and other super finishing processes apart from gear manufacturing processes.
CO5  Summarize numerical control of machine tools and write a part program.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

UNIT I ALLOYS AND PHASE DIAGRAMS 9

UNIT II HEAT TREATMENT 9

UNIT III FERROUS AND NON-FERROUS METALS 9

UNIT IV NON-METALLIC MATERIALS 9
Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of Al₂O₃, SiC, Si₃N₄, PSZ and SIALON –Composites- Classifications- Metal Matrix and FRP - Applications of Composites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9

TOTAL: 45 PERIODS

OUTCOMES
Upon the completion of this course the students will be able to
CO1 Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification.
CO2 Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
CO3 Clarify the effect of alloying elements on ferrous and non-ferrous metals
CO4 Summarize the properties and applications of non metallic materials.
CO5 Explain the testing of mechanical properties.

TEXT BOOKS:
REFERENCES:

CE8395 STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS

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<th>C</th>
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<tr>
<td>3</td>
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<td>3</td>
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</tbody>
</table>

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:

ME8493 THERMAL ENGINEERING - I L T P C

OBJECTIVES:
- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic processes
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam.
- Turbines, Compressors and Refrigeration and Air conditioning systems
  (Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychrometric chart permitted)

UNIT I GAS AND STEAM POWER CYCLES 9

UNIT II RECIPROCATING AIR COMPRESSOR 9
Classification and comparison, working principle, work of compression - with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency. Multistage air compressor with intercooling. Working principle and comparison of Rotary compressors with reciprocating air compressors.

UNIT III INTERNAL COMBUSTION ENGINES AND COMBUSTION 9
UNIT IV INTERNAL COMBUSTION ENGINE PERFORMANCE AND SYSTEMS

UNIT V GAS TURBINES

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Apply thermodynamic concepts to different air standard cycles and solve problems.
CO2 Solve problems in single stage and multistage air compressors
CO3 Explain the functioning and features of IC engines, components and auxiliaries.
CO4 Calculate performance parameters of IC Engines.
CO5 Explain the flow in Gas turbines and solve problems.

TEXT BOOKS:

REFERENCES:

ME8462 MANUFACTURING TECHNOLOGY LABORATORY – II

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

LIST OF EXPERIMENTS:
1. Contour milling using vertical milling machine
2. Spur gear cutting in milling machine
3. Helical Gear Cutting in milling machine
4. Gear generation in hobbing machine
5. Gear generation in gear shaping machine
6. Plain Surface grinding
7. Cylindrical grinding
8. Tool angle grinding with tool and Cutter Grinder
9. Measurement of cutting forces in Milling / Turning Process
10. CNC Part Programming
OUTCOMES:
Upon the completion of this course the students will be able to
CO1  use different machine tools to manufacturing gears
CO2  Ability to use different machine tools to manufacturing gears.
CO3  Ability to use different machine tools for finishing operations
CO4  Ability to manufacture tools using cutter grinder
CO5  Develop CNC part programming

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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

CE8381  STRENGTH OF MATERIALS AND FLUID MECHANICS AND MACHINERY LABORATORY

OBJECTIVES:
• To study the mechanical properties of materials when subjected to different types of loading.
• To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

STRENGTH OF MATERIALS
LIST OF EXPERIMENTS
1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
10. Tempering- Improvement Mechanical properties Comparison

30
(i) Unhardened specimen
(ii) Quenched Specimen and
(iii) Quenched and tempered specimen.
11. Microscopic Examination of
   (i) Hardened samples and
   (ii) Hardened and tempered samples.

OUTCOME:
- Ability to perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.

LIST OF EQUIPMENT FOR 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>Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Torsion Testing Machine (60 NM Capacity)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Impact Testing Machine (300 J Capacity)</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Brinell Hardness Testing Machine</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Rockwell Hardness Testing Machine</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Spring Testing Machine for tensile and compressive loads (2500 N)</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Metallurgical Microscopes</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Muffle Furnace (800 C)</td>
<td>1</td>
</tr>
</tbody>
</table>

FLUID MECHANICS AND MACHINES LABORATORY

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

OUTCOMES:
Upon completion of this course, the students will be able to:
- Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
- Use the measurement equipments for flow measurement.
- Perform test 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>
</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

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

ME8595 THERMAL ENGINEERING – II L T P C
3 0 0 3

OBJECTIVES:
- To apply the thermodynamic concepts for Nozzles, Boilers, Turbines, and Refrigeration & Air Conditioning Systems.
- To understand the concept of utilising residual heat in thermal systems.

UNIT I STEAM NOZZLE
Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.

UNIT II BOILERS

UNIT III STEAM TURBINES
Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.

UNIT IV COGENERATION AND RESIDUAL HEAT RECOVERY

UNIT V REFRIGERATION AND AIR – CONDITIONING

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Solve problems in Steam Nozzle
CO2 Explain the functioning and features of different types of Boilers and auxiliaries and calculate performance parameters.
CO3 Explain the flow in steam turbines, draw velocity diagrams for steam turbines and solve problems.
CO4 Summarize the concept of Cogeneration, Working features of Heat pumps and Heat exchangers
CO5 Solve problems using refrigerant table / charts and psychrometric charts
TEXT BOOKS:

REFERENCES:

ME8593 DESIGN OF MACHINE ELEMENTS L T P C
3 0 0 3

OBJECTIVES
• To familiarize the various steps involved in the Design Process
• To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
• To learn to use standard practices and standard data
• To learn to use catalogues and standard machine components
• (Use of P S G Design Data Book is permitted)

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

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

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

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

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

TOTAL: 45 PERIODS
OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Explain the influence of steady and variable stresses in machine component design.
CO2 Apply the concepts of design to shafts, keys and couplings.
CO3 Apply the concepts of design to temporary and permanent joints.
CO4 Apply the concepts of design to energy absorbing members, connecting rod and crank shaft.
CO5 Apply the concepts of design to bearings.

TEXT BOOKS:

REFERENCES:

ME8501 METROLOGY AND MEASUREMENTS 3 0 0 3

OBJECTIVES:
• To provide knowledge on various Metrological equipments available to measure the dimension of the components.
• To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

UNIT I BASICS OF METROLOGY 9

UNIT II LINEAR AND ANGULAR MEASUREMENTS 9
UNIT III   ADVANCES IN METROLOGY

UNIT IV   FORM MEASUREMENT
Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

UNIT V   MEASUREMENT OF POWER, FLOW AND TEMPERATURE

TOTAL : 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Describe the concepts of measurements to apply in various metrological instruments
CO2 Outline the principles of linear and angular measurement tools used for industrial applications
CO3 Explain the procedure for conducting computer aided inspection
CO4 Demonstrate the techniques of form measurement used for industrial components
CO5 Discuss various measuring techniques of mechanical properties in industrial applications

TEXT BOOKS:

REFERENCES:

ME8594   DYNAMICS OF MACHINES

OBJECTIVES:
- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.
UNIT I FORCE ANALYSIS

UNIT II BALANCING

UNIT III FREE VIBRATION

UNIT IV FORCED VIBRATION

UNIT V MECHANISM FOR CONTROL

TOTAL : 60 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Calculate static and dynamic forces of mechanisms.
CO2 Calculate the balancing masses and their locations of reciprocating and rotating masses.
CO3 Compute the frequency of free vibration.
CO4 Compute the frequency of forced vibration and damping coefficient.
CO5 Calculate the speed and lift of the governor and estimate the gyroscopic effect on automobiles, ships and airplanes.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

LIST OF EXPERIMENTS
1. a) Study of gear parameters. 
   b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains. 
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms. 
   b) Kinematics of single and double universal joints. 
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system. 
   b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus. 
   c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum. 
4. Motorized gyroscope – Study of gyroscopic effect and couple. 
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors. 
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon 
   b) Multi degree freedom suspension system – Determination of influence coefficient. 
8. a) Determination of torsional natural frequency of single and Double Rotor systems.- Undamped and Damped Natural frequencies. 
   b) Vibration Absorber – Tuned vibration absorber. 
9. Vibration of Equivalent Spring mass system – undamped and damped vibration. 
11. a) Balancing of rotating masses. (b) Balancing of reciprocating masses. 
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses. 
   b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies. 
   c) Determination of transmissibility ratio using vibrating table. 

TOTAL: 60 PERIODS

OUTCOMES
Upon the completion of this course the students will be able to
CO1 Explain gear parameters, kinematics of mechanisms, gyroscopic effect and working of lab equipments. 
CO2 Determine mass moment of inertia of mechanical element, governor effort and range sensitivity, natural frequency and damping coefficient, torsional frequency, critical speeds of shafts, balancing mass of rotating and reciprocating masses, and transmissibility ratio. 

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>Cam follower setup.</td>
<td>1 No.</td>
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<tr>
<td>2</td>
<td>Motorised gyroscope.</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Governor apparatus - Watt, Porter, Proell and Hartnell governors.</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Whirling of shaft apparatus.</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Dynamic balancing machine.</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Two rotor vibration setup.</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Spring mass vibration system.</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>Torsional Vibration of single rotor system setup.</td>
<td>1 No.</td>
</tr>
<tr>
<td>9</td>
<td>Gear Models</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>Kinematic Models to study various mechanisms.</td>
<td>1 No.</td>
</tr>
<tr>
<td>11</td>
<td>Turn table apparatus.</td>
<td>1 No.</td>
</tr>
<tr>
<td>12</td>
<td>Transverse vibration setup of a) cantilever</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

**ME8512 THERMAL ENGINEERING LABORATORY**

**OBJECTIVES:**
- To study the value timing-V diagram and performance of IC Engines
- To study the characteristics of fuels/Lubricates used in IC Engines
- To study the Performance of steam generator/ turbine
- To study the heat transfer phenomena predict the relevant coefficient using implementation
- To study the performance of refrigeration cycle / components

**LIST OF EXPERIMENTS**

**I.C. ENGINE LAB**
2. Actual p-v diagrams of IC engines.
5. Morse Test on Multi-cylinder Petrol Engine.
6. Retardation Test on a Diesel Engine.
7. Determination of Flash Point and Fire Point of various fuels / lubricants.

**STEAM LAB**
1. Study on Steam Generators and Turbines.

**HEAT TRANSFER LAB:**
1. Thermal conductivity measurement using guarded plate apparatus.
2. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
4. Determination of heat transfer coefficient under forced convection from a tube.
5. Determination of Thermal conductivity of composite wall.
6. Determination of Thermal conductivity of insulating powder.
7. Heat transfer from pin-fin apparatus (natural & forced convection modes)
8. Determination of Stefan – Boltzmann constant.
10. Effectiveness of Parallel / counter flow heat exchanger.

**REFRIGERATION AND AIR CONDITIONING LAB**
1. Determination of COP of a refrigeration system
2. Experiments on Psychrometric processes
3. Performance test on a reciprocating air compressor
4. Performance test in a HC Refrigeration System
5. Performance test in a fluidized Bed Cooling Tower

**TOTAL: 60 PERIODS**
OUTCOMES:
Upon the completion of this course the students will be able to
CO1 conduct tests on heat conduction apparatus and evaluate thermal conductivity of materials.
CO2 conduct tests on natural and forced convective heat transfer apparatus and evaluate heat transfer coefficient.
CO3 conduct tests on radiative heat transfer apparatus and evaluate Stefan Boltzmann constant and emissivity.
CO4 conduct tests to evaluate the performance of parallel/counter flow heat exchanger apparatus and reciprocating air compressor.
CO5 conduct tests to evaluate the performance of refrigeration and airconditioning test rigs.

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>I.C Engine – 2 stroke and 4 stroke model</td>
<td>1 set</td>
</tr>
<tr>
<td>2</td>
<td>Apparatus for Flash and Fire Point</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>4-stroke Diesel Engine with mechanical loading.</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>4-stroke Diesel Engine with hydraulic loading.</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>4-stroke Diesel Engine with electrical loading.</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Multi-cylinder Petrol Engine</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Single cylinder Petrol Engine</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>Data Acquisition system with any one of the above engines</td>
<td>1 No.</td>
</tr>
<tr>
<td>9</td>
<td>Steam Boiler with turbine setup</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Guarded plate apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>2</td>
<td>Lagged pipe apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Natural convection-vertical cylinder apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Forced convection inside tube apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Composite wall apparatus</td>
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</tr>
<tr>
<td>6</td>
<td>Thermal conductivity of insulating powder apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Pin-fin apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>Stefan-Boltzmann apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>9</td>
<td>Emissivity measurement apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>Parallel/counter flow heat exchanger apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>11</td>
<td>Single/two stage reciprocating air compressor</td>
<td>1 No.</td>
</tr>
<tr>
<td>12</td>
<td>Refrigeration test rig</td>
<td>1 No.</td>
</tr>
<tr>
<td>13</td>
<td>Air-conditioning test rig</td>
<td>1 No.</td>
</tr>
</tbody>
</table>
OBJECTIVE:
- To familiar with different measurement equipments and use of this industry for quality inspection.

LIST OF EXPERIMENTS
2. Calibration and use of measuring instruments – depth micrometer, bore gauge, telescopic gauge
3. Measurement of linear dimensions using Comparators
4. Measurement of angles using bevel protractor and sine bar
5. Measurement of screw thread parameters – Screw thread Micrometers and Three wire method *(floating carriage micrometer)*
6. Measurement of gear parameters – disc micrometers, gear tooth vernier caliper
7. Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM)
8. Programming of CNC Coordinate Measuring Machines for repeated measurements of identical components
9. Non-contact (Optical) measurement using Toolmaker’s microscope / Profile projector and Video measurement system
10. Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc..) using stylus based instruments.
12. Measurement of force, torque and temperature

TOTAL: 60 PERIODS

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

CO1 Measure the gear tooth dimensions, angle using sine bar, straightness and flatness, thread parameters, temperature using thermocouple, force, displacement, torque and vibration.

CO2 Calibrate the vernier, micrometer and slip gauges and setting up the comparator for the inspection.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Micrometer</td>
<td>5</td>
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<tr>
<td>2</td>
<td>Vernier Caliper</td>
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<tr>
<td>3</td>
<td>Vernier Height Gauge</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Vernier depth Gauge</td>
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<tr>
<td>5</td>
<td>Slip Gauge Set</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Gear Tooth Vernier</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Sine Bar</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Floating Carriage Micrometer</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Profile Projector / Tool Makers Microscope</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Parallel / counter flow heat exchanger apparatus</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Mechanical / Electrical / Pneumatic Comparator</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Autocollimator</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Temperature Measuring Setup</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Force Measuring Setup</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Torque Measuring Setup</td>
<td>1</td>
</tr>
</tbody>
</table>
ME8651  DESIGN OF TRANSMISSION SYSTEMS  L  T  P  C
3  0  0  3

OBJECTIVES:
- To gain knowledge on the principles and procedure for the design of Mechanical power
  Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical
  elements
- To learn to use standard data and catalogues
  (Use of P S G Design Data Book permitted)

UNIT I    DESIGN OF FLEXIBLE ELEMENTS  9
Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire
ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT II   SPUR GEARS AND PARALLEL AXIS HELICAL GEARS  9
Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue
strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based
on strength and wear considerations – Pressure angle in the normal and transverse plane-
Equivalent number of teeth-forces for helical gears.

UNIT III  BEVEL, WORM AND CROSS HELICAL GEARS  9
Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth.
Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits-
terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the
worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross
helical gears.

UNIT IV   GEAR BOXES  9
Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding
mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh
gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for
automotive applications.

UNIT V   CAMS, CLUTCHES AND BRAKES  9
Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface
stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-
Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe
brake.

TOTAL : 45 PERIODS
OUTCOMES:
Upon the completion of this course the students will be able to
CO1 apply the concepts of design to belts, chains and rope drives.
CO2 apply the concepts of design to spur, helical gears.
CO3 apply the concepts of design to worm and bevel gears.
CO4 apply the concepts of design to gear boxes.
CO5 apply the concepts of design to cams, brakes and clutches

TEXT BOOKS:

REFERENCES:

ME8691 COMPUTER AIDED DESIGN AND MANUFACTURING

OBJECTIVES:
- To provide an overview of how computers are being used in mechanical component design
- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION
Product cycle- Design process- sequential and concurrent engineering- Computer aided design - CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - Line drawing -Clipping- viewing transformation-Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control - Introduction to CAD/CAM –CAD/CAM concepts —Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance

UNIT II GEOMETRIC MODELING
Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG andB-rep

UNIT III CAD STANDARDS
Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards.
UNIT IV  FUNDAMENTAL OF CNC AND PART PROGRAMING

Introduction to NC systems and CNC - Machine axis and Co-ordinate system- CNC machine tools-
Principle of operation CNC- Construction features including structure- Drives and CNC controllers-
2D and 3D machining on CNC- Introduction of Part Programming, types - Detailed Manual part
programming on Lathe & Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub
program and Macros- Introduction of CAM package.

UNIT V  CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM (FMS)

Group Technology(GT),Part Families–Parts Classification and coding–Simple Problems in Opitz Part
Coding system–Production flow Analysis–Cellular Manufacturing–Composite part concept–Types of
Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control–
Quantitative analysis in FMS

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

CO1 Explain the 2D and 3D transformations, clipping algorithm, Manufacturing models and
Metrics
CO2 Explain the fundamentals of parametric curves, surfaces and Solids
CO3 Summarize the different types of Standard systems used in CAD
CO4 Apply NC & CNC programming concepts to develop part programme for Lathe &
Milling Machines
CO5 Summarize the different types of techniques used in Cellular Manufacturing and FMS

TEXT BOOKS:

REFERENCES:
1. Chris McMahon and Jimmie Browne “CAD/CAM Principles”, "Practice and Manufacturing
3. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice” Pearson
Education -2003

ME8693 HEAT AND MASS TRANSFER

<table>
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<tr>
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OBJECTIVES:
- To understand the mechanisms of heat transfer under steady and transient conditions.
- To understand the concepts of heat transfer through extended surfaces.
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic
concepts of mass transfer.
(Use of standard HMT data book permitted)
UNIT I  CONDUCTION  9+6

UNIT II  CONVECTION  9+6

UNIT III  PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS  9+6

UNIT IV  RADIATION  9+6

UNIT V  MASS TRANSFER  9+6

TOTAL : 75 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1  Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problems
CO2  Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems
CO3  Explain the phenomena of boiling and condensation, apply LMTD and NTU methods of thermal analysis to different types of heat exchanger configurations and solve problems
CO4  Explain basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems
CO5  Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

UNIT I INTRODUCTION

UNIT II ONE-DIMENSIONAL PROBLEMS

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS
Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT V ISOPARAMETRIC FORMULATION

TOTAL : 45 PERIODS

OUTCOMES
CO1 Summarize the basics of finite element formulation.
CO2 Apply finite element formulations to solve one dimensional Problems.
CO3 Apply finite element formulations to solve two dimensional scalar Problems.
CO4 Apply finite element method to solve two dimensional Vector problems.
CO5 Apply finite element method to solve problems on iso parametric element and dynamic Problems.

TEXT BOOKS:
REFERENCES:

ME8694 HYDRAULICS AND PNEUMATICS

OBJECTIVES:
- To provide student with knowledge on the application of fluid power in process, construction and manufacturing industries.
- To provide students with an understanding of the fluids and components utilized in modern industrial fluid power system.
- To develop a measurable degree of competence in the design, construction and operation of fluid power circuits.

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS 9

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS 9

UNIT III HYDRAULIC CIRCUITS AND SYSTEMS 9
Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.

UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS 9
UNIT V TROUBLE SHOOTING AND APPLICATIONS

TOTAL:45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Explain the Fluid power and operation of different types of pumps.
CO2 Summarize the features and functions of Hydraulic motors, actuators and Flow control valves
CO3 Explain the different types of Hydraulic circuits and systems
CO4 Explain the working of different pneumatic circuits and systems
CO5 Summarize the various trouble shooting methods and applications of hydraulic and pneumatic systems.

TEXT BOOKS:

REFERENCES:

ME8681 CAD / CAM LABORATORY

OBJECTIVES:
- To gain practical experience in handling 2D drafting and 3D modelling software systems.
- To study the features of CNC Machine Tool.
- To expose students to modern control systems (Fanuc, Siemens etc.,)
- To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping.

LIST OF EXPERIMENTS
1. 3D GEOMETRIC MODELLING 30 PERIODS

List of Experiments
1. Introduction of 3D Modelling software
Creation of 3D assembly model of following machine elements using 3D Modelling software
2. Flange Coupling
3. Plummer Block
4. Screw Jack
5. Lathe Tailstock
6. Universal Joint
7. Machine Vice
8. Stuffing box
9. Crosshead
10. Safety Valves
11. Non-return valves
12. Connecting rod
13. Piston
14. Crankshaft
* Students may also be trained in manual drawing of some of the above components

   (i) Part Programming - CNC Machining Centre a) Linear Cutting.
   b) Circular cutting.
   (ii) Part Programming - CNC Turning Centre a) Straight, Taper and Radius Turning.
   b) Thread Cutting.

3. Computer Aided Part Programming
   e) CL Data and Post process generation using CAM packages.
   f) Application of CAPP in Machining and Turning Centre.

TOTAL: 60 PERIODS

OUTCOMES
CO1  Draw 3D and Assembly drawing using CAD software
CO2  Demonstrate manual part programming with G and M codes using CAM

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>HARDWARE</td>
<td></td>
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</tr>
<tr>
<td>1.</td>
<td>Computer Server</td>
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<tr>
<td>2.</td>
<td>Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server</td>
<td>30</td>
</tr>
<tr>
<td>3.</td>
<td>A3 size plotter</td>
<td>1</td>
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<tr>
<td>4.</td>
<td>Laser Printer</td>
<td>1</td>
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<tr>
<td>5.</td>
<td>CNC Lathe</td>
<td>1</td>
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<tr>
<td>6.</td>
<td>CNC milling machine</td>
<td>1</td>
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<tr>
<td>SOFTWARE</td>
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</tr>
<tr>
<td>7.</td>
<td>Any High end integrated modeling and manufacturing CAD / CAM software</td>
<td>15 licenses</td>
</tr>
<tr>
<td>8.</td>
<td>CAM Software for machining centre and turning centre (CNC Programming and tool path simulation for FANUC / Sinumeric and Heidenhain controller)</td>
<td>15 licenses</td>
</tr>
<tr>
<td>9.</td>
<td>Licensed operating system</td>
<td>Adequate</td>
</tr>
<tr>
<td>10.</td>
<td>Support for CAPP</td>
<td>Adequate</td>
</tr>
</tbody>
</table>
ME8682 DESIGN AND FABRICATION PROJECT L T P C

OBJECTIVE:
- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

GUIDELINE FOR REVIEW AND EVALUATION
The students may be grouped into 2 to 4 and work under a project supervisor. The device/system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 60 PERIODS

OUTCOMES:
 Upon the completion of this course the students will be able to
CO1 design and Fabricate the machine element or the mechanical product.
CO2 demonstrate the working model of the machine element or the mechanical product.

HS8581 PROFESSIONAL COMMUNICATION L T P C

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:

ME8792 POWER PLANT ENGINEERING

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<tr>
<td>3</td>
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<td>3</td>
</tr>
</tbody>
</table>

OBJECTIVE:
• Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS 9

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

UNIT III NUCLEAR POWER PLANTS 9
UNIT IV  POWER FROM RENEWABLE ENERGY
Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V  ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS
Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL : 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Explain the layout, construction and working of the components inside a thermal power plant.
CO2 Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.
CO3 Explain the layout, construction and working of the components inside nuclear power plants.
CO4 Explain the layout, construction and working of the components inside Renewable energy power plants.
CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

TEXT BOOK:

REFERENCES:

ME8793  PROCESS PLANNING AND COST ESTIMATION  L  T  P  C
3  0  0  3

OBJECTIVE:
• To introduce the process planning concepts to make cost estimation for various products after process planning

UNIT I  INTRODUCTION TO PROCESS PLANNING
Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT II  PROCESS PLANNING ACTIVITIES
Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies
UNIT III INTRODUCTION TO COST ESTIMATION

UNIT IV PRODUCTION COST ESTIMATION
Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION
Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 select the process, equipment and tools for various industrial products.
CO2 prepare process planning activity chart.
CO3 explain the concept of cost estimation.
CO4 compute the job order cost for different type of shop floor.
CO5 calculate the machining time for various machining operations.

TEXT BOOKS:

REFERENCES:

ME8791 MECHATRONICS

OBJECTIVE:
• To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

UNIT I INTRODUCTION
UNIT II  MICROPROCESSOR AND MICROCONTROLLER

UNIT III  PROGRAMMABLE PERIPHERAL INTERFACE

UNIT IV  PROGRAMMABLE LOGIC CONTROLLER
Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT V  ACTUATORS AND MECHATRONIC SYSTEM DESIGN

TOTAL : 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Discuss the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical, Electronic Systems and sensor technology.
CO2 Discuss the architecture of Microprocessor and Microcontroller, Pin Diagram, Addressing Modes of Microprocessor and Microcontroller.
CO3 Discuss Programmable Peripheral Interface, Architecture of 8255 PPI, and various device interfacing
CO4 Explain the architecture, programming and application of programmable logic controllers to problems and challenges in the areas of Mechatronic engineering.
CO5 Discuss various Actuators and Mechatronics system using the knowledge and skills acquired through the course and also from the given case studies

TEXT BOOKS:

REFERENCES:
2. Clarence W, de Silva, ”Mechatronics” CRC Press, First Indian Re-print, 2013
OBJECTIVES:
- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS A. SIMULATION
1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration
3. Mechanism Simulation using Multibody Dynamic software

B. ANALYSIS
1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
5. Thermal stress and heat transfer analysis of plates.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.

TOTAL: 60 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 simulate the working principle of air conditioning system, hydraulic and pneumatic cylinder and cam follower mechanisms using MATLAB.
CO2 analyze the stresses and strains induced in plates, brackets and beams and heat transfer problems.
CO3 calculate the natural frequency and mode shape analysis of 2D components and beams.

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>Computer Work Station</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>Color Desk Jet Printer</td>
<td>01</td>
</tr>
<tr>
<td>3</td>
<td>Multibody Dynamic Software Suitable for Mechanism simulation and analysis</td>
<td>15 licenses</td>
</tr>
<tr>
<td>4</td>
<td>C / MATLAB</td>
<td>5 licenses</td>
</tr>
</tbody>
</table>
OBJECTIVE:
- To know the method of programming the microprocessor and also the design, modeling & analysis of basic electrical, hydraulic & pneumatic Systems which enable the students to understand the concept of mechatronics.

LIST OF EXPERIMENTS:
2. Stepper motor interface.
4. Speed control of DC motor.
5. Study of various types of transducers.
7. Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.
8. Study of PLC and its applications.
9. Study of image processing technique.

TOTAL: 60 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Demonstrate the functioning of mechatronics system with various pneumatic, hydraulic and electrical systems.
CO2 Demonstrate the functioning of control systems with the help of PLC and microcontrollers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control each</td>
<td>1 No.</td>
</tr>
<tr>
<td>2</td>
<td>Basic Hydraulic Trainer Kit</td>
<td>1 No</td>
</tr>
<tr>
<td>3</td>
<td>Hydraulics and Pneumatics Systems Simulation Software</td>
<td>10 No</td>
</tr>
<tr>
<td>4</td>
<td>8051 - Microcontroller kit with stepper motor and drive circuit sets</td>
<td>2 No</td>
</tr>
<tr>
<td>5</td>
<td>Image processing system with hardware &amp; software</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

ME8712 TECHNICAL SEMINAR

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
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:
OBJECTIVE:
- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 300 PERIODS

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

OBJECTIVES:
- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system.

UNIT I VEHICLE STRUCTURE AND ENGINES 9
Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines -components-functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS 9
Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS 9
Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9
Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.
UNIT V ALTERNATIVE ENERGY SOURCES

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 recognize the various parts of the automobile and their functions and materials.
CO2 discuss the engine auxiliary systems and engine emission control.
CO3 distinguish the working of different types of transmission systems.
CO4 explain the Steering, Brakes and Suspension Systems.
CO5 predict possible alternate sources of energy for IC Engines.

TEXT BOOKS:

REFERENCES:

PR8592 WELDING TECHNOLOGY L T P C 3 0 0 3

OBJECTIVE:
• To understand the basics of welding and to know about the various types of welding processes

UNIT I GAS AND ARC WELDING PROCESSES:
Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes - advantages, limitations and applications.

UNIT II RESISTANCE WELDING PROCESSES:
Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

UNIT III SOLID STATE WELDING PROCESSES:
Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.
UNIT IV OTHER WELDING PROCESSES: 9

UNIT V DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS 9
Various weld joint designs – Welding defects – causes and remedies - Weldability of Aluminium, Copper, and Stainless steels. Destructive and non destructive testing of weldments.

OUTCOMES:
Upon completion of this course, the students can able
- Understand the construction and working principles of gas and arc welding process.
- Understand the construction and working principles of resistance welding process.
- Understand the construction and working principles of various solid state welding process.
- Understand the construction and working principles of various special welding processes.
- Understand the concepts on weld joint design, weldability and testing of weldments.

TEXT BOOKS

REFERENCES

ME8096 GAS DYNAMICS AND JET PROPULSION L T P C 3 0 0 3

OBJECTIVES:
- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.
  (Use of Standard Gas Tables permitted)

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 9
Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers

UNIT II FLOW THROUGH DUCTS 9
Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties.
UNIT III NORMAL AND OBLIQUE SHOCKS
Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications.

UNIT IV JET PROPULSION
Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V SPACE PROPULSION

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Apply the concept of compressible flows in variable area ducts.
CO2 Apply the concept of compressible flows in constant area ducts.
CO3 examine the effect of compression and expansion waves in compressible flow.
CO4 use the concept of gas dynamics in Jet Propulsion.
CO5 apply the concept of gas dynamics in Space Propulsion.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

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

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

UNIT I INTRODUCTION
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.

OUTCOME:
• Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

REFERENCES

GE8073 FUNDAMENTALS OF NANOSCIENCE

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

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

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

UNIT III NANOMATERIALS
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-
functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES

UNIT V APPLICATIONS

TOTAL : 45 PERIODS

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

TEXT BOOKS :

REFERENCES:

ME8071 REFRIGERATION AND AIR CONDITIONING L T P C
3 0 0 3

OBJECTIVES:
- To understand the underlying principles of operations in different Refrigeration & Air conditioning systems and components.
- To provide knowledge on design aspects of Refrigeration & Air conditioning systems

UNIT I INTRODUCTION
Introduction to Refrigeration - Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification - Nomenclature - ODP & GWP.

UNIT II VAPOUR COMPRESSION REFRIGERATION SYSTEM
UNIT III OTHER REFRIGERATION SYSTEMS
Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration - Magnetic - Vortex and Pulse tube refrigeration systems.

UNIT IV PSYCHROMETRIC PROPERTIES AND PROCESSES
Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams.

UNIT V AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION
Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls.

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Explain the basic concepts of Refrigeration
CO2 Explain the Vapor compression Refrigeration systems and to solve problems
CO3 Discuss the various types of Refrigeration systems
CO4 Calculate the Psychrometric properties and its use in psychrometric processes
CO5 Explain the concepts of Air conditioning and to solve problems

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- At the end of the course, the students are expected to identify the new methodologies /technologies for effective utilization of renewable energy sources.

UNIT I INTRODUCTION

UNIT II SOLAR ENERGY

UNIT III WIND ENERGY

UNIT IV BIO - ENERGY

UNIT V OTHER RENEWABLE ENERGY SOURCES

TOTAL : 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Discuss the importance and Economics of renewable Energy
CO2 Discuss the method of power generation from Solar Energy
CO3 Discuss the method of power generation from Wind Energy
CO4 Explain the method of power generation from Bio Energy

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To introduce the concept of SQC
- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES
Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation – Theory of control chart- uses of control chart –X chart, R chart and chart - process capability – process capability studies and simple problems. Six sigma concepts

UNIT II PROCESS CONTROL FOR ATTRIBUTES
Control chart for attributes –control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III ACCEPTANCE SAMPLING

UNIT IV LIFE TESTING – RELIABILITY

UNIT V QUALITY AND RELIABILITY
Note: Use of approved statistical table permitted in the examination.

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Summarize the concept of Quality and Process control for variables
CO2 Apply the process control for attributes
CO3 Explain the concept of sampling and to solve problems
CO4 Explain the concept of Life testing
CO5 Explain the concept Reliability and techniques involved

TEXT BOOKS:
REFERENCES:

ME8073 UNCONVENTIONAL MACHINING PROCESSES L T P C
3 0 0 3

OBJECTIVE:
• To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9

UNIT II THERMAL AND ELECTRICAL ENERGY BASED PROCESSES 9

UNIT III CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9

UNIT IV ADVANCED NANO FINISHING PROCESSES 9
Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT V RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES 9
Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Explain the need for unconventional machining processes and its classification
CO2 Compare various thermal energy and electrical energy based unconventional machining processes.
CO3 Summarize various chemical and electro-chemical energy based unconventional machining processes.
CO4 Explain various nano abrasives based unconventional machining processes.
CO5 Distinguish various recent trends based unconventional machining processes.
TEXT BOOKS:

REFERENCES:

MG8491 OPERATIONS RESEARCH

OBJECTIVE:
- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS 15

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS 8

UNIT III INVENTORY MODELS 6
Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS 6
Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS 10

TOTAL: 45 PERIODS

OUTCOME:
- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOK:
REFERENCES:

MF8071 ADDITIVE MANUFACTURING L T P C
3 0 0 3

OBJECTIVES:
• To know the principle, methods, possibilities and limitations as well as environmental effects of Additive Manufacturing technologies.
• To be familiar with the characteristics of the different materials those are used in Additive Manufacturing technologies.

UNIT I INTRODUCTION 9

UNIT II DESIGN FOR ADDITIVE MANUFACTURING 9

UNIT III PHOTOPOLYMERIZATION AND POWDER BED FUSION PROCESSES 9

UNIT IV EXTRUSION BASED AND SHEET LAMINATION PROCESSES 9

UNIT V PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES 9

TOTAL: 45 PERIODS
OUTCOME:
- On completion of this course, students will learn about a working principle and construction of Additive Manufacturing technologies, their potential to support design and manufacturing, modern development in additive manufacturing process and case studies relevant to mass customized manufacturing.

TEXT BOOKS:

REFERENCES:

GE8077 TOTAL QUALITY MANAGEMENT

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

UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
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
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
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY MANAGEMENT SYSTEM

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

ME8099 ROBOTICS

OBJECTIVES:
- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I  FUNDAMENTALS OF ROBOT
Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II  ROBOT DRIVE SYSTEMS AND END EFFECTORS
Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III  SENSORS AND MACHINE VISION
UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 9
Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 9
RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Explain the concepts of industrial robots, classification, specifications and coordinate systems. Also summarize the need and application of robots in different sectors.
CO2 Illustrate the different types of robot drive systems as well as robot end effectors.
CO3 Apply the different sensors and image processing techniques in robotics to improve the ability of robots.
CO4 Develop robotic programs for different tasks and familiarize with the kinematics motions of robot.
CO5 Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.

TEXT BOOKS:

REFERENCES:

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

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

UNIT I LOCATING AND CLAMPING PRINCIPLES: 9
UNIT II  JIGS AND FIXTURES
Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III  PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES

UNIT IV  BENDING AND DRAWING DIES

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

TOTAL: 45 PERIODS

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

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

TEXT BOOKS:

REFERENCES:
1. ASTM Fundamentals of Tool Design Prentice Hall of India.
OBJECTIVES:
- To introduce Governing Equations of viscous fluid flows
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

UNIT I  GOVERNING EQUATIONS AND BOUNDARY CONDITIONS  9

UNIT II  FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION  9

UNIT III  FINITE VOLUME METHOD FOR CONVECTION DIFFUSION  9
Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT IV  FLOW FIELD ANALYSIS  9

UNIT V  TURBULENCE MODELS AND MESH GENERATION  9

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Derive the governing equations and boundary conditions for Fluid dynamics
CO2 Analyze Finite difference and Finite volume methods for Diffusion
CO3 Analyze Finite volume method for Convective diffusion
CO4 Analyze Flow field problems
CO5 Explain and solve the Turbulence models and Mesh generation techniques

TEXT BOOKS:
REFERENCES:

ME8097 NON DESTRUCTIVE TESTING AND EVALUATION  L  T  P  C
3  0  0  3

OBJECTIVE:
- To study and understand the various Non Destructive Evaluation and Testing methods, theory and their industrial applications.

UNIT I OVERVIEW OF NDT
NDT Versus Mechanical testing. Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT, Visual inspection – Unaided and aided.

UNIT II SURFACE NDE METHODS

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET)

UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE)

UNIT V RADIOGRAPHY (RT)
Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square law, characteristics of films - graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

TOTAL : 45 PERIODS
OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Explain the fundamental concepts of NDT
CO2 Discuss the different methods of NDE
CO3 Explain the concept of Thermography and Eddy current testing
CO4 Explain the concept of Ultrasonic Testing and Acoustic Emission
CO5 Explain the concept of Radiography

TEXT BOOKS:

REFERENCES:

ME8092 COMPOSITE MATERIALS AND MECHANICS  L  T  P  C
3  0  0  3

OBJECTIVES:
• To understand the fundamentals of composite material strength and its mechanical behavior
• Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
• Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
• Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING
UNIT II       FLAT PLATE LAMINATE CONSTITUTE EQUATIONS  

UNIT III      LAMINA STRENGTH ANALYSIS  

UNIT IV       THERMAL ANALYSIS  

UNIT V       ANALYSIS OF LAMINATED FLAT PLATES  

TOTAL: 45 PERIODS

OUTCOMES:  
Upon the completion of this course the students will be able to
CO1 Summarize the various types of Fibers, Equations and manufacturing methods for Composite materials
CO2 Derive Flat plate Laminate equations
CO3 Analyze Lamina strength
CO4 Analyze the thermal behavior of Composite laminates
CO5 Analyze Laminate flat plates

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them into design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT


UNIT II REQUIREMENTS AND SYSTEM DESIGN


UNIT III DESIGN AND TESTING


UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT


UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY


TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of the course, the students will be able to:

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES:

GE8074 HUMAN RIGHTS L T P C

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

UNIT I

UNIT II

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

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

UNIT V

TOTAL : 45 PERIODS
OUTCOME:
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

GE8071 DISASTER MANAGEMENT

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.

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

UNIT IV PRODUCTION SCHEDULING

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

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

TEXT BOOKS:

REFERENCES:
5. Melynk, Denzler, " Operations management – A value driven approach” Irwin Mcgraw hill.
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

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:
OBJECTIVE:
- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING

UNIT III CELLULAR MANUFACTURING

UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS)

UNIT V INDUSTRIAL ROBOTICS

OUTCOMES:
CO1 Explain the basic concepts of CAD, CAM and computer integrated manufacturing systems
CO2 Summarize the production planning and control and computerized process planning
CO3 Differentiate the different coding systems used in group technology
CO4 Explain the concepts of flexible manufacturing system (FMS) and automated guided vehicle (AGV) system
CO5 Classification of robots used in industrial applications

TOTAL : 45 PERIODS
TEXT BOOKS:

REFERENCES:

ME8074 VIBRATION AND NOISE CONTROL

OBJECTIVE:
• The student will be able to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of the components

UNIT I BASICS OF VIBRATION 9
Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT II BASICS OF NOISE 9
Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT III AUTOMOTIVE NOISE SOURCES 9

UNIT IV CONTROL TECHNIQUES 9
Vibration isolation, tuned absorbers, un-tuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCE OF NOISE AND CONTROL 9
Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

TOTAL: 45 PERIODS
OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Summarize the Basics of Vibration
CO2 Summarize the Basics of Noise
CO3 Explain the Sources of Automotive Noise
CO4 Discuss the Control techniques for vibration
CO5 Describe the sources and control of Noise

TEXT BOOK:

REFERENCES:

EE8091  MICRO ELECTRO MECHANICAL SYSTEMS  L  T  P  C
3  0  0  3

OBJECTIVES
• To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
• To educate on the rudiments of Micro fabrication techniques.
• To introduce various sensors and actuators
• To introduce different materials used for MEMS
• To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I  INTRODUCTION  9

UNIT II  SENSORS AND ACTUATORS-I  9

UNIT III  SENSORS AND ACTUATORS-II  9
UNIT IV  MICROMACHINING

UNIT V  POLYMER AND OPTICAL MEMS
Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL : 45 PERIODS

OUTCOMES
- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.
- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

REFERENCES:
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
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for
others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation –
Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and
meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS
Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral dilemmas –
Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Models of
professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of
Ethical Theories.

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

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk -
Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational
Discrimination.

UNIT V GLOBAL ISSUES
Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors –
Moral Leadership –Code of Conduct – Corporate Social Responsibility.

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:
New Delhi, 2004.
2003.

REFERENCES:
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity
Web sources:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org