1. PROGRAMME EDUCATIONAL OBJECTIVES:
Bachelor of Mechatronics Engineering curriculum is designed to prepare the graduates having attitude and knowledge to
1. Develop innovative and sustainable products with multidisciplinary Engineering expertise.
2. Solve complex engineering problems by applying mechanical, electrical and computer knowledge and engage in lifelong learning in their profession.
3. Work or pursue higher education in multicultural, multilingual and multinational environment with competent oral and written communication.
4. Lead and contribute in a team entrusted with professional, social and ethical responsibilities.

2. PROGRAMME OUTCOMES:
a. Will be able to apply the laws of science and mathematics to provide engineering solutions to solve complex problems.
b. Will be able to identify and analyze complex problems by modeling with the help of literature survey and validate the solution with experiments.
c. Will be able to design and develop Mechatronics systems by selecting and integrating, sensors, appropriate materials, mechanics, thermal systems, manufacturing and automation methods.
d. Will be able to collect, condition monitor and interpret data to provide engineering solutions.
e. Will be able to create applications, products as well as modernizing the existing systems by using latest tools and technologies.
f. Will be able to develop solutions for local and global requirements by applying engineering knowledge and professional ethics.
g. Will have professional values on environmental and energy consumption for sustainability.
h. Will be able to become a leader and contribute in a team with entrepreneurial qualities.
i. Will be able to interact effectively in both oral and written format.
j. Will continuously update their knowledge and skills to meet the ever changing global needs.

3. PEO / PO Mapping

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ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.E. MECHATRONICS ENGINEERING
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS CURRICULA AND SYLLABI

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<td>1.</td>
<td>EC8093</td>
<td>Digital Image Processing</td>
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#### SEMESTER VIII, ELECTIVE IV

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### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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<tr>
<td>1.</td>
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### SUMMARY

#### B.E. MECHATRONICS ENGINEERING

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<th>Subject Area</th>
<th>Credits Per Semester</th>
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<td>III</td>
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<td>2. Basic Sciences (BS)</td>
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<td>3. Engineering Sciences (ES)</td>
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<td>4. Professional Core (PC)</td>
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<td>5. Professional Electives (PE)</td>
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<td>6. Open Electives (OE)</td>
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<td>7. Project Work (PR/EEC)</td>
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8. **Non-Credit/ (Mandatory)**
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- comprehending longer texts- reading different types of texts- magazines Writing-letter writing, informal or personal letters-e-mails-conventions of personal email- Listening- listening to-dialogues or conversations and completing exercises based on them. Speaking- speaking about oneself- speaking about one's friend- Language development- Tenses- simple present-simple past-present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs.

UNIT V  EXTENDED WRITING  12

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

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

TEXT BOOKS:


REFERENCES

3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student’s Book & Workbook) Cambridge University Press, New Delhi: 2005
UNIT IV  MULTIPLE INTEGRALS  12

UNIT V  DIFFERENTIAL EQUATIONS  12

TOTAL : 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following skills:

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

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

REFERENCES:
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
Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture
of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel. Combustion of fuels: Introduction - caloric value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

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 – H_2-O_2 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:
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
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
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
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
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
Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

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

TOTAL: 90 PERIODS
TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

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

COURSE 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) 0 0 4 2

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

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

TOTAL: 30 PERIODS

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

- apply principles of elasticity, optics and thermal properties for engineering applications.
CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:

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

1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:

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

TOTAL: 30 PERIODS

TEXTBOOKS:

OBJECTIVES:
The Course prepares second semester Engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

UNIT I  INTRODUCTION TECHNICAL ENGLISH  12

UNIT II  READING AND STUDY SKILLS  12
Listening- Listening to longer technical talks and completing exercises based on them-Speaking – describing a process-Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting ccharts, graphs- Vocabulary Development-vocabulary used in formal letters/emails and reports Language Development- impersonal passive voice, numerical adjectives.

UNIT III  TECHNICAL WRITING AND GRAMMAR  12
Listening- Listening to classroom lectures/ talks on engineering/technology -Speaking – introduction to technical presentations- Reading – longer texts both general and technical, practice in speed reading; Writing-Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words. Language Development- embedded sentences

UNIT IV  REPORT WRITING  12

UNIT V  GROUP DISCUSSION AND JOB APPLICATIONS  12
Listening- TED/Ink talks; Speaking – participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting- accident and survey- Vocabulary Development- verbal analogies Language Development- reported speech

TOTAL : 60 PERIODS

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

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.
TEXT BOOKS:

REFERENCES

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

MA8251 ENGINEERING MATHEMATICS - II

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

UNIT I MATRICES

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

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

UNIT IV COMPLEX INTEGRATION
UNIT V LAPLACE TRANSFORMS

TOTAL: 60 PERIODS

OUTCOMES:
After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.
- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green’s theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS:

REFERENCES:

MATERIALS SCIENCE
PH8251 (Common to courses offered in Faculty of Mechanical Engineering 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

UNIT V  NEW MATERIALS

TOTAL : 45 PERIODS

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

TEXT BOOKS:

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

UNIT I  ELECTRICAL CIRCUITS

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

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

UNIT IV  ELECTRONIC DEVICES & CIRCUITS

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

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

TEXT BOOKS
REFERENCES

GE8291  ENVIRONMENTAL SCIENCE AND ENGINEERING  L T P C  3 0 0 3

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

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY  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 POPULATON 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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

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

UNIT I  STATICS OF PARTICLES  

UNIT II  EQUILIBRIUM OF RIGID BODIES  
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  

UNIT IV  DYNAMICS OF PARTICLES  

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

OUTCOMES:

On successful completion of this course, the student will be able to

- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

TEXT BOOKS:
REFERENCES:

GE8261 ENGINEERING PRACTICES LABORATORY

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

GROUP A (CIVIL & MECHANICAL)

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

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

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

II MECHANICAL ENGINEERING PRACTICE

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

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

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

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

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

GROUP B (ELECTRICAL & ELECTRONICS)

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

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

TOTAL: 60 PERIODS

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

MECHANICAL

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

ELECTRICAL

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

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply
OBJECTIVE:
- To train the students in performing various tests on electrical drives, sensors and circuits.

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

Minimum of 10 Experiments to be carried out :-

TOTAL: 60 PERIODS

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

<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  L T P C
4 0 0 4

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

UNIT I  PARTIAL DIFFERENTIAL EQUATIONS  12
Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II  FOURIER SERIES  12

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  12
Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV  FOURIER TRANSFORMS  12

UNIT V  Z - TRANSFORMS AND DIFFERENCE EQUATIONS  12

TOTAL : 60 PERIODS

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

REFERENCES :

CE8395 STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS L T P C 3 0 0 3
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 9

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

UNIT III TORSION 9
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 9
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:

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
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

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

UNIT V  TURBINES

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.

TOTAL: 60 PERIODS

TEXT BOOK:

REFERENCES:

EC8392  DIGITAL ELECTRONICS

OBJECTIVES:
- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
- To explain the various semiconductor memories and related technology
- To introduce the electronic circuits involved in the making of logic gates

UNIT I  DIGITAL FUNDAMENTALS
Number Systems – Decimal, Binary, Octal, Hexadecimal, 1’s and 2’s complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.
UNIT II  COMBINATIONAL CIRCUIT DESIGN  9

UNIT III  SYNCHRONOUS SEQUENTIAL CIRCUITS  9

UNIT IV  ASYNCHRONOUS SEQUENTIAL CIRCUITS  9
Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits.

UNIT V  MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS  9
Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL.

Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics-RTL, TTL, ECL, CMOS

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course:

- Use digital electronics in the present contemporary world
- Design various combinational digital circuits using logic gates
- Do the analysis and design procedures for synchronous and asynchronous sequential circuits
- Use the semiconductor memories and related technology
- Use electronic circuits involved in the design of logic gates

TEXT BOOK:

REFERENCES
OBJECTIVES:
- To understand the working principle and performance characteristics of DC Generator and DC Motor.
- To understand the working principle of induction motor and synchronous machines.
- To provide knowledge in the area of special electrical machines and drives.

UNIT I   ELECTRICAL CIRCUITS AND TRANSFORMERS  6

UNIT II   ELECTRICAL MOTORS  12
Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor.

UNIT III   SPEED CONTROL AND STARTING  9

UNIT IV   ELECTRICAL DRIVES  9
Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.

UNIT V   SOLID STATE DRIVES (QUALITATIVE TREATMENT ONLY)  9

TOTAL   45 PERIODS

OUTCOMES:
After successful completion of this course, the students should be able to
CO1: Get the basic knowledge about the Electric circuits and transformers.
CO2: Understand the various types of electrical motors.
CO3: Know about speed control and starting methods DC and induction motors.
CO4: Understand about various types of electrical drives.
CO5: Get exposure with solid state drives.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To understand the basic principle of switching devices
- To study various types of amplifiers.
- To understand the various functionalities of ICs and Waveform generators.
- To study the characteristics of various electronic devices.

UNIT I  ANALOG ELECTRONICS

Switching Devices: SCR, TRIAC, JFET, MOSFET - Rectifiers and Filters - Regulated Power Supply – Switching Power Supplies, Thermal Considerations - Feedback and power amplifiers - Oscillators: Colpitts oscillator, Hartley oscillator and Wien bridge oscillator

UNIT II  OPERATIONAL AMPLIFIERS AND APPLICATIONS


UNIT III  WAVEFORM GENERATORS AND ICs

Triangular, Saw tooth and Sine wave generators - Multivibrators - Function generator ICs – Timer ICs – Voltage regulator ICs: fixed, Adjustable and General purpose - V/F and F/V convertors – Optocouplers

UNIT IV  TEST AND MEASURING INSTRUMENTS

Measurement of voltage, current ,frequency and power using Multi meters , oscilloscopes, recorders, data loggers, signal sources, counters, analyzers and printers.

UNIT V  DISPLAY DEVICES

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Photo transistor, Solar cell, CCD

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: Apply the various switching devices in electronic circuits.
CO2: Work with various applications of amplifiers
CO3: Design various circuits using ICs.
CO4: Test and measure different parameters available in electronic circuits.
CO5: Explain the principles of various display devices.

TEXT BOOKS:


REFERENCES

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
    (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.

TOTAL: 60 PERIODS

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>
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<tr>
<td>2</td>
<td>Venturi meter setup</td>
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<tr>
<td>3</td>
<td>Rotameter setup</td>
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<tr>
<td>4</td>
<td>Pipe Flow analysis setup</td>
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<tr>
<td>5</td>
<td>Centrifugal pump/submergible pump setup</td>
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<tr>
<td>6</td>
<td>Reciprocating pump setup</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Gear pump setup</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Pelton wheel setup</td>
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<tr>
<td>9</td>
<td>Francis turbine setup</td>
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<tr>
<td>10</td>
<td>Kaplan turbine setup</td>
<td>1</td>
</tr>
</tbody>
</table>

MT8311 ELECTRICAL MACHINES AND DRIVES LABORATORY

OBJECTIVES:
• To familiarize the basic concepts of electrical circuits and associated theorems.
• To understand the fundamentals of DC shunt motors and induction motors.
• To understand the load test and performance characteristics of DC shunt motor, stepper motor and induction motors.

LIST OF EXPERIMENTS
1. Load test on D.C. shunt motor.
2. Speed control of D.C. shunt motor.
3. Swinburne’s test.
4. Load test on three phase induction motor.
5. No load and blocked rotor tests on three – phase induction motor.
7. No load and blocked rotor tests on single phase induction motor.
8. Load test on Synchronous motors.

TOTAL: 60 PERIODS
OUTCOMES:
Upon Completion of the course, the students will be able to:
CO1: Test and assess the performances of the DC motors and single phase AC motor for varying load.
CO2: Control the speed of AC and DC motor.
CO3: Analyze and present the findings of experimental observations in both written and oral format.

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>Shunt motor 5HP</td>
<td>3</td>
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<tr>
<td>2</td>
<td>Single phase Induction Motor 2HP</td>
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</tr>
<tr>
<td>3</td>
<td>Three phase induction Motor 5HP</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Single phase transformer 2KVA</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Three phase auto transformer</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Single phase auto transformer</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>3 point starter</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>DPST, TPST Each</td>
<td>2</td>
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<tr>
<td>9</td>
<td>DC source 300v, 100A</td>
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<tr>
<td>10</td>
<td>Ammeter(0-5A),(0-10A) MC Each</td>
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<tr>
<td>11</td>
<td>Ammeter(0-5A),(0-10A) MI Each</td>
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<tr>
<td>12</td>
<td>Voltmeter(0-300V) MC</td>
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<tr>
<td>13</td>
<td>Voltmeter(0-150V),(0-300V),(0-600V)MI Each</td>
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<td>14</td>
<td>Wattmeter 150/300V, 5/10A UPF</td>
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<td>Wattmeter 300/600V,5/10A UPF</td>
<td>2</td>
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<tr>
<td>16</td>
<td>Wattmeter 150/300V,5/10A LPF</td>
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</tr>
<tr>
<td>17</td>
<td>Wattmeter 300/600V,5/10A LPF</td>
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<tr>
<td>18</td>
<td>Stepper motor 5Kg</td>
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<tr>
<td>19</td>
<td>Synchronous motor 5KW</td>
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<td>20</td>
<td>Rheostat 360 ohm/1.2A</td>
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<td>21</td>
<td>Tachometer</td>
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</tr>
<tr>
<td>22</td>
<td>Rheostat 50 ohm/5A</td>
<td>3</td>
</tr>
</tbody>
</table>

HS8381    INTERPERSONAL SKILLS/LISTENING & SPEAKING  L  T  P  C
0  0  2  1

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.

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
MA8452 STATISTICS AND NUMERICAL METHODS

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 interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

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

UNIT II DESIGN OF EXPERIMENTS
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

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

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

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:

ME8392 MANUFACTURING TECHNOLOGY L T P C 3 0 0 3

OBJECTIVE:
- The automobile components such as piston, connecting rod, crankshaft, engine block, front axle, frame, body etc., are manufactured by various types of production processes involving casting, welding, machining, metal forming, power metallurgy etc.

UNIT I CASTING 8
Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding, special moulding processes – CO2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects.

UNIT II WELDING 8

UNIT III MACHINING 13
General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.
UNIT IV FORMING AND SHAPING OF PLASTICS

UNIT V METAL FORMING AND POWDER METALLURGY
Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

OUTCOME:
• The Students can able to use different manufacturing process and use this in industry for component production

TEXT BOOKS

REFERENCES

MT8491 MICROPROCESSORS AND MICROCONTROLLERS
OBJECTIVES:
Through the use of assembly language, by the end of the course students will become thoroughly familiar with the elements of microprocessor and microcontroller software and hardware. They will be able to:
• Understand fundamental operating concepts behind microprocessors and microcontrollers.
• Emphasis on the hardware features of Microprocessor 8085, 8086 and Microcontroller 8051 with their functions
• Understand commonly used peripheral / interfacing

UNIT I 8085 PROCESSOR
UNIT II  
PROGRAMMING OF 8085 PROCESSOR  
9
Instruction - format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions - stack.

UNIT III  
8051 MICRO CONTROLLER  
9

UNIT IV  
PERIPHERAL INTERFACING  
9
Introduction on Architecture, configuration and interfacing, with ICs: 8255 , 8259 , 8254,8237,8251, 8279 ,- A/D and D/A converters.

UNIT V  
MICRO CONTROLLER PROGRAMMING & APPLICATIONS  
9

TOTAL :45 PERIODS

OUTCOMES:
On the successful completion of the course, students will be able to
CO1: Distinguish the feature of the 8085 microprocessor, Hardware Architecture and PIN diagram.
CO2: Demonstrate programming proficiency using the various addressing modes and data transfer instructions of 8085 microprocessor
CO3: Acquaint the knowledge on architecture and programming of Microcontroller 8051.
CO4: Illustrate the interrupts handling and demonstrate peripherals applications in different IC and Know about A/D and D/A converters.
CO5:Apply the programming concepts to interface the hardware units with microprocessor and Microcontroller

TEXT BOOKS:

REFERENCES:
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 9

UNIT V FRICTION IN MACHINE ELEMENTS 9
Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

TOTAL: 45 PERIODS

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
TEXT BOOKS:

REFERENCES:

MT8401 THERMODYNAMICS AND HEAT TRANSFER L T P C
3 0 0 3

OBJECTIVE:
To acquire knowledge on laws of thermodynamics, types of I.C engines, refrigeration techniques, air conditioning system and heat transfer concepts, principles and mechanism for physical systems.

UNIT I FIRST LAW OF THERMODYNAMICS 8
Thermodynamics – microscopic and macroscopic point of view – systems, properties, process, path, cycle. Units – pressure, temperature – Zeroth law. First law – application to closed and open systems, internal energy, specific heat capacities C_v and C_p – enthalpy

UNIT II SECOND LAW OF THERMODYNAMICS 8

UNIT III INTERNAL COMBUSTION ENGINES(Qualitative Treatment Only) 12
Classification of IC engine - IC engine components and functions. Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines, Comparison of petrol & diesel engine, Fuel supply systems, total fuel consumption, specific fuel consumption, mechanical efficiency, BHP, IHP, FP - Ignition Systems, Lubrication system, Cooling system, MPFI, DTSI, CRDI.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 8
Principles of refrigeration, refrigerator & heat pump cycle, refrigerants, refrigerant properties, refrigerant selection, vapour compression refrigeration cycle, vapour absorption cycle, dry bulb temperature, wet bulb temperature, relative humidity, comfort air-conditioning, Psychrometric chart, humidification, de-humidification, air coolers, cooling towers.

UNIT V HEAT TRANSFER (Qualitative Treatment Only) 9

TOTAL 45 PERIODS
OUTCOMES:
Upon completion of this course, the students can able to
CO1: Understand the basic concepts associated first law of thermodynamics
CO2: Understand basic concepts associated with second law of thermodynamics
CO3: Describing the working of I.C engines and to determine its performance parameters
CO4: Basic principles of refrigeration, air conditioning and psychometric chart
CO5: Distinguishing the various modes of heat transfer and its applications

TEXT BOOK:

REFERENCES:

MT8411 MICROPROCESSOR AND MICROCONTROLERS L T P C
LABORATORY

OBJECTIVES:
- To focus on the implementation of arithmetic operations using microprocessors and microcontroller.
- To simulate assembly language programs.
- To implement various on-chip and off-chip interfacing and algorithms

LIST OF EXPERIMENTS
1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions
   (i) Ascending / Descending order, Maximum / Minimum of numbers
   (ii) Programs using Rotate instructions.
   (iii) Hex / ASCII / BCD code conversions
3. Interface Experiments: with 8085
   (i) A/D Interfacing. & D/A Interfacing.
4. Traffic light controller
5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source
7. Read a key interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including:
   i) Conditional jumps, looping
   ii) Calling subroutines
9. Programming I/O Port 8051
   i) study on interface with A/D & D/A
   ii) study on interface with DC & AC motor
10. Mini project development with processors

TOTAL: 60 PERIODS
OUTCOMES:
Upon Completion of the course, the students will be able to:

CO1: Solve the arithmetic operations using microcontrollers and various on-chip and off-chip interfacing and algorithms.

CO2: Design the digital and analog hardware interface for microcontroller-based systems

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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<tbody>
<tr>
<td>1</td>
<td>8085 Microprocessor Trainer with Power Supply</td>
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<td>2</td>
<td>8051 Micro Controller Trainer Kit with power supply</td>
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<tr>
<td>3</td>
<td>8255 Interface board</td>
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</tr>
<tr>
<td>4</td>
<td>8251 Interface board</td>
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<tr>
<td>5</td>
<td>8259 Interface board</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>8279 Keyboard / Display Interface board</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>8254 timer counter</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>ADC and DAC card</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>AC &amp; DC motor with Controller</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>Traffic Light Control System</td>
<td>5</td>
</tr>
</tbody>
</table>

ME8461 MANUFACTURING TECHNOLOGY LABORATORY

OBJECTIVE:
- Demonstration and study of the VARIOUS machines. The Main emphasis will be on a complete understanding of the machine capabilities and processes.

UNIT I LATHE PRACTICE
1. Plain Turning
2. Taper Turning
3. Thread Cutting

Estimation of machining time for the above turning processes.

UNIT II DRILLING PRACTICE
1. Drilling
2. Tapping
3. Reaming.

UNIT III MILLING
1. Surface Milling.
2. Gear Cutting.

UNIT IV PLANNING AND SHAPING
1. Cutting Key Ways.
2. Dovetail machining.

OUTCOMES:
- Ability to use different machine tools to manufacturing gears.
- Ability to use different machine tools for finishing operations
- Ability to manufacture tools using cutter grinder
- 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>
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<tbody>
<tr>
<td>1</td>
<td>Lathe</td>
<td>15 Nos.</td>
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<tr>
<td>2</td>
<td>Drilling Machine</td>
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</tr>
<tr>
<td>3</td>
<td>Milling Machine</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>4</td>
<td>Planning Machine</td>
<td>1 No</td>
</tr>
<tr>
<td>5</td>
<td>Shaping Machine</td>
<td>2 Nos.</td>
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</tbody>
</table>

ME8381 COMPUTER AIDED MACHINE DRAWING

L T P C 0 0 4 2

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:

HS8461 ADVANCED READING AND WRITING

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
techniquesWriting- Elements of a good essay-Types of essays- descriptive-narrative- issue-based-
argumentative-analytical.

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

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

TOTAL: 30 PERIODS
OUTCOMES: At the end of the course Learners will be able to:

- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.

TEXT BOOKS:

REFERENCES

EE8552 POWER ELECTRONICS

OBJECTIVES:
To impart knowledge on the following Topics

- Different types of power semiconductor devices and their switching
- Operation, characteristics and performance parameters of controlled rectifiers
- Operation, switching techniques and basics topologies of DC-DC switching regulators.
- Different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- Operation of AC voltage controller and various configurations.

UNIT I    POWER SEMI-CONDUCTOR DEVICES
9
Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT- Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR- Introduction to Driver and snubber circuits.

UNIT II   PHASE-CONTROLLED CONVERTERS
9

UNIT III  DC TO DC CONVERTERS
9
UNIT IV INVERTERS
Single phase and three phase voltage source inverters (both 120° mode and 180° mode) – Voltage & harmonic control – PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM – Introduction to space vector modulation – Current source inverter, Applications – Induction heating, UPS.

UNIT V AC TO AC CONVERTERS

OUTCOMES:
• Ability to analyse AC-AC and DC-DC and DC-AC converters.
• Ability to choose the converters for real time applications.

TEXT BOOKS:

REFERENCES

MT8591 SENSORS AND INSTRUMENTATION
L T P C
3 0 0 3

OBJECTIVES:
• To understand the concepts of measurement technology.
• To learn the various sensors used to measure various physical parameters.
• To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

UNIT I INTRODUCTION
UNIT II  MOTION, PROXIMITY AND RANGING SENSORS  9

UNIT III  FORCE, MAGNETIC AND HEADING SENSORS  7

UNIT IV  OPTICAL, PRESSURE AND TEMPERATURE SENSORS  11

UNIT V  SIGNAL CONDITIONING AND DAQ SYSTEMS  9

TOTAL :  45 PERIODS

OUTCOMES:
Upon Completion of the course the students will be able to
CO1: Familiar with various calibration techniques and signal types for sensors.
CO2: Apply the various sensors in the Automotive and Mechatronics applications
CO3: Describe the working principle and characteristics of force, magnetic and heading sensors.
CO4: Understand the basic principles of various pressure and temperature, smart sensors.
CO5: Ability to implement the DAQ systems with different sensors for real time applications.

TEXT BOOKS:

REFERENCES
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  12

UNIT II  BALANCING  12

UNIT III  FREE VIBRATION  12

UNIT IV  FORCED VIBRATION  12

UNIT V  MECHANISM FOR CONTROL  12

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:

EC8391 CONTROL SYSTEMS ENGINEERING

OBJECTIVES:
- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION
Control System: Terminology and Basic Structure-Feed forward and Feedback control theory- Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchros-Multivariable control system

UNIT II TIME RESPONSE ANALYSIS
Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD,PI,PID control systems

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS
Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

UNIT IV CONCEPTS OF STABILITY ANALYSIS
State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

OUTCOMES:
Upon completion of the course, the student should be able to:
- Identify the various control system components and their representations.
- Analyze the various time domain parameters.
- Analysis the various frequency response plots and its system.
- Apply the concepts of various system stability criterions.
- Design various transfer functions of digital control system using state variable models.

TEXT BOOK:

REFERENCES:
### 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>Study of SCR, MOSFET &amp; IGBT characteristics module</td>
<td>1</td>
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<tr>
<td>2</td>
<td>UJT, R, RC firing circuits for SCR module</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Voltage &amp; current commutated chopper module</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>SCR phase control circuit module</td>
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<tr>
<td>5</td>
<td>TRIAC phase control circuit module</td>
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<tr>
<td>6</td>
<td>Study of half controlled &amp; fully controller converters module</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Study of three phase AC regulator module</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Speed control of DC shunt motor using three phase fully controlled converter module</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>SCR single phase cyclo converter module</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>SCR series and parallel inverters module</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>IGBT chopper module</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>IGBT based PWM inverter (single phase) module</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Ammeter (0-5A) MC, (0-2A) MC, (0-2A) MI, (0-5V) MI</td>
<td>15</td>
</tr>
<tr>
<td>14</td>
<td>Voltmeter (0-300V) MC, (0-600V) MC, (0-300V) MI, (0-600V) MI, Multimeter</td>
<td>16</td>
</tr>
<tr>
<td>15</td>
<td>CRO, Transformer 1KVA, 1:1, 230V</td>
<td>Each 3</td>
</tr>
</tbody>
</table>

---

**MT8512 SENSORS AND INSTRUMENTATION LABORATORY**

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**OBJECTIVES:**

- To provide knowledge about sensors and actuators
- To provide hands on experience to measure different signal using sensor and processing them in required form.

**LIST OF EXPERIMENTS**

1. Design and testing of Digital Comparator
2. Design and testing of Voltage to frequency converter and frequency to voltage converter.
3. Design and testing of sample and hold circuit.
4. Design and testing of Flash type Analog to Digital Converters.
5. Design and testing of instrumentation amplifier using OP-AMP.
6. Displacement measurement using potentiometer and LVDT and plotting the characteristic curves.
7. Study of Characteristics and calibration of strain gauge and Load Cell
   a. Measurement of strain using resistive type strain gauges with temperature compensation and various bridge configurations.
8. Temperature measurement using Thermocouple, Thermistor and RTD and comparing the characteristics.
9. Comparison of capacitive and resistive type transducer for humidity measurement with their characteristics.
10. Measurement of sound using microphones and sound level meter.
11. Conversion of time domain audio signal into frequency domain signal (FFT).
12. Measurements of 3 phase power and power factor.

**TOTAL: 45 PERIODS**
OUTCOMES:
Upon Completion of the course the students will be able to:

CO1: Generate appropriate design procedure, suitable for signal conversion to interface with computer.

CO2: Design appropriate circuits by using conventional formulas used in signal conditioning and conversion.

CO3: Implement their design in bread board and test it.

CO4: Generate appropriate design procedure to obtain a required measurement data for temperature, force, humidity, displacement and sound.

CO5: Log the data in computer using LABVIEW/MATLAB/PSILAB.

CO6: Present data in a clear and meaningful manner.

CO7: Use transducers to create simple Mechatronics applications using data logging software.

EQUIPMENTS 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>Digital Signal Oscilloscope</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Function Generator</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Breadboard</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Regulated Power supply</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>LVDT</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Thermistor</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Thermocouple</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>RTD</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Load cell setup</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>4 Channel data acquisition system for strain gauge</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Sound level meter</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Computer with LABVIEW/MATLAB/SCILAB</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Prony brake dynamometer</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Hygrometer</td>
<td>1</td>
</tr>
</tbody>
</table>

ME8481 DYNAMICS LABORATORY

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.

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
• Ability to demonstrate the principles of kinematics and dynamics of machinery
• Ability to use the measuring devices for dynamic testing.

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>
</tr>
<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 b) Free-Free beam c) Simply supported beam.</td>
<td>1 No.</td>
</tr>
</tbody>
</table>
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:
OBJECTIVE:
- This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic components and systems and their application in manufacturing and mechanical systems.

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS
- Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids-
- Properties of fluids – Basics of Hydraulics – Pascal’s Law- Principles of flow – Friction loss- Work,
- Power and Torque. Problems Sources of Hydraulic power: Pumping Theory – Pump Classification-
- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of
- Linear, Rotary- Fixed and Variable displacement pumps-Problems

UNIT II HYDRAULIC ACTUATORS AND VALVES
- Hydraulic Actuators: Cylinders– Types and construction, Application, Hydraulic cushioning - Hydraulic
- motors Control Components: Direction control, Flow control and Pressure control valves-Types,
- Construction and Operation- Servo and Proportional valves - Applications – Types of actuation.
- Accessories: Reservoirs, Pressure Switches- Applications- Fluid Power ANSI Symbols - Problems

UNIT III HYDRAULIC SYSTEMS
- 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 SYSTEMS
- Properties of air– Perfect Gas Laws - Compressors- Filter, Regulator, Lubricator, Muffler, Air control
- Valves, Quick Exhaust valves, Pneumatic actuators, Design of pneumatic circuit cascade method-
- Electro pneumatic circuits, Introduction to Fluidics, Pneumatic logic circuits.

UNIT V TROUBLE SHOOTING AND APPLICATIONS
- Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic
- systems. Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and
- Forklift applications. Design of Pneumatic circuits for a Pick and Place application and tool handling in
- a CNC machine. - Low cost Automation – Hydraulic and Pneumatic power packs- case studies.

OUTCOMES:
- Understanding operating principles and constructional features of hydraulic and pneumatic
- systems.
- Knowledge with selection of hydraulic / pneumatic components
- understanding of designing and layout of Hydraulic Power package and trouble shooting.

TEXT BOOK:

REFERENCES:
OBJECTIVES:
- Mechatronics system design and simulation, ergonomics and safety
- Theoretical and practical aspects of computer interfacing, real time data acquisition and control
- Design of motion control, motion converter and temperature control.

UNIT I  INTRODUCTION TO DESIGN OF MECHATRONICS SYSTEM  9
Key elements – Mechatronics design process – design parameters – mechatronics and traditional design – Advanced approaches in mechatronics design – Introduction to industrial design, modelling, simulation and analysis – Ergonomics and safety.

UNIT II  BASIC SYSTEM MODELLING  9

UNIT III  MECHATRONIC SYSTEM MODELLING  7

UNIT IV  REAL TIME INTERFACING  11
Introduction – Selection of interfacing standards- elements of data acquisition and control systems – Overview of I/O process – general purpose I/O cards and its installation – Data conversion process – Application softwares – Man machine interface

UNIT V  CASE STUDIES ON DESIGN OF MECHATRONICS SYSTEM  9
Motion control using DC Motor, AC Motor and Servomotor - Temperature control of hot/cold reservoir – Pick and place robot – Car parking barriers – Motion and temperature control of washing machine – Auto focus camera, exposure control

TOTAL : 45 PERIODS

OUTCOMES
Students will be able to understand the mechatronics design
CO1: Understand the basics and key elements of Mechatronics design process
CO2: Familiar with basic system modelling
CO3: Understand the concepts of engineering system and dynamic response of the system
CO4: Realize the concepts of real time interfacing and data acquisition
CO5: Understanding the concepts of design of Mechatronics system through case studies

TEXT BOOKS:

REFERENCES
OBJECTIVES

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

UNIT I  STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS  9

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

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

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:
REFERENCES:

MT8602          INDUSTRIAL AUTOMATION            L   T   P   C
3  0  0   3

OBJECTIVES:
- To understand the construction, operation and installation of PLCs.
- To provide the knowledge on interfacing the PLCs and field devices with communication protocols.
- To understand the concepts of DCS and SCADA systems.

UNIT I             PROGRAMMABLE LOGIC CONTROLLER           9

UNIT II            APPLICATIONS OF PLC                 9
Timer instructions - On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, control instructions – Data manipulating instructions, math instructions; Applications of PLC – Motor start and stop, Simple materials handling applications, Automatic water level controller, Automatic lubrication of supplier Conveyor belt, Automatic car washing machine, Bottle label detection and process control application.

UNIT III           SCADA SYSTEM & ARCHITECTURE              9
Data acquisition systems, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries - SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA/HMI Systems Various SCADA architectures, advantages and disadvantages of each system

UNIT IV            DISTRIBUTED CONTROL SYSTEM        9
Introduction to DCS – Various Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities Operator interfaces - Low level and high level operator interfaces – Displays - Engineering interfaces – Low level and high level engineering interfaces – Factors to be considered in selecting DCS – Case studies – Sugar industry and Power plant
UNIT V  INDUSTRIAL PROCESS CONTROL

Study of Advanced Process control blocks: Statistical Process Control, Model Predictive Control, Fuzzy Logic Based Control, Neural-Network Based Control, PID Control

TOTAL: 45 PERIODS

OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Choose appropriate PLC and explain the architecture, installation procedures and trouble shooting.

CO2: Develop PLC programs using various functions of PLCs for a given application.

CO3: Explain the application development procedures in SCADA and manage data, alarm and storage.

CO4: Distinguish DCS, SCADA and PLC and explain the architecture of DCS.

CO5: Describe the controller elements and program methods.

TEXT BOOKS:


REFERENCES


UNIT I  INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

UNIT II  PLANNING

UNIT III  ORGANISING

UNIT IV  DIRECTING

UNIT V  CONTROLLING
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:

MT8611  APPLIED HYDRAULICS AND PNEUMATICS LABORATORY

OBJECTIVE:
To design and test the hydraulic and pneumatic circuits using MATLAB/LABVIEW software and simulate the circuits using Automation studio software.
LIST OF EXPERIMENTS

1. Design and testing of hydraulic circuits such as
   Pressure control
   Flow control
   Direction control
   Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.

2. Design and testing of pneumatic circuits such as
   Pressure control
   Flow control
   Direction control
   Circuits with logic controls
   Circuits with timers
   Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.
   Modeling and analysis of basic electrical, hydraulic, and pneumatic systems using MATLAB/LABVIEW software.

3. Simulation of basic hydraulic, pneumatic and electrical circuits using Automation studio software.

TOTAL: 60 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
CO1: Select the actuators and valves for the design of fluid power circuits.
CO2: Design and simulate the fluid power circuits using software tool.
CO3: Test the simulated output by constructing the fluid power circuits using suitable actuators and valves.

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></td>
<td><strong>Hydraulic equipments</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Pressure relief valve</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Pressure reducing valves</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Flow control valves</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Pressure switch</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Limit switches</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Linear actuator</td>
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</tr>
<tr>
<td>7</td>
<td>Rotary actuator</td>
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</tr>
<tr>
<td>8</td>
<td>Double solenoid actuated DCV</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Single solenoid actuated DCV</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Hydraulic power pack with pump and pressure relief valve</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>PLC</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Pneumatics equipments</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Pneumatic trainer kit with FRL Unit, Single acting cylinder, push button</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Pneumatic training kit with FRL unit, Double acting cylinder, manually actuated DCV</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Pneumatic trainer kit with FRL unit, Double acting cylinder, Pilot actuated DCV</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Pneumatic trainer kit with FRL unit Double acting cylinder, Double solenoid actuated DCV, DCV with sensor / magnetic reed switches</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>PLC with interface card</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>LABVIEW software</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Automation studio software</td>
<td>1</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To identify the differences between various PLCs.
- To provide the skills to install and troubleshoot PLC systems.
- To provide working experience in various programming techniques.
- To control some process parameters and test PID algorithm.
- To use the VFD to control the speed of AC motor.

LIST OF EXPERIMENTS
1. Study of different PLCs and their specification
2. Study of installations and troubleshooting of PLC.
3. Development of Ladder Diagram (LD) and Structured Text (ST) programming in PLC for simple applications.
4. Development of an application by using timer and counter of PLC.
5. Solving simple problems using Functional Block Diagram (FBD) programming in PLC
6. Interfacing between PLC and Process loop (temperature)
7. Interfacing between PLC and Process loop (level)
8. Interfacing between PLC and Process loop (flow)
9. Verification and testing of PID controller in a process loop.
10. Develop one application using SCADA system.
11. AC motor speed control using PLC and VFD

TOTAL: 60 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
CO1: Carryout wiring connections and troubleshoot in different PLCs.
CO2: Develop simple applications using LD, ST and FBD mode of programming.
CO3: Use timers and counter functions of PLC to construct simple applications.
CO4: Integrate and control process station with PLC.
CO5: Develop SCADA application using open source software.
CO6: Perform speed control on AC motor using VFD and PLC.

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>PLC panel board kit with power supply</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Any three PLCs from the following list can be used but not limited to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Allen Bradley (Micro Logix 1200)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Siemens (SIMATIC S7 200) PLC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. DELTA (DVP-SS Series) PLC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Schineder Modicon (M238 series) PLC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Mitsubishi Nexgenie (1000 series)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PLC panel board kit with power supply</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Any three PLCs from the following list can be used but not limited to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Allen Bradley (Micro Logix 1200)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Siemens (SIMATIC S7) PLC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. DELTA (DVP-SS Series) PLC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Schineder Modicon (M238 series) PLC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Mitsubishi Nexgenie (1000 series)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Process control station</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>½ HP AC motor</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>VFD to control ½ HP AC motor</td>
<td>1</td>
</tr>
</tbody>
</table>
ME8682  DESIGN AND FABRICATION PROJECT  L  T  P  C
0  0  4  2

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.

ME8691  COMPUTER AIDED DESIGN AND MANUFACTURING  L  T  P  C
3  0  0  3

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 and B-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 PROGRAMMING

UNIT V CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM (FMS)

TOTAL : 45 PERIODS

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:
OBJECTIVE:
Students will learn about basics of robots, programming and machine vision applications in robots

UNIT I  BASICS OF ROBOTICS  9

UNIT II  ROBOT END EFFECTORS  9
Robot End effectors: Introduction- types of End effectors- Mechanical gripper- types of gripper mechanism- gripper force analysis- other types of gripper- special purpose grippers.

UNIT III  ROBOT MECHANICS  10

UNIT IV  ROBOT PROGR A MMING  8
Robot programming: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- application of robots.

UNIT V  MACHINE VISION FUNDAMENTALS  9
Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology

TOTAL :45 PERIODS

OUTCOMES:
Upon completion of this course, the students can able to
CO1: Express the basic concepts, laws, components and parameters of robots
CO2: Explain the types of grippers and its functions.
CO3: Evaluate the kinematic calculations and apply Lagrangian and Newton-Euler methods to analyze dynamic characteristics of robots
CO4: Describing the various programming techniques used in industrial robots
CO5: Basis of machine vision and apply the concept of image processing

TEXT BOOK:

REFERENCES:
OBJECTIVES:
- To provide the overview of embedded system design principles
- To understand the concepts of real time operating systems
- To provide exposure to embedded system development tools with hands on experience in using basic programming techniques.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 7
Overview of embedded systems, embedded system design process, challenges - common design metrics and optimizing them. Hardware - Software codesign embedded product development.

UNIT II REAL TIME OPERATING SYSTEM 7
Real time operating systems Architecture - Tasks and Task states - Tasks and Data - Semaphore and shared data - Message queues, mail boxes and pipes - Encapsulating semaphores and queues - interrupt routines in an RTOS Environment. Introduction to Vx works, RT Linux.

UNIT III PIC MICROCONTROLLER 9
Architecture - Instruction set - Addressing modes - Timers - Interrupt logic - CCP modules - ADC.

UNIT IV EMBEDDED NETWORKING 7
Introduction - CAN BUS - I²C - GSM - GPRS - Zig bee.

UNIT V EMBEDDED PROGRAMMING LABORATORY : LIST OF EXPERIMENTS 30
I/O Programming
Interrupts and Timer application
Interfacing Keypad
Interfacing LCD
Interfacing ADC/DAC

TOTAL : 60 PERIODS

OUTCOMES:
CO1. Explain the need of embedded systems and their development procedures.
CO2. Summarize the concepts involved in Real time operating systems.
CO3. Use various tools for developing embedded applications.
CO4. Explain the construction, addressing modes and instructions sets of PIC micro controller.
CO5. Conduct experiments with I/O systems used in embedded systems.

TEXT BOOKS:

REFERENCES
OBJECTIVES:

- To understand and interpret drawings of machine components for the preparation of assembly drawings using standard CAD packages.
- To gain practical experience in handling 3D modelling software systems.
- To learn basic principles of finite element analysis procedure and enable the students to formulate the design problems into FEA.
- To understand and interpret program codes for manufacturing different machine components using standard CAM packages.

LIST OF EXPERIMENTS

1. Modelling of a part using any CAD package.
7. NC code generation for milling using any CAM package.
8. NC code generation for turning using any CAM package.

TOTAL: 60 PERIODS

EQUIPMENTS FOR A BATCH OF 30 STUDENTS

NOTE - Any solid modelling and analysis using suitable software packages can be used for exercise.
CNC lathe – 1 no
CNC milling machine – 1 no

OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: Model and assemble a given three dimensional engineering components
CO2: Perform various analyses on simple structures for the application of different loads.
CO3: Generate CNC programs for a given components to work with CNC machines

OBJECTIVES:

- To introduce different types of robotics and demonstrate them to identify different parts and components.
- To write programming for simple operations.

LIST OF EXPERIMENTS

1. Determination of maximum and minimum position of links.
2. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
3. Estimation of accuracy, repeatability and resolution.
4. Robot programming and simulation for pick and place
5. Robot programming and simulation for Colour identification
6. Robot programming and simulation for Shape identification
7. Robot programming and simulation for machining (cutting, welding)
8. Robot programming and simulation for writing practice
9. Robot programming and simulation for any industrial process (Packaging, Assembly)
10. Robot programming and simulation for multi process.

TOTAL: 60 PERIODS

OUTCOME:
Upon completion of the course, the students will be able to:
CO1: Use of any robotic simulation software to model the different types of robots and calculate work volume for different robots

LIST OF EQUIPMENTS BATCH OF 30 STUDENTS:
- ROS (Robotic Operating System)
- 30 Systems with server
- Verification of direct kinematics equations and inverse kinematics equations of 1DOF “R-configuration” robot.
- Verification of direct kinematics equations and inverse kinematics equations of 2DOF “R-R-configuration” robot.

MT8801 AUTOMOTIVE ELECTRONICS

OBJECTIVES:
- The intention and purpose of this course is to study the basics of electronics, emission controls and its importance in automobiles.
- To study the various sensors and actuators used in automobiles for improving fuel economy and emission control.
- To study the various blocks of control units used for control of fuel, ignition and exhaust systems.

UNIT I INTRODUCTION

UNIT II IGNITION AND INJECTION SYSTEMS

UNIT III SENSOR AND ACTUATORS IN AUTOMOTIVES

UNIT IV ENGINE CONTROL SYSTEMS
UNIT V CHASSIS AND SAFETY SYSTEMS


TOTAL : 45 PERIODS

OUTCOMES:
After successful completion of this course, the students should be able to

CO1: Know the importance of emission standards in automobiles.

CO2: Understand the electronic fuel injection/ignition components and their function.

CO3: Choose and use sensors and equipment for measuring mechanical quantities, temperature and appropriate actuators.

CO4: Diagnose electronic engine control systems problems with appropriate diagnostic tools.

CO5: Analyses the chassis and vehicle safety system.

TEXT BOOK:

REFERENCES

MT8811 PROJECT WORK L T P C
0 0 20 10

OBJECTIVES:
- To develop knowledge to formulate a real world problem and project's goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

Students in the form of group, not exceeding 3 members in a group to carry out their main project. It should be a Mechatronics project. However, special considerations can be given for interdisciplinary measurement and computer based simulation projects. This exception should be recorded and approved by the department committee. Management related projects will not be allowed. The interdisciplinary projects will carry more weight age. It is mandatory to publish their main project in national/international level conferences to appear in the viva-voce exam.

TOTAL: 300 PERIODS

OUTCOMES:
After successful completion of this course, the students should be able to

CO1: Design, analyze, realize / simulate a physical system by using the technology they learnt during the program.

CO2: Integrate various systems into one Mechatronics product.

CO3: Work in a team with confined time duration.

CO4: Disseminate his work both in oral and written format.
**OBJECTIVES:**

- To understand the basics of discrete time signals, systems and their classifications.
- To analyze the discrete time signals in both time and frequency domain.
- To design lowpass digital IIR filters according to predefined specifications based on analog filter theory and analog-to-digital filter transformation.
- To design Linear phase digital FIR filters using fourier method, window technique
- To realize the concept and usage of DSP in various engineering fields.

**UNIT I** DISCRETE TIME SIGNALS AND SYSTEMS


**UNIT II** ANALYSIS OF LTI DISCRETE TIME SIGNALS AND SYSTEMS


**UNIT III** INFINITE IMPULSE RESPONSE FILTERS


**UNIT IV** FINITE IMPULSE RESPONSE FILTERS


**UNIT V** APPLICATIONS OF DSP


**OUTCOMES:**

At the end of the course, the students should be able to:

- Perform mathematical operations on signals.
- Understand the sampling theorem and perform sampling on continuous-time signals to get discrete time signal by applying advanced knowledge of the sampling theory.
- Transform the time domain signal into frequency domain signal and vice-versa.
- Apply the relevant theoretical knowledge to design the digital IIR/FIR filters for the given analog specifications.

**TEXT BOOK:**


**REFERENCES**

OBJECTIVE:
• To introduce the C++ programming and its use in object oriented environment

UNIT I  OOP PARADIGM

UNIT II  INTRODUCTION TO C++

UNIT III  CLASSES AND OBJECTS

UNIT IV  OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM
Defining operator overloading: Overloading unary, binary operators. Manipulation of strings using operators – Rules for overloading operators – Type Conversions - Defining derived classes – Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance – Virtual base classes – Abstract classes - Introduction to pointers to objects: This pointer – Pointers to derived classes – Virtual functions – Pure virtual functions

UNIT V  CASE STUDIES
Over view of typical object oriented systems – Case studies- Applications

TOTAL: 45 PERIODS

OUTCOMES:
On the successful completion of the course, students will be able to
CO1: Distinguish between Structured and Object Oriented problem solving approaches and apply them based on the problem given
CO2: Define the fundamental concepts in programming with C++.
CO3: Identify classes and objects from the given problem description and able to create classes and objects using C++
CO4: Achieve code reusability and extensibility by means of Inheritance and Polymorphism.
CO5: Translate the informal description of an algorithm to solutions for problems in engineering, science and text processing using Object Oriented Programming.

TEXT BOOK:
REFERENCES:

ME8091 AUTOMOBILE ENGINEERING

L T P C
3 0 0 3

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, Anti-lock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATIVE ENERGY SOURCES
9

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:

GE8075 INTELLECTUAL PROPERTY RIGHTS

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

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:

AN8091 MAINTENANCE ENGINEERING

OBJECTIVES:
- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
- To illustrate some of the simple instruments used for condition monitoring in industry.

UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING

UNIT II MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE
Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.

UNIT III CONDITION MONITORING
Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear- debris analysis

UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS
Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT
Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance

TOTAL: 45 PERIODS
OUTCOMES:
- Upon completion of the programme, the students can able to implement the maintenance function and different practices in industries for the successful management of maintenance activities
- To identify the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.

TEXT BOOKS:

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 9
Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES 9
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 9
Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION 9
Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION 9
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:

MG8491 OPERATIONS RESEARCH L T P C
3 0 0 3

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

UNIT I LINEAR MODELS

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS

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

UNIT IV QUEUEING MODELS
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

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

TEXT BOOKS:

REFERENCES:

MT8002  ADVANCED MANUFACTURING TECHNOLOGY  L  T  P  C
3  0  0  3

OBJECTIVES:
• To understand the concepts of forming and sheet metal working of metals with its different types of operations and simultaneously to know about various non-traditional machining processes, surface finishing and surface hardening processes with its types and various applications.
• To understand the work and tool holding devices with its principles and its industrial applications

UNIT I  SHEET METAL WORKING OF METALS  8

UNIT II  NON TRADITIONAL MACHINING  9
Ultrasonic machining (USM) – process and description of USM-applications and limitations- Electron Beam Machining (EBM)-Process principles of EBM-applications-process principles- Laser Beam Machining (LBM)-Laser beam production-applications-laser beam welding-Plasma Arc Machining (PAM)-Generation of plasma arc-process parameters-applications
UNIT III  SURFACE FINISHING AND SURFACE HARDENING PROCESS  10
Grinding process, various types of grinding machine-grinding wheel-types-selection of grinding wheel for different applications-selection of cutting speed and work speed- mounting of grinding wheel-galvanizing, electroplating, anodising. Surface hardening- carburizing, carbonitriding, cyaniding, nitriding, ion nitriding, boronizing, laser hardening, thin film coating (PVD, CVD).

UNIT IV  EDM AND ECM  10
Electrical Discharge Machining (EDM) - Description of EDM equipment-electrical circuits - electrolyte-metal removal rate-applications-EDWC - process principles – equipments - applications. Electro Chemical Machining (ECM) - Description of the equipment-electrolyte-metal removal rate -accuracy and surface finish obtained. Electro Chemical grinding (ECG) – Chemical machining-electro chemical grinding equipment-application-electro chemical deburring - honing applications.

UNIT V  JIGS AND FIXTURES  8

OUTCOMES:
CO1: Understand the basics and working principles of various sheet metal working and forming processes
CO2: Knowledge on various non-traditional machining processes with its applications
CO3: Understand the various type of surface finishing and surface hardening process
CO4: Understand the concept of EDM and ECM with its characteristics and application
CO5: Understand the work and tool holding devices used for different machine tools

TEXT BOOKS:

REFERENCES

AE8751  AVIONICS  L T P C  3 0 0 3
OBJECTIVES:
• To introduce the basic of avionics and its need for civil and military aircrafts
• To impart knowledge about the avionic architecture and various avionics data buses
• To gain more knowledge on various avionics subsystems

UNIT I  INTRODUCTION TO AVIONICS  9
Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies – Introduction to digital computer and memories.
UNIT II  DIGITAL AVIONICS ARCHITECTURE  9

UNIT III  FLIGHT DECKS AND COCKPITS  9
Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

UNIT IV  INTRODUCTION TO NAVIGATION SYSTEMS  9

UNIT V  AIR DATA SYSTEMS AND AUTO PILOT  9
Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to built Digital avionics architecture
- Ability to Design Navigation system
- Ability to design and perform analysis on air system.
- Integrate avionics systems using data buses.
- Analyze the performance of various cockpit display technologies.
- Design autopilot for small aircrafts using MATLAB

TEXT BOOKS:

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  PHOTO POLYMERIZATION 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 L T P C
3 0 0 3

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

UNIT I  INTRODUCTION  9
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

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

EC8093  DIGITAL IMAGE PROCESSING

OBJECTIVES:
• To become familiar with digital image fundamentals
• To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
• To learn concepts of degradation function and restoration techniques.
• To study the image segmentation and representation techniques.
• To become familiar with image compression and recognition methods.
UNIT I  DIGITAL IMAGE FUNDAMENTALS

UNIT II  IMAGE ENHANCEMENT

UNIT III  IMAGE RESTORATION

UNIT IV  IMAGE SEGMENTATION

UNIT V  IMAGE COMPRESSION AND RECOGNITION
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL :45 PERIODS

OUTCOMES:
At the end of the course, the students should be able to:
• Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
• Operate on images using the techniques of smoothing, sharpening and enhancement.
• Understand the restoration concepts and filtering techniques.
• Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

TEXT BOOKS:

REFERENCES
OBJECTIVES:
- To understand how to measure biochemical parameters and various physiological information.
- To study the need and technique of electrical safety in Hospitals.
- To study the use of radiation for diagnostic and therapy.
- To study about recorders and advanced equipment in medicine

UNIT I INTRODUCTION
Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting

UNIT II TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION
Basic transducer principles Types – source of bioelectric potentials – resistive, inductive, capacitive, fiber-optic, photoelectric and chemical transducers – their description and feature applicable for biomedical instrumentation – Bio & Nano sensors & application

UNIT III SIGNAL CONDITIONING, RECORDING AND DISPLAY

UNIT IV MEDICAL SUPPORT

UNIT V BIO-MEDICAL DIAGNOSTIC INSTRUMENTATION

OUTCOMES:
After successful completion of this course, the students should be able to
CO1: Explain different measurement techniques used in physiological parameters measurement.
CO2: Describe the sensors and signal conditioning circuits used in biomedical engineering.
CO3: Understand about various amplifiers, recording and display devices.
CO4: Differentiate the working of recorders and explain the advanced systems used in medicine
CO5: Understand about various Bio-medical diagnostics instrumentation.

TEXT BOOKS:
OBJECTIVE:
- Introduce the principle, programming technique with instrument interfaces and applications of virtual instruments and to understand the basics of data acquisition are introduced in mechatronics systems.

UNIT I REVIEW OF VIRTUAL INSTRUMENTATION
Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II VI PROGRAMMING TECHNIQUES
VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

UNIT III DATA ACQUISITION BASICS
AOC.OAC. 010. Counters & timers. PC Hardware structure, timing. Interrupts OMA, software and hardware installation

UNIT IV COMMON INSTRUMENT INTERFACES
Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, VXI, SCXI, PXI, etc., networking basics for office & Industrial applications, Visa and IVI, image acquisition and processing. Motion control.

UNIT V USE OF ANALYSIS TOOLS
Fourier transforms, power spectrum correlation methods, windowing & filtering, VI application in various fields.

OUTCOMES:
CO1: Understand the evolution, advantages, techniques, architecture and applications of visual instrumentation
CO2: Acquiring knowledge on VI programming techniques
CO3: Study about the basics of data acquisition
CO4: Understanding the concept of common instrument interfaces with industrial applications
CO5: Study about the use of analysis tools with various applications.

TEXT BOOK:

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

UNIT I  PROJECT EVALUATION AND PROJECT PLANNING  9

UNIT II  PROJECT LIFE CYCLE AND EFFORT ESTIMATION  9

UNIT III  ACTIVITY PLANNING AND RISK MANAGEMENT  9

UNIT IV  PROJECT MANAGEMENT AND CONTROL  9

UNIT V  STAFFING IN SOFTWARE PROJECTS  9

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

TOTAL  45 PERIODS
GE8072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

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   9

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY  9

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
3 0 0 3

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

UNIT I
UNIT II  

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

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

UNIT V  

TOTAL : 45 PERIODS

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

REFERENCES:  

GE8071  
DISASTER MANAGEMENT  
L T P C  
3 0 0 3

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 (PRls/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.
UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

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

UNIT IV DISASTER RISK MANAGEMENT IN INDIA

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

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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

CS8691

OBJECTIVES:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

UNIT I INTRODUCTION


UNIT II PROBLEM SOLVING METHODS


UNIT III KNOWLEDGE REPRESENTATION


UNIT IV SOFTWARE AGENTS


UNIT V APPLICATIONS


TOTAL :45 PERIODS

OUTCOMES:

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

- Use appropriate search algorithms for any AI problem
- Represent a problem using first order and predicate logic
- Provide the apt agent strategy to solve a given problem
- Design software agents to solve a problem
- Design applications for NLP that use Artificial Intelligence.

TEXT BOOKS:


REFERENCES:


**MG8091 ENTREPRENEURSHIP DEVELOPMENT**

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

**UNIT I ENTREPRENEURSHIP**

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

**UNIT III BUSINESS**

**UNIT IV FINANCING AND ACCOUNTING**

**UNIT V SUPPORT TO ENTREPRENEURS**

**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:
1. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers:

RO8791 MODELING AND SIMULATION L T P C
3 0 0 3

OBJECTIVE:
- To provide an overview of how computers are being used in mechanical component design with the use of various CAD standards and to introduce the concepts of Mathematical Modelling of Engineering Problems using FEM with 2D scalar and vector variables problems respectively.

UNIT I MODELLING AND ASSEMBLY
Assembly modelling – interferences of positions and orientation – tolerance analysis-mass property calculations – mechanism simulation and interference checking

UNIT II 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 III INTRODUCTION TO ANALYSIS
Basic concepts of the Finite Element Method - Discretization -Meshing – Mesh refinement- Mesh Enrichment- Natural co-ordinate systems -Types of elements- Special Elements- Crack tip Element- Introduction to Analysis Software.

UNIT IV TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

UNIT V 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.

TOTAL : 45 PERIODS

OUTCOMES:
CO1: To know the basic concepts of modelling and assembly for different mechanical components
CO2: To know the different types of CAD standards used in modeling of mechanical components
CO3: To know about basic concepts of FEA and analysis software for analyzing mechanical components
CO4: To know about different mathematical techniques used in finite element analysis to solve structural and thermal problems

TEXT BOOKS:
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

UNIT II SENSORS AND ACTUATORS-I

UNIT III SENSORS AND ACTUATORS-II

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:

CS8492 DATABASE MANAGEMENT SYSTEMS

OBJECTIVES
- To learn the fundamentals of data models and to represent a database system using ER diagrams.
- To study SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- To have an introductory knowledge about the Storage and Query processing Techniques

UNIT I RELATIONAL DATABASES 10

UNIT II DATABASE DESIGN 8

UNIT III TRANSACTIONS 9

UNIT IV IMPLEMENTATION TECHNIQUES 9
UNIT V  ADVANCED TOPICS


TOTAL: 45 PERIODS

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

- Classify the modern and futuristic database applications based on size and complexity
- Map ER model to Relational model to perform database design effectively
- Write queries using normalization criteria and optimize queries
- Compare and contrast various indexing strategies in different database systems
- Appraise how advanced databases differ from traditional databases.

TEXT BOOKS:

REFERENCES:

MG8892  MARKETING MANAGEMENT  L  T  P  C  3 0  0  3

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

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

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

UNIT III  PRODUCT PRICING AND MARKETING RESEARCH
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.
UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION

TOTAL: 45 PERIODS

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

TEXTBOOKS:

REFERENCES:

IM8071 PRODUCT DESIGN AND DEVELOPMENT

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

UNIT I INTRODUCTION

UNIT II CONCEPT GENERATION AND SELECTION

UNIT III PRODUCT ARCHITECTURE

UNIT IV INDUSTRIAL DESIGN

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT

TOTAL: 45 PERIODS

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

TEXT BOOK:

REFERENCES:
UNIT II ENGINEERING ETHICS


UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS


UNIT V GLOBAL ISSUES


TOTAL: 45 PERIODS

OUTCOME:

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

TEXT BOOKS:


REFERENCES:


Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org