PROGRAMME EDUCATIONAL OBJECTIVES:
Bachelor of Robotics and Automation curriculum is designed to prepare the graduates having attitude and knowledge to
1. Have successful professional and technical career
2. Have strong foundation in basic sciences, mathematics and computational platforms
3. Have knowledge on the theory and practices in the field and service of robotics Engineering and allied areas
4. Engross in life-long learning to keep themselves abreast of new developments
5. Practice and inspire high ethical values and technical standards

PROGRAMME OUTCOMES:

a) Ability to apply knowledge of mathematics, sciences and engineering
b) Ability to identify the electrical, electronics and mechanical components and use of them design or machine elements and transmission system.
c) Ability to design automatic manufacturing cells with robotic control.
d) Ability to understand the electronic control system in metal machining and other manufacturing process.
e) Ability to understand the features and operation of automation products.
f) Ability to understand ethical and professional responsibilities
g) Ability to communicate effectively and work in interdisciplinary groups
h) Ability to review, comprehend and report technological development.

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## PROFESSIONAL ELECTIVES FOR ROBOTICS AND AUTOMATION

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### Semester VIII, Elective – V

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<td>Wireless Sensors Networks for Robotics</td>
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### Semester VIII, Elective – VI

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<td>Digital Signal Processors and its Applications</td>
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### Employability Enhancement Courses (EEC)

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### Summary

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OBJECTIVES:

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

UNIT I  SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS  12

UNIT II  GENERAL READING AND FREE WRITING  12
Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –Listening- telephonic conversations. Speaking – sharing information of a personal kind—greeting – taking leave- Language development – prepositions, conjunctions Vocabulary development- guessing meanings of words in context.

UNIT III  GRAMMAR AND LANGUAGE DEVELOPMENT  12
Reading- short texts and longer passages (close reading) Writing- understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences Listening – listening to longer texts and filling up the table- product description- narratives from different sources. Speaking- asking about routine actions and expressing opinions. Language development- degrees of comparison-pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs.

UNIT IV  READING AND LANGUAGE DEVELOPMENT  12
Reading- comprehension-reading longer texts- reading different types of texts- magazines Writing-letter writing, informal or personal letters-e-mails-conventions of personal email- Listening- listening to dialogues or conversations and completing exercises based on them. Speaking- speaking about oneself- speaking about one’s friend- Language development- Tenses- simple present-simple past-present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs

UNIT V  EXTENDED WRITING  12
Reading- longer texts- close reading –Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-listening – listening to talks-conversations- Speaking – participating in conversations- short group conversations-Language development-modal verbs- present/past perfect tense - Vocabulary development-collocations- fixed and semi-fixed expressions

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

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

TEXT BOOKS:

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

MA8151 ENGINEERING MATHEMATICS – I

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

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

UNIT II FUNCTIONS OF SEVERAL VARIABLES

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

UNIT V  DIFFERENTIAL EQUATIONS  

TOTAL : 60 PERIODS

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

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

REFERENCES :  
PH8151  
ENGINEERING PHYSICS  
L  T  P  C  
3  0  0  3

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

UNIT I  
PROPERTIES OF MATTER  
9

UNIT II  
WAVES AND FIBER OPTICS  
9

UNIT III  
THERMAL PHYSICS  
9

UNIT IV  
QUANTUM PHYSICS  
9

UNIT V  
CRYSTAL PHYSICS  
9
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

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.

TOTAL : 45 PERIODS
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

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

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

TEXT BOOKS:

REFERENCES:

GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING

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

UNIT I ALGORITHMIC PROBLEM SOLVING
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

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.
TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:

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

TEXT BOOK:
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
Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises-
Speaking – Asking for and giving directions-
Reading – reading short technical texts from journals- newspapers-
Writing- purpose statements – extended definitions – issue-
writing instructions – checklists-recommendations-

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-
paragrapthing-
Writing- interpreting cogs, 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 – reading longer technical texts-
practicing 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
Listening- Listening to documentaries and making notes. Speaking – mechanics of presentations-
Reading – reading for detailed comprehension-
Writing- email etiquette- job application – cover letter-
Résumé preparation( via email and hard copy)-
analytical essays and issue based essays-
Vocabulary Development- finding suitable synonyms-paraphrasing--
Language Development- clauses-

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

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

REFERENCES

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

MA8251 ENGINEERING MATHEMATICS – II

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

UNIT I MATRICES
12

UNIT II VECTOR CALCULUS
12
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
12
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 $w = z + c, \frac{1}{z}, \frac{1}{z^2}$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION
12
UNIT V LAPLACE TRANSFORMS

TOTAL: 60 PERIODS

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

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

TEXT BOOKS :

REFERENCES :

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

L T P C
3 0 0 3

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  
9

UNIT III  
MECHANICAL PROPERTIES  
9

UNIT IV  
MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS  
9

UNIT V  
NEW MATERIALS  
9

TOTAL : 45     PERIODS

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

TEXT BOOKS:

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

UNIT I  ELECTRICAL CIRCUITS  9

UNIT II  AC CIRCUITS  9
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  9
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  9

UNIT V  MEASUREMENTS & INSTRUMENTATION  9
Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical - ,Classification of instruments - Types of indicating Instruments - multimeters –Oscilloscopes- – three-phase power measurements– instrument transformers (CT and PT )

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

TEXT BOOKS

REFERENCES
OBJECTIVES:

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

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

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

UNIT II ENVIRONMENTAL POLLUTION

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

UNIT III NATURAL RESOURCES

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

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

TOTAL: 45 PERIODS

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

TEXTBOOKS:

REFERENCES:
OBJECTIVES:

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

UNIT I  STATICS OF PARTICLES  9+6

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

UNIT III  PROPERTIES OF SURFACES AND SOLIDS  9+6

UNIT IV  DYNAMICS OF PARTICLES  9+6

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

TOTAL : 45+30=75 PERIODS

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

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

TEXT BOOKS:
REFERENCES:

GE8261 ENGINEERING PRACTICES LABORATORY

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

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

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

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

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

II MECHANICAL ENGINEERING PRACTICE

Welding:
(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
(b) Gas welding practice
Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

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

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

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

GROUP B (ELECTRICAL & ELECTRONICS)

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

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

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
• fabricate carpentry components and pipe connections including plumbing works.
• use welding equipments to join the structures.
• Carry out the basic machining operations
• Make the models using sheet metal works
• Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
• Carry out basic home electrical works and appliances
• Measure the electrical quantities
• Elaborate on the components, gates, soldering practices.
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

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

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

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

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

LIST OF EXPERIMENTS:

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

Minimum of 10 Experiments to be carried out :-

TOTAL: 60 PERIODS

OUTCOMES:

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D. C. Motor Generator Set</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>D.C. Shunt Motor</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Single Phase Transformer</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Single Phase Induction Motor</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Ammeter A.C and D.C</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>Voltmeters A.C and D.C</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>Watt meters LPF and UPF</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Resistors &amp; Breadboards</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Cathode Ray Oscilloscopes</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Dual Regulated power supplies</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>A.C. Signal Generators</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>Transistors (BJT, JFET)</td>
<td>-</td>
</tr>
</tbody>
</table>
OBJECTIVES:

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

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

UNIT II  FOURIER SERIES  12

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

UNIT IV  FOURIER TRANSFORMS  12

UNIT V  Z-TRANSFORMS AND DIFFERENCE EQUATIONS  12

TOTAL: 60 PERIODS

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

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

REFERENCES:

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

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS
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  
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

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
Limited, 2016.
2016.

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  
Basics of Measurement – Classification of errors – Error analysis – Static and dynamic 
characteristics of transducers – Performance measures of sensors – Classification of sensors – 
Sensor calibration techniques – Sensor Output Signal Types.

UNIT II  MOTION, PROXIMITY AND RANGING SENSORS  
Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, 
LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF 
beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LiDAR).
UNIT III  FORCE, MAGNETIC AND HEADING SENSORS

UNIT IV  OPTICAL, PRESSURE AND TEMPERATURE SENSORS

UNIT V  SIGNAL CONDITIONING AND DAQ SYSTEMS

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

EC8353  ELECTRON DEVICES AND CIRCUITS

OBJECTIVES:
The student should be made to:
- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.
UNIT I PN JUNCTION DEVICES 9
PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diode characteristics- Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS AND THYRISTORS 9
BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS 9
BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9
BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

TOTAL :45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- Explain the structure and working operation of basic electronic devices.
- Able to identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit.
- Employ the acquired knowledge in design and analysis of oscillators

TEXT BOOKS:

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

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

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

UNIT IV DEFLECTION OF BEAMS
Double Integration method – Macaulay’s method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame’s theorem.

TOTAL: 45 PERIODS

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

TEXT BOOKS:
REFERENCES:

EC8301 OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES L T P C 3 0 0 3

OBJECTIVES:
- To comprehend the fundamentals of object oriented programming, particularly in C++.
- To use object oriented programming to implement data structures.
- To introduce linear data structures.
- To study about the non-linear data structures
- To understand about the different algorithms

UNIT I DATA ABSTRACTION & OVERLOADING 9

UNIT II INHERITANCE & POLYMORPHISM 9
Base Classes and Derived Classes – Protected Members – Casting Class pointers and Member Functions – Overriding – Public, Protected and Private Inheritance – Constructors and Destructors in derived Classes – Implicit Derived – Class Object To Base – Class Object Conversion – Composition Vs. Inheritance – Virtual functions – This Pointer – Abstract Base Classes and Concrete Classes – Virtual Destructors – Dynamic Binding.

UNIT III LINEAR DATA STRUCTURES 10
Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists –Polynomial Manipulation - Stack ADT – Queue ADT - Evaluating arithmetic expressions

UNIT IV NON-LINEAR DATA STRUCTURES 9

UNIT V SORTING AND SEARCHING 8
Sorting algorithms: Insertion sort - Quick sort - Merge sort - Searching: Linear search –Binary Search
TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to:
- To know about data abstraction
- Explain the concepts of Object oriented programming.
- Write simple applications using C++.
- To demonstrate different linearity in data structures.
- Discuss the different methods of organizing large amount of data.
TEXT BOOKS:

REFERENCES:

EC8312 ELECTRONIC CIRCUITS AND DIGITAL LABORATORY

OBJECTIVE:
- To practically train the student to study the characteristics of electronic components and circuits.

LIST OF EXPERIMENTS:
1. Characteristics of diode and clipper circuits.
2. Characteristics of Zener diode and Zener voltage regulator
3. Characteristics of BJT.
4. Characteristics of JFET
5. Application of BJT as an amplifier and switch.
6. Study of Basic Digital ICs.
7. Implementation of Adder and Subtractor circuits
9. Study of Multiplexer and Demultiplexer.
10. Design and Implementation of Counters and registers

TOTAL : 60 PERIODS

OUTCOME:
- Ability to use the electronics components and use of them to build electronic circuits for process the signals.

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>0 – 30V RPS</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>0 – 50V RPS</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>0 – 5V RPS</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>0 – 30V Voltmeter</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>0 – 10V Voltmeter</td>
<td>5</td>
</tr>
<tr>
<td>No</td>
<td>Description</td>
<td>L</td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>6</td>
<td>0 –50V Voltmeter</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0 – 1V Voltmeter</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0 – 30mA Ammeter</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0 – 100mA AC Amplifier</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Audio Oscillator</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>CRO (30 MHZ)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Diodes, Zener Diodes</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Transistors (PNP &amp; NPN)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>UJT</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SCR</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>JFET</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>MOSFET</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>DIAC &amp; TRIAC</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Photodiode</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Photo Transistor</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Required Passive Components</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Variable Resistor</td>
<td></td>
</tr>
</tbody>
</table>

**CE8481  STRENGTH OF MATERIALS LABORATORY  L T P C  0 0 4 2**

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

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

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

**REFERENCES:**
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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

MA8452   STATISTICS AND NUMERICAL METHODS

L     T     P     C
4     0     0     4

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  12

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

UNIT V  NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS  12

TOTAL : 60 PERIODS

OUTCOMES :
Upon successful completion of the course, students will be able to:
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS :

REFERENCES :
OBJECTIVES:
- To study the basics of control system and its response .stability of mechanical and electrical systems . Use of MATLAB to design a stable control system.
- To introduce the elements of control system and their modeling using various Techniques.
- To introduce methods for analyzing the time response.
- To impart knowledge about the frequency response and the stability of systems
- To introduce the state variable analysis method

UNIT I  INTRODUCTION
Open loop and closed loop systems - Examples - Elements of closed loop systems - Transfer function - Modeling of physical systems – Mechanical, Thermal, Hydraulic systems and Electric Networks - Transfer function of DC generator, DC servomotor, AC servomotor ,Potentiometer, Synchros, Tacho-generator, Stepper motor - Block diagram - reduction techniques, Signal flow graph – Mason” gain formula. (Related Tutorials Using MATLAB/ Simulink – Toolboxes & Functions)

UNIT II  TIME DOMAIN ANALYSIS

UNIT III  FREQUENCY DOMAIN ANALYSIS
Frequency domain specifications - Time and frequency response correlation – Polar plot – Bode plot – All pass minimum phase and non-minimum phase systems. (Related Tutorials Using MATLAB/ Simulink – Toolboxes & Functions)

UNIT IV  SYSTEM STABILITY

UNIT V  ROOT LOCUS METHOD

TOTAL : 45 PERIODS

OUTCOMES:
- To understand the basic of the control system
- Ability to know about the time and frequency domain analysis
- To know about the different stability of the systems
- To expose students to the state space representation and its analysis.
- To introduce non-linear systems and their control and to impart knowledge on advanced control techniques

TEXT BOOKS:
2. Richard C Dorf and Robert H Bishop, "Modern Control Systems.", Addison-Wesley -2007

REFERENCES:
OBJECTIVES:
- To study about basic electrical prime movers, electrical transmission and distribution systems.
- To study about the transformers
- To study about the different types of induction motors
- To study about the special machines
- To study about the power system

UNIT I     D.C. MACHINES          10

UNIT II   TRANSFORMERS          10

UNIT III    INDUCTION MOTORS   10

UNIT IV   SYNCHRONOUS AND SPECIAL MACHINES   8

UNIT V   INTRODUCTION TO POWER SYSTEM   7
Structure of electric power systems – generation, transmission, sub-transmission and distribution systems - EHVAC and EHVDC transmission systems – substation layout. (Concepts only).

TOTAL: 45 PERIODS

OUTCOMES:
- Understanding the principles of operations and characteristics of DC machines
- Knowledge of electrical transformers and induction motors
- Know about the different types of induction motors
- Able to visualise the operation of synchronous motors stepper and sevo motors.
- Comprehending the power transmission and distributing systems.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To introduce the basic building blocks of linear integrated circuits
- To learn the linear and non-linear applications of operational amplifiers
- To introduce the theory and applications of analog multipliers and PLL
- To learn the theory of ADC and DAC
- To introduce the concepts of waveform generation and introduce some special function ICs

UNIT I  BASIC OPERATIONAL AMPLIFIER
Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations – JFET Operational Amplifiers – LF155 and TL082.

UNIT II  APPLICATIONS OF OPERATIONAL AMPLIFIERS
Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III  ANALOG MULTIPLIER AND PLL
Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronisation.

UNIT IV  ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS

UNIT V  WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS
Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop – Out(LDO) Regulators - Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of the course, the student should be able to:

- Design linear and non-linear applications of OP-AMPS
- Design applications using analog multiplier and PLL
- Design ADC and DAC using OP-AMPS
- Generate waveforms using OP-AMP Circuits
- Analyze special function ICs

TEXT BOOKS:

REFERENCES:

RO8403 KINEMATICS AND DYNAMICS OF MACHINCES L T P C
3 2 0 4

OBJECTIVES:
- To understand the basic knowledge about kinematics of machines.
- 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 KINEMATIC OF MACHINES 9+6
UNIT II  GEARs and GEAR TRAINS  9+6

UNIT III  FRICTION  9+6
Sliding and Rolling Friction angle – friction in threads – Friction Drives –Belt and rope drives.

UNIT IV  FORCE ANALYSIS  9+6

UNIT V  BALANCING AND VIBRATION  9+6

TOTAL :75 PERIODS

OUTCOMES:
Upon completion of this course,
- the students be able to understand the basic knowledge of kinematics of machines
- Students can able to apply fundamentals of mechanism for the design of new mechanisms
- Able to know about the linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- Impart knowledge about the gears and gear trains.
- Ability to analyse them for optimum design.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To impart hands on experience in verification of circuit laws and theorems
- To measure the circuit parameters, study of circuit characteristics and simulation of time response.
- To expose the students to the basic operation of electrical machines and help them to develop experimental skills.
- To construct Induction Motors with Loading Arrangement
- To verify the circuit laws and theorems and measure the circuit parameters.

LIST OF EXPERIMENTS:
1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator.
3. Load test on D.C. shunt motor.
4. Load test on D.C. series motor.
5. Swinburne’s test
7. Load test on single phase transformer
8. Open circuit and short circuit tests on single phase transformer (Determination of equivalent circuit parameters).
9. Load test on single phase induction motor.
10. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
11. Load test on Three phase induction motor.
12. Study of Starters

OUTCOMES:
- Knowledge about the basic operation of electrical machines and help them to develop experimental skills.
- Ability to verify the circuit laws and theorems and measure the circuit parameter.
- Ability to operate electrical machines.
- Ability to construct a Single Phase, Three Phase Induction Motor with Loading Arrangement and to operate switches
- Ability to determination the equivalent circuit parameters.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>DC Shunt Motor with Loading Arrangement</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Single Phase Transformer</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>DC Series Motor with Loading Arrangement</td>
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</tr>
<tr>
<td>4.</td>
<td>Three Phase Induction Motor with Loading Arrangement</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>Single Phase Induction Motor with Loading Arrangement</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>DC Shunt Motor Coupled With DC Compound Generator</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>DC Shunt Motor Coupled With DC Shunt Generator</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>Tachometer - Digital/Analog</td>
<td>8</td>
</tr>
<tr>
<td>9.</td>
<td>Single Phase Auto Transformer</td>
<td>2</td>
</tr>
<tr>
<td>10.</td>
<td>Three Phase Auto Transformer</td>
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</tr>
<tr>
<td>11.</td>
<td>Single Phase Resistive Loading Bank</td>
<td>2</td>
</tr>
<tr>
<td>12.</td>
<td>Three Phase Resistive Loading Bank</td>
<td>2</td>
</tr>
<tr>
<td>13.</td>
<td>SPST switch</td>
<td>2</td>
</tr>
</tbody>
</table>
OBJECTIVES:
• To supplement the principles learnt in kinematics and Dynamics of Machinery.
• To understand how certain measuring devices are used for dynamic testing.

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

TOTAL : 60 PERIODS

OUTCOMES:
• 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>
</tbody>
</table>
10  Kinematic Models to study various mechanisms.  1 No.
11  Turn table apparatus.  1 No.
12  Transverse vibration setup of
   a) cantilever  1 No.
   b) Free-Free beam
   c) Simply supported beam.

OBJECTIVES:
- To impart launch on experience in 56 characterizing different LIC
- To train the students in MATLAB simulation of study the characteristics of LIC

LIST OF EXPERIMENTS:
3. Performance characteristics of Voltage Regulator Ics.
4. Study of 555 Timer and 566 VCO.
5. Design and Implementation of Active Filters.
6. Determination of transfer function of DC servomotor.
7. Determination of transfer function of AC servomotor and study of synchros.
8. Time domain Response of first order and second order systems using MATLAB.
9. Frequency response of first and second order system using MATLAB.
10. Characteristics of PID controllers using MATLAB.

OUTCOMES:
- Ability to design LIC and describe the characteristics.
- Ability to attain knowledge about MATLAB

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dual, (0-30V) variable Power Supply</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>CRO 30MHz</td>
<td>9</td>
</tr>
<tr>
<td>3.</td>
<td>Digital Multimeter</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>Function Generator 1 MHz</td>
<td>8</td>
</tr>
<tr>
<td>5.</td>
<td>IC Tester (Analog)</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Bread board</td>
<td>10</td>
</tr>
<tr>
<td>7.</td>
<td>Computer (PSPICE installed)</td>
<td>1</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- Understand evolution and principle of CNC machine tools
- Write simple programs for CNC turning and machining centres
- Generate CNC programs for popular CNC controllers
- Describe about linear and angular measurements in metrology
- Study about the advancement in metrology

UNIT I INTRODUCTION TO CNC MACHINE TOOLS
Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators – Computer Aided Inspection, CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways

UNIT II DRIVES AND WORK HOLDING DEVICES
Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives – stepper motor, servo principle, DC and AC servomotors, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosyn, laser interferometer, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines

UNIT III CNC PROGRAMMING
Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre for well known controllers such as Fanuc, Heidenhain, Sinumerik etc., generation of CNC codes from CAM packages.

UNIT IV LINEAR AND ANGULAR MEASUREMENTS

UNIT V ADVANCES IN METROLOGY

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course the students can able to understand
- Ability to know about the basic in CNC machineries
- Evolution and principle of CNC machine tools and different measurement technologies
- Able to write simple programs for CNC machinery
- To impart knowledge about linear and angular measurements in metrology
- Ability to know about the advancement in metrology
TEXT BOOKS:

REFERENCES:

RO8591 PRINCIPLES OF ROBOTICS

OBJECTIVES:
- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

UNIT I BASIC CONCEPTS

UNIT II DIRECT AND INVERSE KINEMATICS

UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS
Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints-Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV PATH PLANNING
Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V DYNAMICS AND CONTROL
Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to understand basic concept of robotics.
- To analyze Instrumentation systems and their applications to various
- To know about the differential motion add statics in robotics
- To know about the various path planning techniques.
- To know about the dynamics and control in robotics industries.
TEXT BOOKS:

REFERENCES:

RO8502 MICROCONTROLLER AND PLC

OBJECTIVES:
- To introduce the basic features, programming methods and applications of Micro controllers
- To study about programming in microcontroller
- Discuss different applications in microcontroller
- To know about the design of systems using PLC is introduced in detail.
- To know about the applications in PLC

UNIT I INTRODUCTION TO MICROCONTROLLER

UNIT II MICROCONTROLLER PROGRAMMING
8051 Assembly Language Programming- Block transfer, arithmetic operations, Code conversion, Time delay generation, Interrupt programming, Lookup table techniques

UNIT III MICROCONTROLLER APPLICATIONS

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS
Introduction — Principles of operation – PLC Architecture and specifications – PLC hardware components Analog & digital I/O modules , CPU & memory module – Programming devices – PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram. PLC programming Simple instructions – Manually operated switches – Mechanically operated a Proximity switches - Latching relays,
UNIT V  APPLICATIONS OF PROGRAMMABLE LOGIC CONTROLLERS.  9
Timer instructions - On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, control instructions – Data manipulating instructions, math instructions; Applications of PLC – Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application.

TOTAL : 45 PERIODS

OUTCOMES:
- The students will learn the basic of microcontroller
- The students will learn the programming in microcontroller.
- To know about the different applications of microcontroller
- The students will learn about the design of systems using Programmable Logic Controllers
- To know about the different applications of Programmable Logic Controllers

TEXT BOOKS:

REFERENCES:

PR8551  DESIGN OF MACHINE ELEMENTS AND TRANSMISSION SYSTEMS  L T P C
3 2 0 4

OBJECTIVE:
- To introduce students to the design and theory of common machine elements and to give students experience in solving design problems involving machine elements.

UNIT I  INTRODUCTION

UNIT II  DETACHABLE AND PERMANENT JOINTS
Design of Bolts under Static Load, Design of Bolt with Tightening/Initial Stress, Design of Bolts subjected to Fatigue – Keys -Types, Selection of Square and Flat Keys-Design of Riveted Joints and Welded Joints
UNIT III  SHAFTS AND COUPLING  
Design of Shaft –For Static and Varying Loads, For Strength and Rigidity-Design of Coupling-Types, Flange, Muff and Flexible Rubber Bushed Coupling

UNIT IV  GEARS AND BELT DRIVES  
Design of Spur and Helical Gear drives-Design of Belt drives-Flat and V Belts

UNIT V  SPRINGS AND BEARINGS  
Design of Helical Spring-Types, Materials, Static and Variable Loads-Design of Leaf Spring-Design of Journal Bearing -Antifriction Bearing-Types, Life of Bearing, Reliability Consideration, Selection of Ball and Roller Bearings

TOTAL: 75 PERIODS

OUTCOMES:
Upon completion of this course, the students can able
1. To formulate and analyze stresses and strains in machine elements subjected to various loads
2. To analyze and design structural joints such as Riveted joints, welded joints, Bolts
3. To analyze and design the components for power transmission like shaft and couplings.
4. To analyze and design different types of gears and belts for engineering applications.
5. To analyze and design mechanical springs and bearings.

TEXT BOOKS:

REFERENCES:

COMPUTER ARCHITECTURE

CS8491

OBJECTIVES:
• To learn the basic structure and operations of a computer.
• To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.
• To learn the basics of pipelined execution.
• To understand parallelism and multi-core processors.
• To understand the memory hierarchies, cache memories and virtual memories.
• To learn the different ways of communication with I/O devices.

UNIT I  BASIC STRUCTURE OF A COMPUTER SYSTEM  
UNIT II ARITHMETIC FOR COMPUTERS

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism

UNIT III PROCESSOR AND CONTROL UNIT

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT IV PARALLELISM


UNIT V MEMORY & I/O SYSTEMS


OUTCOMES:
On Completion of the course, the students should be able to:

- Understand the basics structure of computers, operations and instructions.
- Design arithmetic and logic unit.
- Understand pipelined execution and design control unit.
- Understand parallel processing architectures.
- Understand the various memory systems and I/O communication.

TEXT BOOKS:

REFERENCES
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.

RO8511 CNC AND METROLOGY LABORATORY

OBJECTIVES:
- To impart knowledge in CNC programming for turning and milling operations.
- To use measuring systems for the geometrical measurements of gears and threads.
- To know the measurement of Taper Angle using Sine Bar.

LIST OF EXPERIMENTS:
1. Study of the CNC machine.
2. Programming and simulation of a lathe using any CAM package.
4. Programming and operation of a CNC Lathe.
5. Programming and operation of a CNC machining centre.
7. Optical profile projector – study of profile of gear tooth, screw threads.
8. Tool maker’s microscope – to study cutting tool geometry, screw threads.
9. Tool wear and surface finish measurement.
10. Dimensional measurement of machined components using, bore gauge, air gauge and Height master.
OUTCOMES:

- Ability to understand the features and operation of CNC machines.
- Ability to prepare CNC program from the component drawings
- Understanding the usage of profile projectors and tool makers microscopes.

REFERENCE:

- Laboratory Manual Prepared by R&AE Department

TOTAL : 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CNC lathe</td>
<td>1 no</td>
</tr>
<tr>
<td>2.</td>
<td>CNC milling machine</td>
<td>1 no</td>
</tr>
<tr>
<td>3.</td>
<td>Production type CNC machining centre</td>
<td>1 no</td>
</tr>
<tr>
<td>4.</td>
<td>CNC lathe and milling programming software (FANUC controller)</td>
<td>10 Licenses</td>
</tr>
<tr>
<td>5.</td>
<td>CNC lathe and milling programming software (Heidenhain controller)</td>
<td>5 Licenses</td>
</tr>
<tr>
<td>6.</td>
<td>Optical profile projector</td>
<td>1 no</td>
</tr>
<tr>
<td>7.</td>
<td>tool makers microscope</td>
<td>1 no</td>
</tr>
<tr>
<td>8.</td>
<td>Measuring gauges for hole depth and height.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Sine Bar0</td>
<td>1 no</td>
</tr>
</tbody>
</table>

RO8512 INNOVATION LABORATORY

Students have to do a Mechatronics project based on their idea. It can be a modeling, simulation, design or hardware project.

TOTAL: 30 PERIODS

EI8077 POWER ELECTRONICS AND DRIVES

OBJECTIVES

- Comprehensive introduction to various power electronic devices, their structure, operating principle and characteristics
- Give exposure to Various topologies, working principle and analysis of controlled rectifiers and ac controllers
- Detailed knowledge on Classifications, structure, operating principle of dc choppers
- Introduction to different types of Inverters, their principle of operation and waveform control
- Overview on dc and ac drives and their control using power electronic circuits.
UNIT I  POWER SEMICONDUCTOR DEVICES AND CHARACTERISTICS  9

UNIT II  CONTROLLED RECTIFIERS AND AC CONTROLLERS  9

UNIT III  DC TO DC CONVERTERS  9
Step up and Step down Chopper – Chopper classification - quadrant of operation – Switching mode Regulators – Buck, Boost, Buck-Boost, and Cuk Regulators.

UNIT IV  INVERTERS  9

UNIT V  DRIVES AND CONTROL  9
Static and Dynamic equations of dc and ac machines – Electrical breaking – Rectifier and chopper control of DC drives – Principles of v/f control of AC drives – Open loop and Closed loop schemes for DC and AC drives(Block diagram approach only) – Introduction to vector control of AC drives.

TOTAL : 45 PERIODS

COURSE OUTCOMES (COs)
1. Ability to explain various devices and their structure, operating characteristics in the field of electronics.
2. Ability to classify, analyze and design Control rectifier, chopper and inverter.
3. Will have ability to apply power electronic circuits for the control of popular applications.
4. Exposure to design and analyze PE circuit using simulation software.

TEXT BOOKS:

REFERENCES:
5. NPTEL Lecture Series on “Power Electronics” by Dr.B.G.Fernandes, IIT Bombay.
OBJECTIVES:
The student should be made to:
- Learn the architecture and programming of ARM processor.
- Be familiar with the embedded computing platform design and analysis.
- Be exposed to the basic concepts of real time Operating system.
- Learn the system design techniques and networks for embedded systems
- Learn about some real time operating systems

UNIT I  INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS
Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output-supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

UNIT II  EMBEDDED COMPUTING PLATFORM DESIGN
The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT III  PROCESSES AND OPERATING SYSTEMS
Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE.

UNIT IV  SYSTEM DESIGN TECHNIQUES AND NETWORKS
Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.

UNIT V  CASE STUDY IN EMBEDDED SYSTEMS
Data compressor - Alarm Clock - Audio player - Software modem-Digital still camera - Telephone answering machine-Engine control unit – Video accelerator.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to:
- Describe the architecture and programming of ARM processor.
- Explain the basic concepts of embedded systems and real time Operating system design.
- Use the system design techniques to develop software for embedded systems
- Differentiate between the general purpose operating system and the real time operating system
- Model real-time applications using embedded-system concepts
REFERENCES:

UNIT I VISION SYSTEM
Basic Components – Elements of visual perception, Lenses: Pinhole cameras, Gaussian Optics – Cameras – Camera-Computer interfaces

UNIT II VISION ALGORITHMS

UNIT III OBJECT RECOGNITION
Object recognition, Approaches to Object Recognition, Recognition by combination of views – objects with sharp edges, using two views only, using a single view, use of dept values.

UNIT IV APPLICATIONS

UNIT V ROBOT VISION
Basic introduction to Robotic operating System (ROS) - Real and Simulated Robots - Introduction to OpenCV, Open NI and PCL, installing and testing ROS camera Drivers, ROS to OpenCV - The cv_bridge Package.

TOTAL : 45 PERIODS
OUTCOMES:
- Knowledge or gadgets of vision systems
- Ability to understand the image capturing and processing techniques
- Ability to apply the vision system in other machines
- Knowledge for recognizing the objects.
- Knowledge in application of vision and image processing in robot operations.

TEXT BOOKS:

REFERENCES:

RO8603 AUTOMATION SYSTEM DESIGN

OBJECTIVES:
- To know about the basic concepts in industrial automation
- To design automated systems.
- To know about transfer lines and automated assembly
- Be exposed to pneumatic, electric, hydraulic and electronic systems in automation of mechanical operations.
- To know about the advancement in hydraulics and pneumatics

UNIT I FUNDAMENTAL CONCEPTS OF INDUSTRIAL AUTOMATION
Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation.

UNIT II TRANSFER LINES AND AUTOMATED ASSEMBLY

UNIT III DESIGN OF MECHATRONIC SYSTEMS
Stages in design, traditional and mechatronic design, possible design solutions. Case studies-pick and place robot, engine management system.

UNIT IV PROGRAMMABLE AUTOMATION
Special design features of CNC systems and features for lathes and machining centers. Drive system for CNC machine tools. Introduction to CIM; condition monitoring of manufacturing systems.
UNIT V  DESIGN FOR HIGH SPEED AUTOMATIC ASSEMBLY  

TOTAL: 45 PERIODS  

OUTCOMES:  
- Knowledge of industrial automation by transfer lines and automated assembly lines.  
- Ability to design an automated system  
- Understanding of automated controls using pneumatic and hydraulic systems  
- Ability to understand the electronic control systems in metal machining and other manufacturing processes.  
- To understand advancement in hydraulics and pneumatics systems.  

TEXT BOOKS:  

REFERENCES:  

ME8694  HYDRAULICS AND PNEUMATICS  

L  T  P  C  
3  0  0  3  

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

UNIT I  FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS  

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

UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS 9

UNIT V TROUBLE SHOOTING AND APPLICATIONS 9

TOTAL:45 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To provide hands on experience with power electronic converters and testing.

LIST OF EXPERIMENTS
1. Gate Pulse Generation using R, RC and UJT.
2. Characteristics of SCR and TRIAC
3. Characteristics of MOSFET and IGBT
4. AC to DC half controlled converter
5. AC to DC fully controlled Converter
6. Step down and step up MOSFET based choppers
7. IGBT based single phase PWM inverter module
8. IGBT based three phase PWM inverter
9. AC Voltage controller
10. Switched mode power converter.
11. Simulation of PE circuits (1Φ & 3Φ semi converters, 1Φ & 3Φ full converters, DC-DC converters, AC voltage controllers).
12. Characteristics of GTO & IGCT.
13. Characteristics of PMBLDC motor

TOTAL: 60 PERIODS

OUTCOMES:
- Ability to practice and understand converter and inverter circuits and apply software for engineering problems.
- Ability to experiment about switching characteristics various switches.
- Ability to analyze about AC to DC converter circuits.
- Ability to analyze about DC to AC circuits.
- Ability to acquire knowledge on AC to AC converters
- Ability to acquire knowledge on simulation software.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Device characteristics(for SCR, MOSFET, TRIAC,GTO,IGCT and IGBT kit with built-in /discrete power supply and meters) - 2 each
2. SinglephaseSCRbasedhalfcontrolledconverterandfullycontrolledconverteralong with built-in/separate/firing circuit/module and meter – 2 each
3. MOSFET based step up and step down choppers (Built in/ Discrete) – 1 each
4. IGBT based single phase PWM inverter module/Discrete Component – 2
5. IGBT based three phase PWM inverter module/Discrete Component – 2
6. Switched mode power converter module/Discrete Component – 2
7. SCR &TRIAC based 1 phase AC controller along with lamp or rheostat load - 2
8. Cyclo converter kit with firing module – 1
9. Dual regulated DC power supply with common ground
10. Cathode ray Oscilloscope –10
11. Isolation Transformer – 5
12. Single phase Auto transformer –3
13. Components (Inductance, Capacitance ) 3 set for each
14. Multimeter – 5
15. LCR meter – 3
16. Rheostats of various ranges – 2 sets of 10 value
17. Work tabilities – 10
18. DC and AC meters of required ranges – 20
19. Component data sheets to be provided
OBJECTIVES:
- To illustrate the design and simulation of multiple actuator systems using pneumatic, electro-pneumatic and PLCs and enable the students to integrate various fringe conditions in multiple actuator systems.
- To design a system using PNEUMOSIM software
- To design a Microcontroller kit with stepper motor and drive circuit using LABVIEW software
- To expose the students in sensors/actuators interfaced with computers.
- To design a circuit using stepper motor

LIST OF EXPERIMENTS:
1. Co-ordinated motion of multiple pneumatic actuators in a desired sequence using Cascade method
2. Integration of fringe condition modules in multiple actuator pneumatic systems
3. Co-ordinated motion of multiple actuator, electro – pneumatic systems in a desired sequence using hard – wire programmed control systems
4. Co-ordinated motion of multiple actuator, electro – pneumatic systems in a desired sequence using PLC.
5. Interfacing of an LVDT with a PC for monitoring the displacement of machine slide and raising an alarm if the displacement exceeds specified limit.
6. Inspection using Machine vision System
7. Control of speed, direction and number of revolutions of a stepper motor using PC.

OUTCOMES
- Able to design and layout multiple actuator systems with start shop and emergency modules
- Able to develop Ladder logic for electro-pneumatic actuator systems.
- Acquiring skill of interfacing different sensors like LVDT, ultrasonic and touch sensors.
- Ability to develop control system for stepper motors.
- Ability to design Microcontroller kit with stepper motor and drive circuit using LABVIEW software

TOTAL :60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Basic Pneumatic Trainer Kit with manual and electrical controls</td>
<td>1 each</td>
</tr>
<tr>
<td>2.</td>
<td>PNEUMOSIM software / Automation studio</td>
<td>10 sets</td>
</tr>
<tr>
<td>3.</td>
<td>8051 – Microcontroller kit with stepper motor and drive circuit LABVIEW software</td>
<td>2 sets</td>
</tr>
<tr>
<td>4.</td>
<td>machine vision system with software</td>
<td>1 no</td>
</tr>
<tr>
<td>5.</td>
<td>stepper motors with PC interface cards</td>
<td>2 nos</td>
</tr>
<tr>
<td>6.</td>
<td>servo motor with PC interface card</td>
<td>1 no</td>
</tr>
<tr>
<td>7.</td>
<td>ultrasonic, touch and non contact sensors</td>
<td>2 each</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

TOTAL : 30 PERIODS

REFERENCES:
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  9
Assembly modelling – interferences of positions and orientation – tolerance analysis-mass property calculations – mechanism simulation and interference checking

UNIT II  CAD STANDARDS  9
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  9
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  9

UNIT V  TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS  9
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
OBJECTIVES:

- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study about the localization, planning and navigation.
- To study the control of robots for some specific applications.
- To study about the humanoid robots.

UNIT I INTRODUCTION


UNIT II LOCALIZATION


UNIT III PLANNING AND NAVIGATION

Introduction-Path planning overview- Road map path planning- Cell decomposition path planning-Potential field path planning-Obstacle avoidance - Case studies: tiered robot architectures.

UNIT IV FIELD ROBOTS

Ariel robots- Collision avoidance-Robots for agriculture, mining, exploration, underwater, civilian and military applications, nuclear applications, Space applications.

UNIT V HUMANIIDS:


OUTCOMES:

Upon completion of the course, the student should be able to:

- Explain the basic concepts of working of robot
- Analyze the function of sensors in the robot
- Write program to use a robot for a typical application
- Use Robots in different applications
- Know about the humanoid robots.

TEXT BOOKS:

1. Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza, „Introduction to Autonomous Mobile Robots”, Bradford Company Scituate, USA, 2004

REFERENCES:

OBJECTIVE:
- To expose the students to the usage of CAD/CAE softwares for modeling and analysis purposes.

LIST OF EXPERIMENTS:
1. Solid modeling of engineering components and assembly.
2. Determination of stresses and factor of safety in critical machine components by FEM and experimental validation of the results by strain measurement.
3. Dynamic analysis of chassis frame of an automobile.
5. Kinematic and dynamic analysis of mechanisms using mechanism analysis software.

TOTAL: 60 PERIODS

OUTCOMES:
- Exposed to use CAD softwares for modeling of machine components.
- Exposed to use softwares for mechanism analysis.
- Knowledge in conducting crash/impact analysis using FEA.

REFERENCE:
- Laboratory Manual Prepared by RAE Department

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>3-D solid modeling CAD software</td>
<td>10 licences</td>
</tr>
<tr>
<td>2</td>
<td>Multibody kinematic and dynamic analysis software</td>
<td>5 licences</td>
</tr>
<tr>
<td>3</td>
<td>non linear / crash / impact analysis software</td>
<td>2 licences</td>
</tr>
<tr>
<td>4</td>
<td>metal forming / metal cutting simulation software</td>
<td>2 licenses</td>
</tr>
<tr>
<td>5</td>
<td>loading and strain measuring set up</td>
<td>1 no</td>
</tr>
<tr>
<td>6</td>
<td>workstation configuration computers</td>
<td>15 nos</td>
</tr>
</tbody>
</table>
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.

RO8811   PROJECT WORK   L T P C  
0 0 20 10

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

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

TOTAL: 300 PERIODS

OUTCOME:
- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.
OBJECTIVES:
The student should be made to:
- Study the Architecture of 8085 microprocessor.
- Study the Architecture of 8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Study about communication and bus interfacing.
- Study the Architecture of 8051 microcontroller.

UNIT I 8086 MICROPROCESSOR
8

UNIT II 80286 MICROPROCESSOR
8
Functional block diagram - Modes of operation – Real and protected mode – Memory management and protection features.

UNIT III 80386, 80486 PROCESSORS
8

UNIT IV PENTIUM MICROPROCESSOR
6
Introduction – Architecture – Special Pentium registers – Memory management.

UNIT V PIC MICROCONTROLLER
15

OUTCOMES:
At the end of the course, the student should be able to:
- Design and implement programs on 8085 microprocessor.
- Design and implement programs on 8086 microprocessor.
- Design I/O circuits.
- Design Memory Interfacing circuits.
- Design and implement 8051 microcontroller based systems.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
The student should be made to:
- Understand the phases in a software project.
- Understand fundamental concepts of requirements engineering and Analysis Modelling.
- Understand the major considerations for enterprise integration and deployment.
- Learn various testing and maintenance measures.
- Learn about various parsing techniques.

UNIT I ASSEMBLERS
General Design procedures – Design of an Assembler – data structures – format of databases –
algorithm – flow chart – PASS structures – modular functions. MACRO LANGUAGE AND MACRO
PROCESSORS: Macro instructions, features of a macro facility –implementation.

UNIT II LOADERS
Loader schemes – compile and go loaders, general load scheme – absolute loaders – direct linking
loaders and their design. Other loading schemes : linking loaders, overlays, dynamic binders.

UNIT III COMPILERS
Introduction – Structure of a compiler – phases of a compiler - compiler writing tools. LEXICAL
ANALYSIS: Role of a lexical analyzer – finite automata –regular expressions to finite automata –
minimizing the number of states of a deterministic finite automata – implementation of a lexical
analyzer.

UNIT IV PARSING TECHNIQUES
Context free grammars – derivations and parse trees – ambiguity – capabilities of context free
grammars. Top down and bottom up parsing – handles – shift reduce parsing – operator precedence
parsing – recursive descent parsing – predictive parsing.

UNIT V INTERMEDIATE CODE GENERATION
Postfix notation, Quadruples, triples , indirect triples – Representing information in a symbol table –
introduction to code optimization – basic blocks – DAG representation – error detection and recovery -
code generation.

OUTCOMES:
At the end of the course, the student should be able to
- Identify the key activities in managing a software project.
- Compare different process models.
- Concepts of requirements engineering and Analysis Modeling.
- Apply systematic procedure for software design and deployment.
- Compare and contrast the various testing and maintenance.

TEXT BOOKS:
Pearson Education, Inc., 2008

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

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

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

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

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

UNIT V ALTERNATIVE ENERGY SOURCES 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 L T P C
3 0 0 3

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

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

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

UNIT III AGREEMENTS AND LEGISLATIONS

UNIT IV DIGITAL PRODUCTS AND LAW

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

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

TEXT BOOKS

REFERENCES
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:
OBJECTIVES:
- To introduce the students the lean manufacturing concepts
- To understand group technology and use of it for part identification
- To understand value stream mapping in lean manufacturing.
- To teach the tools and method used in lean manufacturing
- To introduce concept of Total Productive Maintenance and other system

UNIT I  INTRODUCTION:

UNIT II  GROUP TECHNOLOGY AND CELLULAR LAYOUT
JIT with cell manufacturing – part families- production flow analysis – Composite part concept – machine cell design – quantitative analysis – case studies – single piece flow

UNIT III  VALUE STREAM MAPPING
The value stream– benefits mapping process - the current state map–mapping icons - mapping steps.VSM exercises - Takt time calculations.

UNIT IV  LEAN MANUFACTURING TOOLS AND METHODOLOGIES
Standardized work–standard work sequence timing and working progress .Quality at source – Autonomation /Jidoka, Visual management system, Mistake proofing / Poka-Yoke. 5S technique – Elements and waste elimination through 5S, advantages and benefits - 5S-audit - visual control aids for improvement, flexible work force

UNIT V  TOTAL PRODUCTIVE MAINTENANCE

OUTCOMES:
- Ability to implement lean manufacturing concepts in industries
- Ability to group the parts in manufacturing
- Ability to apply value stream in mapping.
- Ability to use the lean manufacturing tools and method
- Ability to apply total productive maintenance concepts in industries.

TEXT BOOKS:
REFERENCES:

RO8091     INDUSTRIAL DESIGN AND APPLIED ERGONOMICS      L T P C
                       3 0 0 3

OBJECTIVES:
- To explain the general principles that governs the interaction of humans in their working environment
- To improve improving worker performance and safety.
- To know about the environmental conditions in the industry.
- To know about bio thermodynamics and bioenergetics
- To know about the human factors in industrial aspects

UNIT I     INTRODUCTION
Definition, human technological system, multidisciplinary engineering approach, human–machine system, manual, mechanical, automated system, human system reliability, conceptual design, advanced development, detailed design and development. INFORMATION INPUT: Input and processing, text, graphics, symbols, codes, visual display of dynamic information, auditory, tactual, olfactory displays, speech communications.

UNIT II    HUMAN OUTPUT AND CONTROL
Physical work, manual material handling, motor skill, human control of systems, controls and data entry devices, hand tools and devices.

WORKPLACE DESIGN:
Applied anthropometry, workspace design and seating, arrangement of components within a physical space, interpersonal aspects of work place design, design of repetitive task, design of manual handling task, work capacity, stress, and fatigue.

UNIT III   ENVIRONMENTAL CONDITIONS
Illumination, climate, noise, motion, sound, vibration, colour and aesthetic concepts. BIOMECHANICS: Biostatic mechanics, statics of rigid bodies, biodynamic mechanics, human body kinematics, kinetics, impact and collision.

UNIT IV    BIOTERMODYNAMICS AND BIOENERGETICS
Biothermal fundamentals, human operator heat transfer, human system bioenergetics, thermoregulatory physiology, human operator thermo regularity, passive operator, active operator, heat stress.

UNIT V     HUMAN FACTORS APPLICATIONS
Human error, accidents, human factors and the automobile, organizational and social aspects, steps according to ISO/DIS6385, OSHA’s approach, virtual environments.

TOTAL : 45 PERIODS
OUTCOMES:
The Student should

- Know about ergonomic principles to design workplaces
- Improve human performance
- Judge the environmental conditions in the workplace.
- Know about biotermodynamics and bioenergetics
- Implement latest occupational health and safety to the work place.

TEXT BOOK:

REFERENCES:
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

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

UNIT I LINEAR MODELS
15

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS
8

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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 (PRIs/ULBs), States, Centre, and other stake-holders - Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.
UNIT III  INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT  9
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  9
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  9
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

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

TEXTBOOKS:

REFERENCES
1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
OBJECTIVES:
- Study the fundamentals of CMOS circuits and its characteristics.
- Learn the design and realization of combinational & sequential digital circuits.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
- Learn the different FPGA architectures and testability of VLSI circuits.

UNIT I  INTRODUCTION TO MOS TRANSISTOR  9

UNIT II  COMBINATIONAL MOS LOGIC CIRCUITS  9

UNIT III  SEQUENTIAL CIRCUIT DESIGN  9
Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

UNIT IV  DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM  9
Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.
Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V  IMPLEMENTATION STRATEGIES AND TESTING  9

TOTAL: 45 PERIODS

OUTCOMES:
UPON COMPLETION OF THE COURSE, STUDENTS SHOULD be ABLE TO
- Realize the concepts of digital building blocks using MOS transistor.
- Design combinational MOS circuits and power strategies.
- Design and construct Sequential Circuits and Timing systems.
- Design arithmetic building blocks and memory subsystems.
- Apply and implement FPGA design flow and testing.

TEXT BOOKS:
REFERENCES

MT8071 VIRTUAL INSTRUMENTATION L T P C
3 0 0 3

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 9
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 9
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 9
AOC.OAC. 010. Counters & timers. PC Hardware structure, timing. Interrupts OMA, software and hardware installation.

UNIT IV COMMON INSTRUMENT INTERFACES 9
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 9
Fourier transforms, power spectrum correlation methods, windowing & filtering, VI application in various fields.

TOTAL: 45 PERIODS

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:

RO8003 ARTIFICIAL INTELLIGENCE FOR ROBOTICS

OBJECTIVES:
The student should be made to:
- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of Expert Systems and machine learning.
- Learn about planning and reasoning artificial intelligence.
- Solve the risk in artificial intelligence.

UNIT I INTRODUCTION

UNIT II PLANNING
Planning with forward and backward State space search – Partial order planning – Planning graphs–Planning with propositional logic – Planning and acting in real world.

UNIT III REASONING:

UNIT IV LEARNING:
Forms of learning – Knowledge in learning – Statistical learning methods –reinforcement learning, communication, perceiving and acting, Probabilistic language processing, perception.

UNIT V AI IN ROBOTICS:
Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics.

OUTCOMES:
At the end of the course, the student should be able to:
- Identify problems that are amenable to solution by AI methods.
- Identify appropriate AI methods to solve a given problem.
- Formalise a given problem in the language/framework of different AI methods.
- Implement basic AI algorithms.
- Design and carry out an empirical evaluation of different algorithms on a problem formalisation, and state the conclusions that the evaluation supports.
TEXT BOOKS:

REFERENCE:

RO8004 SPECIAL MACHINES AND CONTROLLERS  L  T  P  C

OBJECTIVES:
- To know about stepper motors.
- To know about switched reluctance motors
- To know about permanent magnet brushless d.c. Motors
- To know about permanent magnet synchronous motors
- To know about linear motors

UNIT I STEPPER MOTORS

UNIT II SWITCHED RELUCTANCE MOTORS

UNIT III PERMANENT MAGNET BRUSHLESS D.C. MOTORS

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS
Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power Controllers, Torque speed characteristics, Self control, Vector control, Current control Schemes – Applications.

UNIT V LINEAR MOTORS:

TOTAL : 45 PERIODS

OUTCOMES:
- Understanding principles of operation, types and applications of stepper motors
- Understanding principles of operation, types and applications of switched reluctance motors
- Knowledge in evaluating the performance of dc motors
- To evaluate knowledge in permanent magnet synchronous motors.
- Ability to understand the working and applications linear motors and servo motors.
TEXT BOOKS:

REFERENCES:

RO8005 ADVANCED CONTROL SYSTEMS L T P C
3 0 0 3

OBJECTIVES
• To provide knowledge on design in state variable form
• To provide knowledge in phase plane analysis.
• To give basic knowledge in describing function analysis.
• To study the design of optimal controller.
• To study the design of optimal estimator including Kalman Filter

UNIT I STATE VARIABLE DESIGN
Introduction to state Model- effect of state Feedback- Necessary and Sufficient Condition for Arbitrary Pole-placement- pole placement Design- design of state Observers- separation principle- servo design: -State Feedback with integral control

UNIT II PHASE PLANE ANALYSIS

UNIT III DESCRIBING FUNCTION ANALYSIS

UNIT IV OPTIMAL CONTROL
Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti’s equation – Application examples.

UNIT V OPTIMAL ESTIMATION
Optimal estimation – Kalman Bucy Filter-Solution by duality principle-Discrete systems- Kalman Filter- Application examples..

TOTAL : 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
- Design in state variable form
- Knowledge in phase plane analysis.
- To describe function analysis.
- Know the design of optimal controller.
- Know about the design of optimal estimator including kalman filter

TEXT BOOKS

REFERENCES

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 in to 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 9

UNIT III DESIGN AND TESTING 9

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9

TOTAL: 45 PERIODS

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

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

REFERENCES:
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:
UNIT II  TOTAL PRODUCTIVE MAINTENANCE:  12
Principles; preparatory stages of implementation – TPM organisation structure, creation; basic TPM policies and aids, master plan. TPM IMPLEMENTATION: Small group activities, autonomous maintenance, establishing planned maintenance, training, developing equipment management program.

UNIT III  SAFETY SYSTEMS ANALYSIS:  6
Definitions, safety systems; safety information system: basic concept, safety cost / benefit analysis; industrial safety engineering, OSHA regulations.

UNIT IV  HAZARD ANALYSIS:  10

UNIT V  SAFETY IN MACHINE OPERATION:  10

OUTCOMES:
Students must be able to
- Maintain the industry without any risk in its operation
- Improve the production
- Analyze the hazards in maintenance and to solve it.
- Identify and prevent chemical, environmental mechanical, fire hazard through analysis
- Apply proper safety techniques on safety engineering and management.

TEXT BOOKS:

REFERENCES:

RO8007  NEURAL NETWORKS AND FUZZY SYSTEMS  L T P C
3 0 0 3

OBJECTIVES:
The student should be made to:
- Learn the various soft computing frame works
- Be familiar with design of various neural networks
- Be exposed to fuzzy logic
- Learn genetic programming
- Be exposed to hybrid systems
UNIT I INTRODUCTION TO NEURAL NETWORKS
Differences between Biological and Artificial Neural Networks - Typical Architecture, Common Activation Functions, McCulloch - Pitts Neuron, Simple Neural Nets for Pattern Classification, Linear Separability - Hebb Net, Perceptron, Adaline, Madaline - Architecture, algorithm, and Simple Applications.

UNIT II PATTERN ASSOCIATION

UNIT III COMPETITION, ADAPTIVE RESONANCE AND BACK PROPAGATION NEURAL NETWORKS

UNIT IV CLASSICAL AND FUZZY SETS AND RELATIONS

UNIT V MEMBERSHIP FUNCTIONS
Features of membership function, Standard forms and Boundaries, fuzzification, membership value assignments, Fuzzy to Crisp Conversions, Lambda Cuts for fuzzy sets and relations, Defuzzification methods.

APPLICATIONS: Neural Networks: Robotics, Image compression, Control systems - Fuzzy Logic: Mobile robot navigation, Autotuning a PID Controller.

OUTCOMES:
Upon completion of the course, the student should be able to:
- Apply various soft computing frame works
- Design of various neural networks
- Use fuzzy logic
- Apply genetic programming
- Discuss hybrid soft computing

TOTAL:45 PERIODS

TEXT BOOKS:

REFERENCES:
INDUSTRIAL ROBOTICS AND MATERIAL HANDLING SYSTEMS

OBJECTIVES:
• To introduce the basic concepts, parts of robots and types of robots.
• To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
• To select the robots according to its usage.
• To discuss about the various applications of robots, justification and implementation of robot.
• To know about material handling in a system.

UNIT I INTRODUCTION
Types of industrial robots, Load handling capacity, general considerations in Robotic material handling, material transfer, machine loading and unloading, CNC machine tool loading, Robot centered cell.

UNIT II ROBOTS FOR INSPECTION
Robotic vision systems, image representation, object recognition and categorization, depth measurement, image data compression, visual inspection, software considerations.

UNIT III OTHER APPLICATIONS
Application of Robots in continuous arc welding, Spot welding, Spray painting, assembly operation, cleaning, robot for underwater applications.

UNIT IV END EFFECTORS
Gripper force analysis and gripper design, design of multiple degrees of freedom, active and passive grippers. SELECTION OF ROBOT: Factors influencing the choice of a robot, robot performance testing, economics of robotisation, Impact of robot on industry and society.

UNIT V MATERIAL-handling
Concepts of material handling, principles and considerations in material handling systems design, conventional material handling systems - industrial trucks, monorails, rail guided vehicles, conveyor systems, cranes and hoists, advanced material handling systems, automated guided vehicle systems, automated storage and retrieval systems (ASRS), bar code technology, radio frequency identification technology.

OUTCOMES:
The Student must be able
• Learn about the basic concepts, parts of robots and types of robots.
• To design automatic manufacturing cells with robotic control using the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming.
• Ability in selecting the required robot
• Know various applications of robots
• Apply their knowledge in handling the materials.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To gain knowledge in automation in industries.
- To gain knowledge in various electrical and electronic programmable automations and their applications.
- To know about the basic in SCADA and DCS systems.
- To gain knowledge in communication protocols in an integrated system.
- To know about the advanced in automation industries.

UNIT I

TOTAALLYY INTEGRATTEEDD AUTOMATION:

Need, components of TIA systems, advantages, Programmable Automation Controllers (PAC), Vertical Integration structure.

UNIT II

HMI SYSTEMS:

Necessity and Role in Industrial Automation, Need for HMI systems. Types of HMI- Text display - operator panels - Touch panels - Panel PCs - Integrated displays (PLC & HMI). Check with PLC 502 and remove.

UNIT III

SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA):


UNIT IV

COMMUNICATION PROTOCOLS of SCADA:


UNIT V

DISTRIBUTED CONTROL SYSTEMS (DCS):


TOTAL : 45 PERIODS

OUTCOMES:

- Knowledge of PLC & PAC automation
- Knowledge in HMI systems and to integrate it with other systems.
- Ability to apply SCADA and usage of C programming for report generation.
- Acquiring information’s on communication protocols in automation systems.
- Ability to design and develop automatic control system using distributed control systems.

TEXT BOOKS:


REFERENCES:

3. CIMPLICITY SCADA Packages Manual, Fanuc India Ltd, 2004
GE8077 TOTAL QUALITY MANAGEMENT

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

UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

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

UNIT V QUALITY MANAGEMENT SYSTEM

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

TEXT BOOK:

REFERENCES:
4. ISO 9001-2015 standards
OBJECTIVES:
- To provide 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 code sign 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. Summaries 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 know the basic knowledge about wireless sensor networks
- To impart knowledge in networking using sensors
- To know about the tools used in networking
- To understand the basic in wireless architecture
- To know about the different techniques used in networking

UNIT I  OVERVIEW OF WIRELESS SENSOR NETWORKS  8

UNIT II  ARCHITECTURES  9

UNIT III  NETWORKING SENSORS  10

UNIT IV  INFRASTRUCTURE ESTABLISHMENT  9
Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V  SENSOR NETWORK PLATFORMS AND TOOLS  9

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to know about the different techniques used in networking
- To expose basic knowledge about wireless sensor networks
- Ability to know about the tools in networking
- Understand the basic in wireless architecture
- Ability to know about the protocols used in networking

TEXTBOOKS

REFERENCES
OBJECTIVES:
The student should be made to:
- Basic knowledge about networking in industries.
- Understand the evolution of computer networks using the layered network architecture.
- Understand the concepts of data communications.
- Be familiar with the Transmission media and Tools.
- Design computer networks using sub-netting and routing concepts.

UNIT I  INTRODUCTION

UNIT II  MODBUS

UNIT III  ETHERNET SYSTEMS

UNIT IV  WIRELESS COMMUNICATIONS

UNIT V  APPLICATIONS

OUTCOMES:
At the end of the course, the student should be able to:
- Apply the concepts of data communications and to design computer networks using sub-netting and routing concepts.
- Compare the various medium access control techniques.
- Compare and contrast the characteristics of physical layer.
- Analyze the different protocols.
- Compare and contrast the different network components.

TEXT BOOKS:
1. Steve Mackay, Edwin Wright, Deon Reynders and John Park, “Practical Industrial Data Networks: Design, Installation and Troubleshooting”, Newnes (Elsevier), 2004
REFERENCES:

MG8791

SUPPLY CHAIN MANAGEMENT

L T P C
3 0 0 3

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

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

UNIT II SUPPLY CHAIN NETWORK DESIGN

UNIT III LOGISTICS IN SUPPLY CHAIN
Role of transportation in supply chain – factors affecting transportation decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation.

UNIT IV SOURCING AND COORDINATION IN SUPPLY CHAIN
Role of sourcing supply chain supplier selection assessment and contracts - Design collaboration - sourcing planning and analysis - supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT V SUPPLY CHAIN AND INFORMATION TECHNOLOGY
The role IT in supply chain - The supply chain IT frame work Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain –E-Business in supply chain.

TOTAL: 45 PERIODS

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

TEXT BOOK :

REFERENCES:
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:

MG8591 PRINCIPLES OF MANAGEMENT

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

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

UNIT II PLANNING

UNIT III ORGANISING

UNIT IV DIRECTING

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:

RO8012 DIGITAL SIGNAL PROCESSORS AND ITS APPLICATIONS

OBJECTIVES:
- To understand the concept of information, types of channels
- To understand the capabilities of various source coding theorems and the fundamental limit of transmission over the channel.
- To understand the various concepts of signal processing with its applications.
- To understand the capabilities of various channel coding theorems.
- To develop the knowledge on pass band communication and spread spectrum.

UNIT I ARCHITECTURE OF TMS320C5X
Introduction -Bus structure-Central Arithmetic Logic unit(CALU)-Auxiliary Register ALU(ARAU)-Index register(INDX)-Auxiliary register compare register-Block move address register-,Block repeat registers-parallel logic unit-memory mapped registers-program controllers-on chip features.

UNIT II TMS320C5X PROGRAMMING
Assembly language syntax-Addressing modes, Load/store instructions-Addition/subtraction instructions-Move instructions-Multiplication instruction-NORM instruction-Program control instructions-Peripheral instructions-Instruction Pipelining inC5x-Pipeline structure, Pipeline operation-Normal pipeline Operation.

UNIT III APPLICATIONS
C50 based starter kit-Programs for familiarization of the addressing modes-Program for familiarization of Arithmetic Instructions-Programs in C5x for Processing Real time signals.

UNIT IV ARCHITECTURE OF TMS320C54X
Introduction-Architecture-Buses-Memory Organization-CPU-ALU-Barrel shifter-Multiplier/Adder unit-Compare, Select and store unit-Exponent Encoder-C54X pipeline-On chip Peripherals-Data Address Generation logic-Program address generation logic.
UNIT V TMS320C54X PROGRAMMING 9
TOTAL: 45 PERIODS

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

- Know about the various concepts of signal processing with its applications
- Discuss the representation of signals and the process of sampling, quantization and coding that are fundamental to the digital transmission of analog signals.
- Know about the capabilities of various source coding theorems and the fundamental limit of transmission over the channel.
- Design the baseband and band pass signal transmission and reception techniques.
- Explain error control coding which encompasses techniques for the encoding and decoding of digital data streams for their reliable transmission over noisy channels.

TEXT BOOK:

REFERENCES:
2. Steven W smith “Scientist and Engineer”s Guide to Digital signal processing”, 200

MG8091 ENTERPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

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

UNIT I ENTREPRENEURSHIP 9

UNIT II MOTIVATION 9
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 9
UNIT IV  FINANCING AND ACCOUNTING  

UNIT V  SUPPORT TO ENTREPRENEURS  

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

TEXT BOOKS :

REFERENCES :

RO8013  INTERNET TOOLS AND JAVA PROGRAMMING  
L T P C 3 0 0 3

OBJECTIVES:
The student should be made to:
• Learn about the various tools used in internet
• Learn Java Programming.
• Understand different Internet Technologies and the way to handle it.
• Be familiar with client – side programming and server – side programming.
• Learn to develop web applications.

UNIT I  INTERNET TOOLS  
UNIT II  ABSTRACT FUNCTIONS AND PACKAGES  6

UNIT III  EXCEPTION HANDLING  9
Fundamentals - Exception types - Uncaught Exception - Using Try and Catch - Multiple catch clauses - Nested Try statements - Throw - Throws - Java Built-in Exception - Creating your own subclasses. MULTI THREADED PROGRAMMING: Java thread model - Priorities - Synchronization - Messaging - Thread class and runnable Interface - Main thread - Creating the Thread - Synchronization - Interthread Communication - Deadlock.

UNIT IV  I/O, APPLETS  12
I/O basics - Stream - Stream Classes - Predefined stream - Reading/Writing console input - Applet fundamentals - Native methods - GUI Components - Applets - Java Scripts – AWT / Swings.

UNIT V  INTRODUCTION TO NETWORK PROGRAMMING  9
Fundamentals - Internet Addresses - Internet Protocols - DNS - Internet Services - Socket programming, UDP, TCP. JAVA DATABASE PROGRAMMING: JDBC –Database Connection and Table Creation – Execution of Embedded SQL Statements - ResultSet and ResultSetMetaData – Examples.

TOTAL :45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Implement Java programs and to create a basic website using HTML and Cascading Style Sheets.
- Design and implement dynamic web page with validation using JavaScript objects and by applying different event handling mechanisms.
- Design rich client presentation using AJAX.
- Design and implement simple web page in PHP, and to present data in XML format.
- Design and implement server side programs using Servlets and JSP.

TEXT BOOKS:

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

UNIT I INTRODUCTION

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING

UNIT III CELLULAR MANUFACTURING

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

UNIT V INDUSTRIAL ROBOTICS

TOTAL : 45 PERIODS

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

REFERENCES:

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

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

UNIT I  HUMAN VALUES

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