ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.E. MECHANICAL ENGINEERING (SANDWICH)
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES:
Bachelor of Mechanical Engineering (SW) 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 of electrical power 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 understand and apply basic theorems and postulates in circuit, field and control theories
c) Ability to identify, formulate, and solve electrical power engineering problems
d) Ability to analyse and apply electronics in the field of electrical power apparatus and systems
e) Ability to understand and apply computational platforms and software tools for engineering applications
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

PEO / PO Mapping

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**YEAR IV**

**SEMESTER VII**

**YEAR V**

**SEMESTER IX**

**YEAR VI**

**SEMESTER X**

**YEAR VII**

**SEMESTER XI**
ANNA UNIVERSITY, CHENNAI  
AFFILIATED INSTITUTIONS  
B.E. MECHANICAL ENGINEERING (SANDWICH)  
REGULATIONS – 2017  
CHOICE BASED CREDIT SYSTEM  
I TO X SEMESTERS CURRICULA AND SYLLABI

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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 to 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:
OBJECTIVES:

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

UNIT I  PROPERTIES OF MATTER


UNIT II  WAVES AND FIBER OPTICS


UNIT III  THERMAL PHYSICS


UNIT IV  QUANTUM PHYSICS


UNIT V  CRYSTAL PHYSICS

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

OUTCOMES:

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

REFERENCES:

CY8151 ENGINEERING CHEMISTRY

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

UNIT I WATER AND ITS TREATMENT

UNIT II SURFACE CHEMISTRY AND CATALYSIS

UNIT III ALLOYS AND PHASE RULE
UNIT IV  FUELS AND COMBUSTION  

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:
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  7+12  
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

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

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

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

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

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

TEXT BOOK:
REFERENCES:


Publication of Bureau of Indian Standards:


Special points applicable to University Examinations on Engineering Graphics:

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

GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING
LABORATORY

OBJECTIVES:

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

LIST OF PROGRAMS

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

**PLATFORM NEEDED**
Python 3 interpreter for Windows/Linux

**OUTCOMES:**
Upon completion of the course, students will be able to
- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

**TOTAL: 60 PERIODS**

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**BS8161**

**PHYSICS AND CHEMISTRY LABORATORY**

(Common to all branches of B.E. / B.Tech Programmes)

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

**LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)**

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

**TOTAL: 30 PERIODS**

**OUTCOMES:**
Upon completion of the course, the students will be able to
- apply principles of elasticity, optics and thermal properties for engineering applications.
CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

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

1. Estimation of HCl using Na$_2$CO$_3$ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

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

TOTAL: 30 PERIODS

TEXTBOOKS:
UNIT I  INTRODUCTION TECHNICAL ENGLISH

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

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

UNIT IV  REPORT WRITING

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

TOTAL :  60 PERIODS

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

TEXT BOOKS:

REFERENCES

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

UNIT I  MATRICES

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

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

UNIT IV  COMPLEX INTEGRATION

UNIT V  LAPLACE TRANSFORMS

TOTAL: 60 PERIODS

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

REFERENCES:

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

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

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

UNIT II FERROUS ALLOYS

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

UNIT V  NEW MATERIALS  9

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

TEXT BOOKS:

REFERENCES

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

OBJECTIVES:
To impart knowledge on
- Electric circuit laws, single and three phase circuits and wiring
- Working principles of Electrical Machines
- Working principle of Various electronic devices and measuring instruments
UNIT I  ELECTRICAL CIRCUITS  9

UNIT II  AC CIRCUITS  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

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain,

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

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:

GE8292 ENGINEERING MECHANICS L T P C
3 2 0 4

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

UNIT I STATICS OF PARTICLES 9+6

UNIT II EQUILIBRIUM OF RIGID BODIES 9+6
UNIT III  PROPERTIES OF SURFACES AND SOLIDS  9+6

UNIT IV  DYNAMICS OF PARTICLES  9+6

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

TOTAL : 45+30=75 PERIODS

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

TEXT BOOKS:

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

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13
Buildings:
(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

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

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

II MECHANICAL ENGINEERING PRACTICE 18
Welding:
(a) Preparation of butt joints, lap joints and T-joints by Shielded metal arc welding.
(b) Gas welding practice
Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

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

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

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

III ELECTRICAL ENGINEERING PRACTICE

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.
9. Study-purpose items: centrifugal pump, air-conditioner One each.

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

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

**BE8261 BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION**

**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>

MA8353 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

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

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

UNIT II FOURIER SERIES

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

ME8351  MANUFACTURING TECHNOLOGY – I  L T P C
3 0 0 3

OBJECTIVE:
- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.
UNIT I METAL CASTING PROCESSES 9
Sand Casting : Sand Mould – Type of patterns - Pattern Materials – Pattern allowances –Moulding sand Properties and testing – Cores –Types and applications – Moulding machines – Types and applications; Melting furnaces : Blast and Cupola Furnaces; Principle of special casting processes : Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting - CO2 process – Stir casting; Defects in Sand casting

UNIT II JOINING PROCESSES 9
Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.

UNIT III METAL FORMING PROCESSES 9

UNIT IV SHEET METAL PROCESSES 9

UNIT V MANUFACTURE OF PLASTIC COMPONENTS 9

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

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

UNIT I BASICS OF MECHANISMS


UNIT II KINEMATICS OF LINKAGE MECHANISMS


UNIT III KINEMATICS OF CAM MECHANISMS


UNIT IV GEARS AND GEAR TRAINS


UNIT V FRICTION IN MACHINE ELEMENTS

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1 Discuss the basics of mechanism
CO2 Calculate velocity and acceleration in simple mechanisms
CO3 Develop CAM profiles
CO4 Solve problems on gears and gear trains
CO5 Examine friction in machine elements
TEXT BOOKS:

REFERENCES:

CE8395 STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

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

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

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

UNIT IV DEFLECTION OF BEAMS
Double Integration method – Macaulay’s method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.
UNIT V  THIN CYLINDERS, SPHERES AND THICK CYLINDERS
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame’s theorem.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

MS8301  MACHINE DRAWING  L T P C
2 0 4 4

OBJECTIVES:
- Use of drawing tools to show the assembly view of the component and mark suitable units, fir tolerance data.
- Practicing free hand sketches and assembly drawings.
- Creating bill of materials and practicing various calculations.

UNIT I  INTRODUCTION  6+12

UNIT II  ASSEMBLY CONCEPTS  6+12
Methods and concepts of assemblies-assembly requirements, Bill of materials. Methods of assembly-bolts, nuts, studs, screws and pins. Methods of arresting motion of a member in an assembly. Assembly and dismantling exercise of a typical assembly with emphasis on assembly sequence and appropriate fits.
UNIT III FITS AND TOLERANCES 6+12

UNIT IV ASSEMBLY DRAWING PRACTICE 6+12
Making free hand sketches of typical subassemblies-flange coupling, stuffing box, journal bearings, rolling element bearings, keyed joints, cotter joints, C clamp.

UNIT V ASSEMBLY USING SOLID MODELING 6+12
Modeling and assembly using software-extracting views and sections. Drawing of assemblies-plummer block, machine vice, stop valve, screw jack, tail stock, cylindrical gear box, simple drill jig. Creation of bill of materials, calculation of mass and section properties, interference check between solids.

TOTAL (L:45+P:15): 90 PERIODS

OUTCOMES:
- Upon completion of this course, the students can able to apply the drawing tools to show the assembly view of the component and mark suitable units, fit tolerance data.
- Able to draw free hand sketches and assembly drawing.
- Able to create bill of materials.

TEXT BOOKS:

REFERENCES:

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

TOTAL: 60 PERIODS
OUTCOME:
- The students will have the required knowledge in the area of testing of materials and components of structural elements experimentally.

REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Equipment</th>
<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 Rockwell Vicker’s Brinnel</td>
<td>1 each</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>

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

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

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

TOTAL: 60 PERIODS
OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Demonstrate the safety precautions exercised in the mechanical workshop.
CO2 Make the workpiece as per given shape and size using Lathe.
CO3 Join two metals using arc welding.
CO4 Use sheet metal fabrication tools and make simple tray and funnel.
CO5 Use different moulding tools, patterns and prepare sand moulds.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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

MS8311 INDUSTRIAL TRAINING I (PROCESS ENGINEERING AND ASSEMBLY TECHNOLOGIES) 0 0 0 2
Machining, assembly and process engineering - preparation of process sheets for spur gear – helical gear - sprockets - worm - worm wheel and rack - sequence of operations - machine tools used - speed and feed in each type of machine tool-setting time - operating time - cutting tools - Jigs and fixtures - gauges and instruments - study of assembly method for conventional lathe, pre assembly, sub-assembly and final assembly - study of assembly drawings - preparation of ration of loading sheets - assembly flow chart - assembly time - fits and tolerance between components – inspection methods – material flow diagrams.

HS8381 INTERPERSONAL SKILLS/LISTENING&SPEAKING 0 0 2 1
OBJECTIVES: The Course will enable learners to:
• Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
• Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
• improve general and academic listening skills
• Make effective presentations.
UNIT I
Listening as a key skill - its importance - speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

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

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

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

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

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:
Listen and respond appropriately.
Participate in group discussions
Make effective presentations
Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

REFERENCES
MA8391 PROBABILITY AND STATISTICS

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

UNIT I PROBABILITY AND RANDOM VARIABLES 12

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS 12
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT V STATISTICAL QUALITY CONTROL 12
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

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

TEXT BOOKS:
REFERENCES:

ME8451 MANUFACTURING TECHNOLOGY – II L T P C
3 0 0 3

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

UNIT I THEORY OF METAL CUTTING 9
Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools– nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II TURNING MACHINES 9
Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle : Swiss type, automatic screw type – multi spindle:

UNIT III SHAPER, MILLING AND GEAR CUTTING MACHINES 9

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

UNIT V CNC MACHINING 9

TOTAL : 45 PERIODS
OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Explain the mechanism of material removal processes.
CO2 Describe the constructional and operational features of centre lathe and other special purpose lathes.
CO3 Describe the constructional and operational features of shaper, planner, milling, drilling, sawing and broaching machines.
CO4 Explain the grinding and other super finishing processes apart from gear manufacturing processes.
CO5 Summarize numerical control of machine tools and write a part program.

TEXT BOOKS:

REFERENCES:

CE8394 FLUID MECHANICS AND MACHINERY

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

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

UNIT II FLOW THROUGH CIRCULAR CONDUITS 12

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

UNIT V  TURBINES

TOTAL: 60 PERIODS

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

TEXT BOOK:

REFERENCES:

ME8594  DYNAMICS OF MACHINES

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

UNIT I  FORCE ANALYSIS
UNIT II BALANCING

UNIT III FREE VIBRATION

UNIT IV FORCED VIBRATION

UNIT V MECHANISM FOR CONTROL

TOTAL : 60 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To impart knowledge on measurements and variables
- To introduce different parameters in environment and measuring techniques
- To teach the control system principle and build times response of different system

UNIT I TRANSODUCER VARIABLES AND MEASUREMENT SIGNALS 10
Three stages of generalized measurement system – mechanical loading – static characteristics of instruments- factors considered in selection of instruments – commonly used terms, error analysis and classification – sources of error – frequency response – displacement transducers – potentiometer, strain gauge – orientation of strain gauge, LVDT – variable reluctance transducers, proximity sensors, capacitance transducers, tacho generator; smart sensors, integrated sensors, radio telemetry, torque measurements, precision systems like video discs and drives, laser printer etc.,

UNIT II VIBRATION AND TEMPERATURE 9
Elementary accelerometer and vibrometer – seismic instrument for acceleration – velocity measurement, piezo electric accelerometer, temperature measurement-liquid in glass thermometer, pressure thermometer, resistance temperature detector, thermocouples and thermopiles, thermistor, total radiation pyrometer, optical pyrometer – temperature measuring problem in flowing fluid.

UNIT III PRESSURE AND FLOW MEASUREMENT 9
Manometer, elastic transducer, elastic diaphragm transducer – pressure cell, bulk modulus pressure gauge – Mc Leod gauge – thermal conductivity gauge, calibration of pressure gauge, flow measurement – turbine type meter, hotwire anemometer, magnetic flow meter; liquid level sensors, light sensors, selection of sensors.

UNIT IV CONTROL SYSTEM PRINCIPLE 16
Basic elements of control systems – open loop and closed loop control – elements of closed loop control system – introduction to sampled data, digital control and multivariable control systems. Elements of lead and lag compensation, elements of proportional, integral - derivative (PID) control.

MODELLING OF SYSTEMS:

UNIT V SYSTEM ANALYSIS 16

TOTAL: 60 PERIODS

OUTCOMES:
- Able to know the working principle of temperature, pressure, vibration, flowing sensors.
- Use of control system principle and use of the sensor to design close loop system.
- Develop mathematical model for mechanical and electrical system.
TEXT BOOKS:

REFERENCES:

CE8462 FLUID MECHANICS AND MACHINERY LABORATORY

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

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

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

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>Orifice meter setup</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Venturi meter setup</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Rotameter setup</td>
<td>1</td>
</tr>
</tbody>
</table>
ME8481  DYNAMICS LABORATORY  L T P C
0 0 4 2

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>
<tr>
<td>9</td>
<td>Gear Models</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>Kinematic Models to study various mechanisms.</td>
<td>1 No.</td>
</tr>
<tr>
<td>11</td>
<td>Turn table apparatus.</td>
<td>1 No.</td>
</tr>
<tr>
<td>12</td>
<td>Transverse vibration setup of</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>a) cantilever</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Free-Free beam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Simply supported beam</td>
<td></td>
</tr>
</tbody>
</table>

### ME8462 MANUFACTURING TECHNOLOGY LABORATORY – II

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

**LIST OF EXPERIMENTS:**
1. Contour milling using vertical milling machine
2. Spur gear cutting in milling machine
3. Helical Gear Cutting in milling machine
4. Gear generation in hobbing machine
5. Gear generation in gear shaping machine
6. Plain Surface grinding
7. Cylindrical grinding
8. Tool angle grinding with tool and Cutter Grinder
9. Measurement of cutting forces in Milling / Turning Process
10. CNC Part Programming

**OUTCOMES:**

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

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

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

MS8411  INDUSTRIAL TRAINING II (INSPECTION AND TESTING OF MECHANICAL ASSEMBLIES) 0 0 0 2

Inspection and testing of lathes, pumps and motors - BIS specification for motors and pump sets – list of testing instrument - functions - foot mounting motor dimensions as per IS: 1231 - importance of name plate and identification of name plate details - trouble shooting of induction motors - type of routine test of induction motor as per IS : 7538 (Performance Calculations) 1) Measurement of stator resistance 2) High voltage test 3) Measurement of insulation resistance 4) Reduced voltage test 5) No load test 6) Full load test 7) Locked rotor test 8) Starting torque and starting current 9) Pull up torque 10) Pull out torque 11) Momentary over load test 12) Temperature rise test - Final inspection and testing for conventional lathes - Test charts - Inspection of the machine tool for BIS and IMTMA standard - Cutting test - Method of inspection testing - Gauges and instruments required – Accuracy requirements - Deviation observed - Study of inspection methods and preparation of inspection format for lathe bed - Head stock body - Tail stock body - Apron body - Threading and feed box – Gear box - Head stock spindle - Tail stock spindle - Gear - Lead screw - Feed shaft - Spine shaft. – Exposure to metrological aspects of components used for lathes, pumps and motors.

MA8491  NUMERICAL METHODS 4 0 0 4

OBJECTIVES:
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To acquaint the student with understanding of 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.
- To understand the knowledge of various techniques and methods of solving various types of partial differential equations.
UNIT I  SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS  12

UNIT II  INTERPOLATION AND APPROXIMATION  12
Interpolation with unequal intervals - Lagrange’s interpolation – Newton’s divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton’s forward and backward difference formulae.

UNIT III  NUMERICAL DIFFERENTIATION AND INTEGRATION  12

UNIT IV  INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS  12

UNIT V  BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS  12
Finite difference methods for solving second order two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL : 60 PERIODS

OUTCOMES :
Upon successful completion of the course, students should be able to:
- Understand the basic concepts and techniques of solving algebraic and transcendental equations.
- Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
- 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:

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

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

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

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

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

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

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

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

TEXT BOOKS:

REFERENCES:

MS8501 INDUSTRIAL METALLURGY L T P C
3 0 0 3

OBJECTIVE:
• To understand and learn the fundamental principles of metallurgy and material science and heat treatment processes of metals.

UNIT I CRYSTAL STRUCTURE
BCC, FCC and HCP structure- unit cell –crystallographic planes and directions, miller indices-crystal imperfections, point, line, planar and volume defects –Grain size, ASTM grain size number

UNIT II MECHANICAL PROPERTIES AND TESTING
UNIT III CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

UNIT IV HEAT TREATMENT 9

UNIT V FERROUS MATERIAL 9

TOTAL : 45 PERIODS

OUTCOMES:
- ability to relate crystal structure with material properties
- knowledge of material characterisation and testing
- ability to select suitable heat treatment method for improving mechanical properties.
- knowledge of selecting material for engineering application

TEXT BOOK:

REFERENCES:
UNIT III  PROPERTIES OF PURE SUBSTANCE  9+6
Pure substance, phase-change processes, property diagram for phase processes, properties table, Mollier chart. VAPOUR POWER CYCLE: Rankine and modified Rankine cycle, Reheat cycle, Regenerative cycle, Reheat-Regenerative cycle, Binary vapour cycle.

UNIT IV  PROPERTIES OF IDEAL GASES AND REAL GASES  9+6
Ideal gas equation, evaluation of work and heat, entropy changes, real gases, Van der Waals equation, compressibility - universal compressibility chart and general thermodynamic relations.

UNIT V  PSYCHROMETRY  9+6

TOTAL: 75 PERIODS

OUTCOMES:
- Upon completion of this course, the students can apply the Thermodynamic Principles to Mechanical Engineering application.
- Apply mathematical fundamentals to study the properties of steam, gas and gas mixtures.

TEXT BOOKS:

REFERENCES:

MS8503  METROLOGY AND QUALITY ASSURANCE  L T P C
3 0 0 3

OBJECTIVES:
- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.
UNIT I  BASICS OF MEASUREMENT AND DEVICES  9

UNIT II  LINEAR MEASUREMENTS  9
Material length standards – line and end measurement – calibration of end bars, datum and reference surfaces, surface plates, gauges – feeler gauges, micrometers, dial test indicator, slip gauges, care of gauge blocks, Comparators- mechanical, electrical, optical and pneumatic, optical projector. GEOMETRICAL MEASUREMENT: Angular measurement – plain vernier and optical protractors, sine bar, optical instruments, flatness, parallelism and roundness measurement, need for limit gauge, design of plug gague, Taylor’s principle, three basic types of limit gauges, surface texture, reasons for controlling surface texture, parameters used , specification of surface texture, drawing and symbols, Tomilson surface meter. CMM.

UNIT III  METROLOGY OF MACHINE ELEMENTS  9
Types of screw threads, terminology, proportions of ISO metric thread, measurement of major, minor and effective diameters. Gear terminology and standard proportions, spur gear measurement, checking of composite errors, base pitch measurement, clean room environment.

UNIT IV  MACHINE INSTALLATION AND TESTING  9
Equipment erection, commissioning, testing procedure for lathe, milling, continuous process line. First aid, safety precautions in installation of equipment, protocol for repair and testing, inspection check list.

UNIT V  STATISTICAL QUALITY CONTROL  9
Process capability, steps in using control charts, basic principles of lot sampling – sampling inspection, single and double sampling, determination of sample size, OC curves, AOQ, ABC standards. QUALITY CONTROL CHARTS: Types, manufacturing specifications, p chart, np chart, c chart, u chart, X and R chart – solving problems using the charts. Design of tool for inspection, gauging design of plug, snap gauges, thread gauges. Gauge repeatability and reproducibility studies.

TOTAL : 45 PERIODS

OUTCOME:
- Upon completion of this course, the students can apply different measurement technologies and use of them in Industrial Components

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To familiar with different measurement equipments and use of this industry for quality inspection

LIST OF EXPERIMENTS
1. Measurements of angle using Sine bar / bevel protractor
2. Measurement of External and internal Taper angle
3. Measurement of Bore Diameter
4. Calibration of Dial gauge
5. Measurement of Roundness
6. Measurements of Screw Thread Parameters using three-wire method
7. Measurements of Surface Roughness
8. Measurements using Toolmakers Microscope
9. Measurements using Profile Projector
10. Measurements using Vision System
11. Measurements using CMM

TOTAL: 60 PERIODS

OUTCOMES:
Upon completion of this course, the students will have
- Ability to handle different basic measurement tools and perform precise measurements.
- Ability to measure the surface roughness both manually and using sophisticated device.
- Ability to measure the dimensions using CMM.
- Ability to measure the dimension using Vision System.
- Ability to calibrate the measuring device.

LIST OF EQUIPMENTS 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>Vernier Calipers 0-150 mm</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Vernier Calipers 0-300 mm</td>
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</tr>
<tr>
<td>3</td>
<td>Micrometer 0-25 mm</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Micrometer 25-50 mm</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Micrometer 50-75 mm</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Dial gauges LC 10micrometer</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Dial gauge L.C. 2micrometer</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>Height gauge Analog</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Height gauge Digital</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Slip gauge set</td>
<td>2 SET</td>
</tr>
<tr>
<td>11</td>
<td>Sine Bar 100 mm</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Sine Bar 200 mm</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>Toolmakers microscope</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Profile Projector</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>Gear tooth verniers</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>Flangernic 0-25</td>
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<tr>
<td>17</td>
<td>Flangemic 25-50</td>
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<tr>
<td>18</td>
<td>Floating carriage micrometer</td>
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<tr>
<td>19</td>
<td>Thread plug gauges m24 x 3</td>
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</tr>
<tr>
<td>20</td>
<td>Thread plug gauges m20 x 2.5</td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>3 wire set box</td>
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</tr>
<tr>
<td>22</td>
<td>Surface roughness measuring Instrument</td>
<td>1</td>
</tr>
<tr>
<td>23</td>
<td>Precision spheres different dia</td>
<td>1 SET</td>
</tr>
<tr>
<td>24</td>
<td>Dial Guage Caliberator</td>
<td>1</td>
</tr>
</tbody>
</table>
LIST OF EXPERIMENTS:

1. Specimen preparation for macro – examination.
2. Specimen preparation for micro examination and study of Micro structure of –
   a) Carbon steel s(High, Medium, and Low)
   b) Cast Iron (Gray, White, Nodular, Malleable)
   c) Brass (70/30), Bronze (tin bronze), Al-Si alloy, cupro-nickel, Ti alloy.
4. Cooling curves
   a) Pure Metal (Pb or Sn)
   b) Alloy (Pb-Sn or Pb-Sb)
5. Heat treatments (carry out the following heat treatment and study the micro structure before and after heat treatments)
   a) Annealing
   b) Normalising
   c) Quench Hardening
   d) Tempering
6. Jominy End Quench Test
7. Foundry Sand testing
   a) Sieve analysis
   b) Strength of moulding sand
   c) Permeability of moulding sand
   d) Clay content of moulding sand
   e) Moisture content of moulding sand
8. Electro-chemical Test
   a) Electro deposition
   b) Electro-chemical etching test

TOTAL: 60 PERIODS
OUTCOMES:
- Ability to interpret the microstructure of different ferrous and non-ferrous alloys.
- Ability to perform quantitative metallography.
- Ability to perform heat treatment, surface treatment on metals.
- Ability to analyze the properties of Foundry Sand.
- Ability to perform Electro Chemical Tests.

LIST OF EQUIPMENTS 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>Jominy End Quench Test</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Specimen Mounting Test with Digital Measurements</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Trinocular Microscopes with Objective Lens</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Disc Polishing Machine</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Muffle Furnace</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Optical Microscope with Image Analyzing Software</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Micro Vicker Hardness Tester</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Printer to print the Microstructure</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Hardness Tester (Brinell or Rockwell)</td>
<td>1</td>
</tr>
</tbody>
</table>

MS8511  INDUSTRIAL TRAINING III  (PRODUCT DEVELOPMENT AND QUALITY SYSTEMS)  L T P C  0 0 0 2

Total product knowledge, reverse engineering and quality system skill (Mini Project- I), Detailed constructional knowledge of product assembly, sub assembly, components, Sequential assembly and disassembly procedure, capturing of all geometrical dimensions, drawings, tolerances, fits, form error, material of construction and to understand the product development skills for lathes, drilling machines, submersible pumps, mono block pumps & electric motors - Comparison of design construction of other makes for above products and analysis - To develop any new product with innovation & creativity - Report preparation, presentation and evaluation - Awareness of TQM, ISO9000, ISO14000 and other standards etc. - Process capability studies – Rejection analysis – Six sigma applications – Calibration needs – Calibration authorities – Records – Charts – Applications – Form error understanding and verification - Case studies in quality systems.

ME8651  DESIGN OF TRANSMISSION SYSTEMS  L T P C  3 0 0 3

OBJECTIVES:
- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues (Use of P S G Design Data Book permitted)
UNIT I DESIGN OF FLEXIBLE ELEMENTS
Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

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

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS

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

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

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

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
ME8493 THERMAL ENGINEERING - I L T P C
3 0 0 3

OBJECTIVES:
- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic processes
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam.
- Turbines, Compressors and Refrigeration and Air conditioning systems

(Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychrometric chart permitted)

UNIT I GAS AND STEAM POWER CYCLES
9

UNIT II RECIPROCATING AIR COMPRESSOR
9

UNIT III INTERNAL COMBUSTION ENGINES AND COMBUSTION
9

UNIT IV INTERNAL COMBUSTION ENGINE PERFORMANCE AND SYSTEMS
9

UNIT V GAS TURBINES
9

TOTAL:45 PERIODS

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

TEXT BOOKS:
REFERENCES:

ME8694 HYDRAULICS AND PNEUMATICS

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

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS

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

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

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:

ME8592 CAD/CAM L T P C 3 0 0 3
OBJECTIVE:
• To provide an overview of how computers are being used in mechanical component design

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS
Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations homogeneous coordinates - Line drawing -Clipping- viewing transformation

UNIT II GEOMETRIC MODELING AND VISUAL REALISM

UNIT III ASSEMBLY OF PARTS AND CAD STANDARDS
Assembly modelling – interferences of positions and orientation – tolerance analysis-massproperty calculations – mechanism simulation and interference checking.
Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards.
UNIT IV  FUNDAMENTALS OF CAM


UNIT V  PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING


OUTCOME:
- Upon completion of this course, the students can able to use computer and CAD software’s for modeling of mechanical components

TEXT BOOK:

REFERENCES:

ME8681  CAD/CAM LABORATORY

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

LIST OF EXPERIMENTS

1. 3D GEOMETRIC MODELLING  30 PERIODS

List of Experiments
1. Introduction of 3D Modelling software

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

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

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

**TOTAL: 60 PERIODS**

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

### LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Qty</th>
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</thead>
<tbody>
<tr>
<td><strong>HARDWARE</strong></td>
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<tr>
<td>1.</td>
<td>Computer Server</td>
<td>1</td>
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<tr>
<td>2.</td>
<td>Computer nodes or systems (High end CPU with atleast 1 GB main memory) networked to the server</td>
<td>30</td>
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<tr>
<td>3.</td>
<td>A3 size plotter</td>
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<tr>
<td>4.</td>
<td>Laser Printer</td>
<td>1</td>
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<tr>
<td>5.</td>
<td>CNC Lathe</td>
<td>1</td>
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<tr>
<td>6.</td>
<td>CNC milling machine</td>
<td>1</td>
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<tr>
<td><strong>SOFTWARE</strong></td>
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<tr>
<td>7.</td>
<td>Any High end integrated modeling and manufacturing CAD / CAM software</td>
<td>15 licenses</td>
</tr>
<tr>
<td>8.</td>
<td>CAM Software for machining centre and turning centre (CNC Programming and tool path simulation for FANUC / Sinumeric and Heidenhain controller)</td>
<td>15 licenses</td>
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<tr>
<td>9.</td>
<td>Licensed operating system</td>
<td>Adequate</td>
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<tr>
<td>10.</td>
<td>Support for CAPP</td>
<td>Adequate</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To study the value timing-V diagram and performance of IC Engines
- To Study the characteristics of fuels/Lubricates used in IC Engines
- To study the Performance of steam generator/ turbine

LIST OF EXPERIMENTS

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

STEAM LAB
1. Study on Steam Generators and Turbines.

OUTCOME:
- Ability to conduct experiment on IC engine to study the characteristic and performance of IC design/ steam turbines.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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

INDUSTRIAL TRAINING IV

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

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

UNIT II
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

UNIT III
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying —GD strategies- activities to improve GD skills

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

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

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

Recommended Software
1. Open Source Software
2. Win English

REFERENCES:
ME8791  MECHATRONICS  L  T  P  C
3  0  0  3

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

UNIT I  INTRODUCTION  9

UNIT II  MICROPROCESSOR AND MICROCONTROLLER  9

UNIT III  PROGRAMMABLE PERIPHERAL INTERFACE  9

UNIT IV  PROGRAMMABLE LOGIC CONTROLLER  9
Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT V  ACTUATORS AND MECHATRONIC SYSTEM DESIGN  9

TOTAL : 45 PERIODS

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

TEXT BOOKS:
REFERENCES:

ME8595 THERMAL ENGINEERING – II

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

UNIT I STEAM NOZZLE 9
Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.

UNIT II BOILERS 9

UNIT III STEAM TURBINES 9
Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.

UNIT IV COGENERATION AND RESIDUAL HEAT RECOVERY 9

UNIT V REFRIGERATION AND AIR – CONDITIONING 9

TOTAL:45 PERIODS

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

REFERENCES:

ME8692 FINITE ELEMENT ANALYSIS L T P C
3 0 0 3

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

UNIT I INTRODUCTION
9

UNIT II ONE-DIMENSIONAL PROBLEMS
9

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS
9

UNIT IV 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.

UNIT V ISOPARAMETRIC FORMULATION
9

TOTAL: 45 PERIODS
OUTCOMES
CO1 Summarize the basics of finite element formulation.
CO2 Apply finite element formulations to solve one dimensional Problems.
CO3 Apply finite element formulations to solve two dimensional Problems.
CO4 Apply finite element method to solve heat transfer and fluid mechanics problems.
CO5 Apply finite element method to solve problems on dynamic analysis.

TEXT BOOKS:

REFERENCES:

ME8781 MECHATRONICS LABORATORY

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OBJECTIVES:
- To know the method of programming the microprocessor and also the design, modeling & analysis of basic electrical, hydraulic & pneumatic Systems which enable the students to understand the concept of mechatronics.

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

TOTAL: 60 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Demonstrate the functioning of mechatronics system with various pneumatic, hydraulic and electrical systems.
CO2 Demonstrate the functioning of control systems with the help of PLC and microcontrollers.
OBJECTIVE:
- To expose the students in the usage of software for modeling and analysis of machine components.

LIST OF EXPERIMENTS:
1. Solid modeling of engineering components of a typical assembly and extraction of production drawings of the above 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.
4. Thermal analysis of IC engine components using FEA software.
5. Crash analysis of an automobile using FEA software.
10. Tolerance stack up using simulation software.

TOTAL: 60 PERIODS

OUTCOMES:
- Exposed to use CAD software for creating wire frame and solid models of machine parts
- Ability to conduct kinematic and dynamic simulations of mechanisms
- Knowledge in using softwares for Crash/Impact, flow analysis.
- Usage of FEA softwares in mechanical and thermal load analysis

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<thead>
<tr>
<th>Sl. No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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<tbody>
<tr>
<td>1</td>
<td>Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control each</td>
<td>1 No.</td>
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<tr>
<td>2</td>
<td>Basic Hydraulic Trainer Kit</td>
<td>1 No</td>
</tr>
<tr>
<td>3</td>
<td>Hydraulics and Pneumatics Systems Simulation Software</td>
<td>10 No</td>
</tr>
<tr>
<td>4</td>
<td>8051 - Microcontroller kit with stepper motor and drive circuit sets</td>
<td>2 No</td>
</tr>
<tr>
<td>5</td>
<td>Image processing system with hardware &amp; software</td>
<td>1 No.</td>
</tr>
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MS8711 COMPUTER AIDED ENGINEERING LABORATORY

L T P C
0 0 4 2

TOTAL: 60 PERIODS
OBJECTIVES
- To study the heat transfer phenomena and predict the relevant coefficient using implementation
- To study the performance of refrigeration cycle / components

LIST OF EXPERIMENTS:

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

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

OUTCOME
- Ability to demonstrate the fundamentals of heat

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
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<tr>
<td>1</td>
<td>Guarded plate apparatus</td>
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<td>2</td>
<td>Lagged pipe apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Natural convection-vertical cylinder apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Forced convection inside tube apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Composite wall apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Thermal conductivity of insulating powder apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Pin-fin apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>Stefan-Boltzmann apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>9</td>
<td>Emissivity measurement apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>Parallel/counter flow heat exchanger apparatus</td>
<td>1 No.</td>
</tr>
<tr>
<td>11</td>
<td>Single/two stage reciprocating air compressor</td>
<td>1 No.</td>
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<tr>
<td>12</td>
<td>Refrigeration test rig</td>
<td>1 No.</td>
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<tr>
<td>13</td>
<td>Air-conditioning test rig</td>
<td>1 No.</td>
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79
MS8713  INDUSTRIAL TRAINING V  L T P C
(MANAGERIAL SKILLS, CREATIVITY, SOFT SKILLS, HRM)  0 0 0 2
Managerial skills, soft skills and HRM, Generation of creative and innovative ideas, SWOT analysis
Executive Skills-Group Discussions-Communication Skills-Project Report preparation methods-Focus
on customer needs-Visual Management-Scheduling systems-Maintenance Management-Vendor
Developments-Model Preparations-Production, Planning & Controls-Storage & Inventory
Management-Supply Chain Management-Lean Methods-Wastage Identifications - Equipment Up
Time-Kaizen & Lean Practices, human Resource Management Skills-Innovation & Adaptation Skills-
Creative Skills- Patent Right knowledge-Competitive Skills- Interview focusing skills- Product
Development Skills- Reverse Engineering Skills- Concurrent Engineering Skills-Prototyping Skills-

MS8801  DESIGN FOR MANUFACTURE AND ASSEMBLY  L T P C
3 2 0 4
OBJECTIVES:
- Apply the principle of geometric tolerance in assembly.
- Use of datum system for assembly
- Use of systematic assembly procedure for manufacturing assembly.

UNIT I  DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS
IN INDUSTRY  9+6
DFM approach, DFM guidelines, standardisation, group technology, value engineering, comparison of
materials on cost basis, design for assembly, DFA index, Poka - Yoke principle; concept; design
creativity.

UNIT II  TOLERANCE ANALYSIS  9+6
Process capability, process capability metrics, Cp, Cpk , cost aspects, feature tolerances, geometric
tolerances, surface finish, review of relationship between attainable tolerance grades and different
machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law.
SELECTIVE ASSEMBLY: Interchangeable and selective assembly, deciding the number of groups,
Model-I: group tolerances of mating parts equal; Model-II: total and group tolerances of shaft, control
of axial play-introducing secondary machining operations, laminated shims, examples.

UNIT III  DATUM SYSTEMS  9+6
Degrees of freedom, grouped datum systems-different types, two and three mutually perpendicular
grouped datum planes, grouped datum system with spigot and recess, pin and hole, grouped datum
system with spigot and recess pair and tongue-slot pair, computation of translational and rotational
accuracy, geometric analysis and applications.

UNIT IV  TRUE POSITION TOLERANCING THEORY  9+6
Comparison between co-ordinate and convention method of feature location, tolerancing and true
position tolerancing, virtual size concept, floating and fixed fasteners, projected tolerance zone,
assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging,
compound assembly, examples.

FORM DESIGN OF CASTINGS AND WELDMENTS:
Redesign of castings based on parting line considerations, minimising core requirements, redesigning
cast members using weldments, use of welding symbols – design considerations for plastic
component manufacturing.
UNIT V  
TOLERANCE CHARTING TECHNIQUE:  
Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples, design features to facilitate machining, datum features - functional and manufacturing, component design-machining considerations, redesign for manufacture, examples.  
LEAN MANUFACTURING: Need for lean concepts, different types of waste, metrics of manufacturing, an overview of value stream mapping-present state map, future state map, evaluation of benefits – Process FMEA, Design FMEA.

OUTCOMES:  
- Upon completion of this course the student and able to apply the principle of geometric tolerance in assembly,  
- Use of datum system for assembly and use of systematic assembly procedure for manufacturing assembly.

TEXT BOOKS:  

REFERENCES:  

MG8491  
OPERATIONS RESEARCH  
L T P C  
3 0 0 3

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

UNIT I  
LINEAR MODELS  
UNIT II TRANSPORTATION MODELS AND NETWORK MODELS

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

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

UNIT V DECISION MODELS

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:

ME8091 AUTOMOBILE ENGINEERING

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</tbody>
</table>

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
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

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

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

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

UNIT V ALTERNATIVE ENERGY SOURCES


TOTAL: 45 PERIODS

OUTCOMES:

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

CO1 recognize the various parts of the automobile and their functions and materials.
CO2 discuss the engine auxiliary systems and engine emission control.
CO3 distinguish the working of different types of transmission systems.
CO4 explain the Steering, Brakes and Suspension Systems.
CO5 predict possible alternate sources of energy for IC Engines.

TEXT BOOKS:


REFERENCES:

OBJECTIVES:
- To understand the mechanisms of heat transfer under steady and transient conditions.
- To understand the concepts of heat transfer through extended surfaces.
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.
  (Use of standard HMT data book permitted)

UNIT I  CONDUCTION  9+6

UNIT II  CONVECTION  9+6

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

UNIT IV  RADIATION  9+6

UNIT V  MASS TRANSFER  9+6

TOTAL : 75 PERIODS

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

TEXT BOOKS:
REFERENCES:

MS8811 HEAT AND MASS TRANSFER LABORATORY

OBJECTIVES:
- To impart practical knowledge in conducting experiments using heat and mass transfer devices like tubes, tins etc.
- To make the students to understand different modes of heat transfer mechanisms

LIST OF EXPERIMENTS:
1. Experiment on Pin Fin apparatus
2. Experiment on natural convective heat transfer from vertical cylinder
3. Experiment on forced heat transfer inside tube
4. Determination of Stefan-Boltzmann constant
5. Determination of emissivity of grey surface
6. Effectiveness of parallel/counter flow heat exchanger
7. Experiment on boiling and condensation apparatus
8. Study on heat transfer in compressor and IC engine cylinder heads using finite element analysis software.

TOTAL: 60 PERIODS

OUTCOMES:
- Understanding the various heat and mass transfer mechanisms using experiments.
- Ability to use FEA for analysis of Engine components.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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<td>1</td>
<td>Guarded plate apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>2</td>
<td>Lagged pipe apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>3</td>
<td>Natural convection-vertical cylinder apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>4</td>
<td>Forced convection inside tube apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>5</td>
<td>Pin-fin apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>6</td>
<td>Stefan-Boltzmann apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>7</td>
<td>Emissivity measurement apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>8</td>
<td>Parallel/counter flow heat exchanger apparatus</td>
<td>1 no</td>
</tr>
<tr>
<td>9</td>
<td>Finite element thermal loading analysis softwares licenses</td>
<td>5 nos</td>
</tr>
</tbody>
</table>
The depth of understanding of the courses studied by the students will be evaluated by a panel of faculty.

TOTAL: 30 PERIODS


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

UNIT I INTRODUCTION

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

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

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


TOTAL: 45 PERIODS

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

TEXT BOOK:

REFERENCES:
4. ISO 9001-2015 standards

ME8793 PROCESS PLANNING AND COST ESTIMATION

L T P C
3 0 0 3

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

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

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

UNIT III INTRODUCTION TO COST ESTIMATION
Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

ME8682 DESIGN AND FABRICATION PROJECT

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.
INDUSTRIAL TRAINING VII


MG8591  PRINCIPLES OF MANAGEMENT  L T P C

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

UNIT I  INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS  9

UNIT II  PLANNING  9

UNIT III  ORGANISING  9

UNIT IV  DIRECTING  9

UNIT V  CONTROLLING  9
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS
OUTCOME:
- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

REFERENCES:

MS8111 PROJECT WORK

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

The students in a group of 3 to 4 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

OUTCOMES:
- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.
OBJECTIVES:
- To understand the fundamentals of composite material strength and its mechanical behavior
- Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
- Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 9

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 9

UNIT III LAMINA STRENGTH ANALYSIS 9

UNIT IV THERMAL ANALYSIS 9

UNIT V ANALYSIS OF LAMINATED FLAT PLATES 9

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

TOTAL: 45 PERIODS
CO4 Analyze the thermal behavior of Composite laminates
CO5 Analyze Laminate flat plates

TEXT BOOKS:

REFERENCES:

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

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

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9

UNIT II THERMAL AND ELECTRICAL ENERGY BASED PROCESSES 9

UNIT III CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9

UNIT IV ADVANCED NANO FINISHING PROCESSES 9
Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.
UNIT V  RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES 9
Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

ME8098  QUALITY CONTROL AND RELIABILITY ENGINEERING  L  T  P  C
3  0  0  3

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

UNIT I  INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 9
Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation – Theory of control chart- uses of control chart –X chart, R chart and chart - process capability – process capability studies and simple problems. Six sigma concepts

UNIT II  PROCESS CONTROL FOR ATTRIBUTES 9
Control chart for attributes –control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.
UNIT III ACCEPTANCE SAMPLING

UNIT IV LIFE TESTING – RELIABILITY

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

GE8075 INTELLECTUAL PROPERTY RIGHTS

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

UNIT I INTRODUCTION
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.
UNIT II  REGISTRATION OF IPRs  10
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III  AGREEMENTS AND LEGISLATIONS  10

UNIT IV  DIGITAL PRODUCTS AND LAW  9

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

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

TEXT BOOKS

REFERENCES

GE8073 FUNDAMENTALS OF NANOSCIENCE L T P C  3 0 0 3

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

UNIT I  INTRODUCTION  8
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II  GENERAL METHODS OF PREPARATION  9
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.
UNIT III   NANOMATERIALS

UNIT IV   CHARACTERIZATION TECHNIQUES

UNIT V   APPLICATIONS

TOTAL : 45 PERIODS

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

TEXT BOOKS :

REFERENCES:

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

OBJECTIVES:
- To understand the underlying principles of operations in different Refrigeration & Air conditioning systems and components.
- To provide knowledge on design aspects of Refrigeration & Air conditioning systems
UNIT I  INTRODUCTION
Introduction to Refrigeration - Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification - Nomenclature - ODP & GWP.

UNIT II  VAPOUR COMPRESSION REFRIGERATION SYSTEM

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

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

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

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

TOTAL: 45 PERIODS

TEXT BOOK:

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

UNIT I GAS AND ARC WELDING PROCESSES: 9
Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes - advantages, limitations and applications.

UNIT II RESISTANCE WELDING PROCESSES: 9
Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

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

UNIT IV OTHER WELDING PROCESSES: 9

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

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

TEXT BOOKS

REFERENCES

TOTAL : 45 PERIODS
OBJECTIVES:
- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.
  (Use of Standard Gas Tables permitted)

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

UNIT II  FLOW THROUGH DUCTS
Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties.

UNIT III  NORMAL AND OBLIQUE SHOCKS
Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl– Meyer relations – Applications.

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

UNIT V  SPACE PROPULSION

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To know the principle, methods, possibilities and limitations as well as environmental effects of Additive Manufacturing technologies.

- To be familiar with the characteristics of the different materials those are used in Additive Manufacturing technologies.

UNIT I  INTRODUCTION

UNIT II  DESIGN FOR ADDITIVE MANUFACTURING

UNIT III  PHOTO POLYMERIZATION AND POWDER BED FUSION PROCESSES

UNIT IV  EXTRUSION BASED AND SHEET LAMINATION PROCESSES

UNIT V  PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES

OUTCOME:

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

TEXT BOOKS:
REFERENCES:

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

UNIT IV DISASTER RISK MANAGEMENT IN INDIA
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.
UNIT V  DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS

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

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

TEXT BOOKS:

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

ME8072  RENEWABLE SOURCES OF ENERGY  L  T  P  C
3  0  0  3

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

UNIT I  INTRODUCTION

UNIT II  SOLAR ENERGY
UNIT III  WIND ENERGY

UNIT IV  BIO - ENERGY

UNIT V  OTHER RENEWABLE ENERGY SOURCES

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

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 9

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:

ME8099 ROBOTICS

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

UNIT I FUNDAMENTALS OF ROBOT 9
Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9
Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 9

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 9
Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.
UNIT V IMPLEMENTATION AND ROBOT ECONOMICS
RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

ME8093 COMPUTATIONAL FLUID DYNAMICS

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

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS
UNIT II    FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION
Derivation of finite difference equations – Simple Methods – General Methods for first and second
order accuracy – Finite volume formulation for steady state One, Two and Three -
dimensional diffusion problems – Parabolic equations – Explicit and Implicit schemes –
Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume
methods.

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

UNIT IV    FLOW FIELD ANALYSIS
Finite volume methods - Representation of the pressure gradient term and continuity equation
– Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction
equation, SIMPLE algorithm and its variants – PISO Algorithms.

UNIT V    TURBULENCE MODELS AND MESH GENERATION
Turbulence models, mixing length model, Two equation (k- ) models – High and low
Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh
refinement – Adaptive mesh – Software tools.

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

TOTAL: 45 PERIODS

TEXT BOOKS:
2. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The

REFERENCES:
1. Anil W. Date "Introduction to Computational Fluid Dynamics" Cambridge University Press,
   2005.
   2004
OBJECTIVES:
- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
- To illustrate some of the simple instruments used for condition monitoring in industry.

UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING

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

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

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

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

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

TEXT BOOKS:

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

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

UNIT II SURFACE NDE METHODS

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET)

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

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:
REFERENCES:

MS8001 TOOLS DESIGN L T P C
3 0 0 3

OBJECTIVES:
- To select suitable point cutting tool and multipoint cutting tool for machining process.
- Design Jigs and Fixtures for holding tool and work piece respective.
- Use of suitable moulding for the design of die components.

UNIT I CUTTING TOOLS 9
Materials-properties, classification, selection, insert and coated tools, tool wear, tool life. Recent developments and applications.

UNIT II SINGLE POINT TOOLS 9
Nomenclature, types and styles, design and manufacture of HSS and carbide insert type tools for turning, boring, shaping, planning and slotting operations. Design of form tools. Tools and holders for CNC applications, tools for dry machining.

MULTIPOINT CUTTERS
Nomenclature, classification and selection, construction methods, cutter setting, design and manufacture of drills, reamers, taps, dies, thread chasers, milling cutters, broaches, hobs and gear shaper cutters. Grinding-wheel specification and selection.

UNIT III JIGS 9
Degrees of freedom, principles of location and clamping, principles of jig design, fool proofing, elements of jigs, classification of jigs, design of jigs for drilling and reaming.

FIXTURES:
Principles of fixture design, locators and different types of clamps, elements of fixtures, provision for tool setting, design of fixtures for milling, turning, boring and grinding operations. Fixtures for turning centers and machining centers. Modular fixturing-concepts and applications.

UNIT IV PRESS TOOLS 9
Design and manufacture of die sets for sheet metal components-simple, compound and progressive dies for punching and blanking operations. Dies for drawing and bending operations. Selection of presses and tools.
UNIT V DESIGN OF INJECTION MOULDING AND DIE CASTING DIES

Product and mould, thermal considerations, design of two plate mould, runner and gate design, mould cooling and ejection, analysis of mould flow.

SPECIAL TOOLS:
Design of limit gauges. Tool maintenance and planning.

OUTCOME:
- Upon completion of this course the student can apply suitable moulding for the design of die components.

TEXT BOOKS:

REFERENCES:

GE8076 PROFESSIONAL ETHICS IN ENGINEERING

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

MG8091 ENTERPRENEURSHIP DEVELOPMENT

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

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

UNIT III BUSINESS

UNIT IV FINANCING AND ACCOUNTING

UNIT V SUPPORT TO ENTREPRENEURS

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
1. To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
2. To educate on the rudiments of Micro fabrication techniques.
3. To introduce various sensors and actuators
4. To introduce different materials used for MEMS
5. 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.

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:

AT8091 MANUFACTURING OF AUTOMOTIVE COMPONENTS

OBJECTIVE:
- To impart knowledge on basic principle and production methods of automotive components.

UNIT I CASTED ENGINE COMPONENTS
Material selection and Manufacturing methods for Piston, Piston rings, Cylinder block, wet and dry liners, Engine head, Oil pan, Carburetors. Thermal barrier coating of Engine head and valves.

UNIT II FORGED ENGINE COMPONENTS
Material selection and Manufacturing methods for Crank shaft, Connecting rod, Cam shaft, valve, Piston pin, Push rod, Rocker arm, tappets, spark plug.

UNIT III TRANSMISSION SYSTEM

UNIT IV VEHICLE CHASSIS

UNIT V RECENT DEVELOPMENTS

TOTAL : 45 PERIODS

OUTCOME:
- Upon completion of this course the student can able to use the basic principle and production methods of automotive components
TEXT BOOK:

REFERENCES:
2. Newton and steels, the motor vehicle, ELBS, 1990

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: 14

UNIT II GROUP TECHNOLOGY AND CELLULAR LAYOUT 7
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 7
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 7
Standardized work–standard work sequence timing and working progress .Quality at source – Autonotation /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 10

TOTAL : 45 PERIODS
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:

MS8002 INDUSTRIAL PSYCHOLOGY AND WORK ETHICS L T P C 3 0 0 3

OBJECTIVES:
- To understand the behaviour of self others and society.
- To understand the global work standards and ethical practices.

UNIT I INTRODUCTION TO INDUSTRIAL PSYCHOLOGY: Definitions and Scope. Major influences on industrial Psychology. Performance Management : Training and Development.

UNIT II INDIVIDUAL IN WORKPLACE: Motivation and Job satisfaction, stress management. Organizational culture, Leadership and group dynamics.

WORK ENVIRONMENT AND ENGINEERING PSYCHOLOGY-FATIGUE:
Boredom, accidents and safety. Job Analysis, Recruitment and Selection – Reliability & Validity of recruitment tests

UNIT III SOCIOLOGY:
A general over view scope of industrial sociology, industry and education, industry and family, industry and social stratification.

INTRODUCTION TO ETHICS:
History and evolution of values and ethics in social work.

UNIT IV PROFESSIONAL STANDARDS
Team work, communication, organizational skills and time management
LEGAL REQUIREMENTS:
Considerations for each jurisdiction that registers, certifies or licenses social workers

UNIT V ETHICAL PRACTICE AND SOCIETY 9
Professional values and self-awareness about ethical professional behavior, ethical decision making processes and dilemma examples

OUTCOMES:
- Ability to develop and demonstrate good interpersonal relationship in an organisation.
- Ability to handle human resources efficiently
- Understanding the sociology, professional work standards and work ethics.

TEXT BOOKS:

REFERENCES:

GE8074 HUMAN RIGHTS L T P C
3 0 0 3

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

UNIT I

UNIT II

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

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

UNIT V

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

REFERENCES:

MS8003 SOCIOLOGY AND GLOBAL ISSUES

OBJECTIVE:
- To understand the human behaviour in societal context and to know the conceptual tools and methodology for the same.

UNIT I SOCIOLOGICAL PERSPECTIVE
Social facts, causes, imagination, science, common sense and levels of organization. Interaction and social organization - frame work, statuses and roles, interaction process, social exchange, network and structure of society.

INDIVIDUAL AND SOCIETY:
Elements of culture, culture interaction and diversity. Dynamics of socialization, social class, agents, and secondary socialization

UNIT II SOCIAL GROUPS
Characteristics, dynamics, types, individual commitment and group survival, techniques of formal organization. The effects of urbanization and community, population and society, dynamics of population change. Politics, the state and war, the economy, business and work, social systems, social institution – the family, marriage, education goals, values and dilemmas. Transformation of society - Science and technology, growth, role, process of science, society and technologies. Collective behavior and social movement

UNIT III GLOBAL ISSUES – ENERGY
The energy crisis, the effect of the energy crisis in less developed nations, climate change, the energy transition, nuclear power

UNIT IV GLOBAL ISSUES – THE ENVIRONMENT
Awakening, the air, the water, the workplace, the use of natural resources.

UNIT V GLOBAL ISSUES – THE TECHNOLOGY
Benefits of technology, short term and long term benefits, unanticipated consequences on the use of technology. Inappropriate use of technology, the threat of nuclear weapons.

TOTAL: 45 PERIODS

OUTCOMES:
- Able to study the interactions of people in society
- Understanding the effects of societal history, group behavior studies on families etc
- Relating the sociology with global issues like energy crisis, environmental pollution etc.
TEXT BOOKS:

REFERENCES:

MS8004 DESIGN OF HEAT EXCHANGERS L T P C
3 0 0 3

OBJECTIVES:
- To learn the thermal and stress analysis on various parts of the heat exchangers
- To analyze the sizing and rating of the heat exchangers for various applications

UNIT I INTRODUCTION
Types of heat exchangers, shell and tube heat exchangers – regenerators and recuperators - Temperature distribution and its implications - Parts description, Classification as per Tubular Exchanger Manufacturers Association (TEMA)

UNIT II PROCESS DESIGN OF HEAT EXCHANGERS

UNIT III STRESS ANALYSIS
Stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses - types of failures, buckling of tubes, flow induced vibration.

UNIT IV COMPACT AND PLATE HEAT EXCHANGER
Types- Merits and Demerits- Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.

UNIT V CONDENSERS AND COOLING TOWERS
Design of surface and evaporative condensers – cooling tower – performance characteristics.

TOTAL: 45 PERIODS

OUTCOME:
- Upon completion of this course, the students can able to apply the mathematical knowledge for thermal and stress analysis on various parts of the heat exchangers components.
TEXT BOOKS:

REFERENCES:

ME8074 VIBRATION AND NOISE CONTROL L T P C
3 0 0 3

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

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

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

UNIT III Automotive Noise Sources 9

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

UNIT V Source of Noise and Control 9
Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

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

TEXT BOOK:

REFERENCES:

MS8005 BIOGAS ENGINEERING

OBJECTIVE:
To get exposure on production, processing and application of Biogas.

UNIT I INTRODUCTION

MATERIALS FOR BIOMETHANATION AND PRODUCTS OF METHANATION:

UNIT II BIO-REACTORS
Types of bio-reactors- Constant pressure type reactors, Ganesh model, Pragathi model, Astra model, Jwala biogas plant, Batch digester, Manawat digester, German designs, plastic bag digesters, free fabricated steel/plastic digesters, Tunnel type digester, Maya Farms model, Large Farm biogas plants, Anaerobic Contact reactors, Anaerobic Filter reactors

UNIT III DESIGN, SELECTION, CONSTRUCTION AND OPERATION OF BIOGAS PLANTS
UNIT IV  PURIFICATION, SCRUBBING, COMPRESSION AND STORAGE OF BIOGAS  

UNIT V  UTILISATION SYSTEMS OF BIOGAS  

OUTCOMES:
- Knowledge of materials for biogas production and their by products.
- Understanding the working of biogas reactors and bioplants / knowledge in design, construct and operate the biogas plants.
- Visualising the applications biogases in power generation.

TEXT BOOKS:

REFERENCES:

MS8006  DESIGN OF PRESSURE VESSELS AND PIPING  
OBJECTIVES:
- To understand the Mathematical knowledge to design pressure vessels and piping
- To understand the ability to carry of stress analysis in pressure vessels and piping

UNIT I  INTRODUCTION  

UNIT II  STRESSES IN PRESSURE VESSELS  
UNIT III DESIGN OF VESSELS 15
Design of Tall cylindrical self supporting process columns – Supports for short vertical vessels – Stress concentration at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of Reinforcement – Pressure Vessel Design.

UNIT IV BUCKLING AND FRACTURE ANALYSIS IN VESSELS 8
Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

UNIT V PIPING 4

OUTCOME:
• Upon completion of this course, the students can able to apply the mathematical fundamental for the design of pressure vessels and pipes. Further they can able to analyse and design of pressure vessels and piping.

TEXT BOOK:

REFERENCES:

IM8691 VALUE ENGINEERING AND PROJECT MANAGEMENT L T P C
3 2 0 4

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

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

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

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

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

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

TEXT BOOKS:

REFERENCES

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

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

UNIT I  INTRODUCTION  9
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  9

UNIT III  LOGISTICS IN SUPPLY CHAIN  9

UNIT IV  SOURCING AND COORDINATION IN SUPPLY CHAIN  9
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:

RO8091  INDUSTRIAL DESIGN AND APPLIED ERGONOMICS

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  BIOHERMODYNAMICS 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 work place.
- know about biothermodynamics and bioenergetics
- implement latest occupational health and safety to the work place.

TEXT BOOK:

REFERENCES:

MF8091  PACKAGING MATERIALS AND TECHNOLOGY  

OBJECTIVE:
- To study the fundamentals of packaging, manufacturing process, packaging materials and package testing.

UNIT I  FUNDAMENTALS OF PACKAGING  
Definition, functions of packaging, types and selection of package, Packaging hazards, interaction of package and contents, materials and machine interface, Environmental and recycling considerations - life cycle assessment Package Design - Fundamentals, factors influencing design, stages in package development, graphic design, Structural design – simulation softwares

UNIT II  PACKAGING MATERIALS  
Major Plastic packaging materials viz. Polyolefins, Polystyrene, Polyvinylchloride, Polyesters, Polyamides (Nylons), Polycarbonate and newer materials such as High Nitrile Polymers, Polyethylene Naphthalate (PEN), Nanomaterials, biodegradable materials – properties and applications, recycling; Wood, Paper, Textile, Glass, Metals - Tin, Steel, aluminum, Labelling materials, Cushioning Materials – properties and areas of application.

UNIT III  CONVERSION TECHNOLOGY  

Surface treatment for printing, Printing processes – offset, flexo, gravure and pad printing.
UNIT IV SPECIALITY PACKAGING
Aerosol packaging, Shrink and Stretch wrapping, Blister packaging, Anti-static packaging, Aseptic packaging, Active packaging, Modified Atmospheric Packaging, Ovenable package; Cosmetic packaging, Hardware packaging, Textile packaging, Food packaging; Child resistant and Health care packaging, Export packaging, Lidding, RFID in packaging.

UNIT V TESTING

OUTCOMES
- Ability to effectively use diffuse packing materials.
- Ability to test packaging materials.

TEXT BOOKS

REFERENCES:

IE8791 DESIGN OF EXPERIMENTS

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

OBJECTIVES:
- To demonstrate knowledge and understanding of Classical Design of Experiments (DOE)
- To demonstrate knowledge and understanding of Taguchi’s approach
- To develop skills to design and conduct experiments using DOE and Taguchi’s approach
- To develop competency for analysing the data to determine the optimal process parameters that optimize the process.
UNIT I  FUNDAMENTALS OF EXPERIMENTAL DESIGNS  9
Hypothesis testing – single mean, two means, dependant/ correlated samples – confidence intervals, Experimentation – need, Conventional test strategies, Analysis of variance, F-test, terminology, basic principles of design, steps in experimentation – choice of sample size – Normal and half normal probability plot – simple linear and multiple linear regression, testing using Analysis of variance.

UNIT II  SINGLE FACTOR EXPERIMENTS  9
Completely Randomized Design- effect of coding the observations- model adequacy checking- estimation of model parameters, residuals analysis- treatment comparison methods- Duncan's multiple range test, Newman-Keuel's test, Fisher's LSD test, Tukey's test- testing using contrasts-
Randomized Block Design – Latin Square Design- Graeco Latin Square Design – Applications.

UNIT III  FACTORIAL DESIGNS  9
Main and Interaction effects - Two and three factor full factorial designs- Fixed effects and random
effects model - Rule for sum of squares and Expected Mean Squares- $2^K$ Design with two and three factors- Yates’s Algorithm- fitting regression model- Randomized Block Factorial Design - Practical applications.

UNIT IV  SPECIAL EXPERIMENTAL DESIGNS  9
Blocking and Confounding in $2^K$ Designs- blocking in replicated design- $2^K$ Factorial Design in two
blocks- Complete and partial confounding- Confounding $2^K$ Design in four blocks- Two level Fractional
Factorial Designs- one-half fraction of $2^K$ Design, design resolution, Construction of one-half fraction
with highest design resolution, one-quarter fraction of $2^K$ Design- introduction to response surface
methods, central composite design.

UNIT V  TAGUCHI METHODS  9
Design of experiments using Orthogonal Arrays, Data analysis from Orthogonal experiments-
Response Graph Method, ANOVA- attribute data analysis- Robust design- noise factors, Signal to
noise ratios, Inner/outer OA design- case studies.

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

TEXT BOOK:

REFERENCES: