PROGRAMME EDUCATIONAL OBJECTIVES:
1. Graduates formulate, analyze and solve Manufacturing and Industrial engineering problems.
2. Graduates acquire employment in Manufacturing Sectors / become product and process design professionals for sustainable manufacturing.

PROGRAM OUTCOMES (POS):
After the successful completion of Engineering Program, the graduates will be able to,

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<th>S.NO</th>
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<tr>
<td>a.</td>
<td>Engineering Knowledge</td>
<td>Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization in to the solution of complex engineering problems.</td>
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<td>b.</td>
<td>Problem Analysis</td>
<td>Identify, formulate, study literature, and analyze complex problems in Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.</td>
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<tr>
<td>c.</td>
<td>Design and Development of solution</td>
<td>Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.</td>
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<tr>
<td>d.</td>
<td>Conduct Investigation of Complex problem</td>
<td>Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex Engineering Problems.</td>
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<td>e.</td>
<td>Modern tools usage</td>
<td>Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.</td>
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<tr>
<td>f.</td>
<td>Engineer and Society</td>
<td>Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.</td>
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<td>g.</td>
<td>Environment and Sustainability</td>
<td>Understand the impact of the Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.</td>
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<td>h.</td>
<td>Ethics</td>
<td>Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.</td>
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<tr>
<td>i.</td>
<td>Individual and team work</td>
<td>Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.</td>
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<td>Communication</td>
<td>Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.</td>
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<td>k</td>
<td>Project management and finance</td>
<td>Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.</td>
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<td>l</td>
<td>Life long learning</td>
<td>Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.</td>
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**PEO / PO Mapping**

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| SEMESTER V |
| Engineering Metrology and Measurements | √ | √ | √ | √ | | | |
| Metal Forming Technology | √ | √ | √ | | | | |
| Design of Machine Elements and Transmission Systems | √ | √ | √ | √ | | | |
| Foundry Technology | √ | √ | √ | | | | |
| Welding Technology | √ | √ | √ | | | | |
| Open Elective - I | | | | | | | |
| Welding and Foundry Laboratory | √ | √ | √ | √ | √ | | |
| Metrology Laboratory | √ | √ | √ | √ | | | |
| Professional Communication | | | | | | | |

<p>| SEMESTER VI |
|------------------|------------------|------------------|------------------|------------------|
| Production Planning and Control | √ | √ | | | | | |
| Computer Aided Product Design | √ | √ | √ | √ | | | |
| Metal Cutting and CNC Machines | √ | √ | √ | √ | | | |
| Design of Jigs, Fixtures and Press Tools | √ | √ | √ | | | | |
| Finite Element Analysis | √ | √ | √ | | | | |
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ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
B.E. PRODUCTION ENGINEERING
REGULATIONS - 2017
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS CURRICULA AND SYLLABI

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**TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 185**
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### PROFESSIONAL ELECTIVES FOR PRODUCTION ENGINEERING

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# SEMESTER VIII, ELECTIVE V

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## EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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

UNIT I 
SHARING INFORMATION RELATED TO ONESELF/FAMILY & FRIENDS
12
Reading - short comprehension passages, practice in skimming-scanning and predicting-
Language development - Wh- Questions - asking and answering - yes or no questions - parts of speech. Vocabulary development - prefixes - suffixes - articles - count/uncount nouns.

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:
1.  Board of Editors. Using English A Course book for Undergraduate Engineers and

REFERENCES
1  Bailey, Stephen. Academic Writing: A practical guide for students. New York:
Rutledge,2011.
2  Means,L. Thomas and Elaine Langlois. English & Communication For Colleges.
CengageLearning ,USA: 2007
3  Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student’s Book&
4  Comfort, Jeremy, et al. Speaking Effectively : Developing Speaking Skills for Business
5  Dutt P. Kiranmai and RajeevanGeeta. Basic Communication Skills, Foundation Books:
2013

MA8151  ENGINEERING MATHEMATICS  –  I  L  T  P  C
4  0  0  4

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

UNIT I  DIFFERENTIAL CALCULUS  12
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules -
Maxima and Minima of functions of one variable.

UNIT II  FUNCTIONS OF SEVERAL VARIABLES  12
Partial differentiation – Homogeneous functions and Euler’s theorem – Total derivative – Change of
variables – Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions of two
variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined
multipliers.
UNIT III INTEGRAL CALCULUS 12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

UNIT V DIFFERENTIAL EQUATIONS 12

TOTAL : 60 PERIODS

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

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

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

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

UNIT I       PROPERTIES OF MATTER

UNIT II      WAVES AND FIBER OPTICS

UNIT III     THERMAL PHYSICS

UNIT IV      QUANTUM PHYSICS

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

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

REFERENCES:

CY8151 ENGINEERING CHEMISTRY

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

UNIT I WATER AND ITS TREATMENT

UNIT II SURFACE CHEMISTRY AND CATALYSIS

UNIT III ALLOYS AND PHASE RULE
UNIT IV  FUELS AND COMBUSTION


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.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
UNIT II DATA, EXPRESSIONS, STATEMENTS 9
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 9
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 9
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 9
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.

TOTAL : 45 PERIODS

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.

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+2
Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 90 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
• familiarize with the fundamentals and standards of Engineering graphics
• perform freehand sketching of basic geometrical constructions and multiple views of objects.
• project orthographic projections of lines and plane surfaces.
• draw projections and solids and development of surfaces.
• visualize and to project isometric and perspective sections of simple solids.
TEXT 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**
CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:

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

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

OUTCOMES:

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

TOTAL: 30 PERIODS

TEXTBOOKS:


OBJECTIVES:

The Course prepares second semester engineering and Technology students to:

- Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- Foster their ability to write convincing job applications and effective reports.
- Develop their speaking skills to make technical presentations, participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialisation.
UNIT I  INTRODUCTION TECHNICAL ENGLISH  12

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

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

UNIT IV  REPORT WRITING  12

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

TOTAL : 60 PERIODS

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

TEXT BOOKS:

REFERENCES

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

UNIT I MATRICES

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

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

UNIT IV COMPLEX INTEGRATION

UNIT V LAPLACE TRANSFORMS

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

TOTAL: 60 PERIODS
TEXT BOOKS:

REFERENCES:

MATERIALS SCIENCE
(Except B.E. Materials Science and Engineering )

PH8251
L T P C
3 0 0 3

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

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

UNIT II FERROUS ALLOYS

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
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)

TOTAL : 45 PERIODS

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  14
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II  ENVIRONMENTAL POLLUTION  8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES  10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.
UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

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

TEXT BOOKS:

REFERENCES:

GE8292 ENGINEERING MECHANICS

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

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

UNIT III  PROPERTIES OF SURFACES AND SOLIDS  9+6

UNIT IV  DYNAMICS OF PARTICLES  9+6

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

TOTAL : 45+30=75 PERIODS

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

TEXT BOOKS:

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

GROUP A (CIVIL & MECHANICAL)

I  CIVIL ENGINEERING PRACTICE

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

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

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

II  MECHANICAL ENGINEERING PRACTICE

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

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

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

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

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

III ELECTRICAL ENGINEERING PRACTICE

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

IV ELECTRONICS ENGINEERING PRACTICE

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

TOTAL: 60 PERIODS

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

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

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**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

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**BE8261** BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY

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**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 :-

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36
OUTCOMES:
- Ability to determine the speed characteristic of different electrical machines
- Ability to design simple circuits involving diodes and transistors
- Ability to use operational amplifiers

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>D. C. Motor Generator Set</td>
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<tr>
<td>2</td>
<td>D.C. Shunt Motor</td>
<td>2</td>
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<tr>
<td>3</td>
<td>Single Phase Transformer</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Single Phase Induction Motor</td>
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<tr>
<td>5</td>
<td>Ammeter A.C and D.C</td>
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<tr>
<td>6</td>
<td>Voltmeters A.C and D.C</td>
<td>20</td>
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<tr>
<td>7</td>
<td>Watt meters LPF and UPF</td>
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<tr>
<td>8</td>
<td>Resistors &amp; Breadboards</td>
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<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>
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</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 12
Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 12

UNIT V Z-TRANSFORMS AND DIFFERENCE EQUATIONS 12

TOTAL: 60 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To impart the knowledge on basic concepts of various machining processes and machine tools.

UNIT I  LATHE

UNIT II  SHAPER, PLANER AND SLOTTER

UNIT III  DRILLING

UNIT IV  MILLING

UNIT V  GRINDING

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the students will be able to:

- Understand the constructional features and working principles of Lathe, work holding devices and also understands the concepts of mechanics of metal cutting.
- Understand the constructional features and working principles of shaper, planer and slotter, work holding devices and various machining operations performed.
- Understand the constructional features and working principles of drilling machine and its types.
- Understand the constructional features and working principles of milling machine and its types, work holding devices and various machining operations performed.
- Understand the constructional features and working principles of grinding machine and its types.

TEXT BOOKS

REFERENCES

PR8302 THERMODYNAMICS AND THERMAL ENGINEERING L T P C 3 2 0 4

OBJECTIVE:
- To introduce fundamental concepts in thermodynamics, heat transfer, propulsion and refrigeration and air conditioning.

UNIT 1 BASIC THERMODYNAMICS

UNIT II AIR CYCLE AND COMPRESSORS
- Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency . Mean effective pressure, Reciprocating compressors.

UNIT III STEAM AND JET PROPULSION

UNIT IV REFRIGERATION AND AIR-CONDITIONING
- Principles of Psychrometry and refrigeration - Vapour compression - Vapour absorption types - Coefficient of performance, Properties of refrigerants – Basic Principle and types Air conditioning.
UNIT V  HEAT TRANSFER  

(Use of standard thermodynamic tables, Mollier diagram and Refrigerant property tables are permitted) 

OUTCOMES: 
Student will be able to 
- To solve the basic problem in thermodynamics and its concepts 
- To understand the concepts in Internal Combustion engines and Compressor 
- To understand the basics in Production of Electricity and solve problems based on same 
- To know the basics in Refrigeration and Air conditioning 
- To analyze the heat transfer techniques and heat transfer in condensers. 

TEXT BOOKS 

REFERENCES 

CE8395  
STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS 

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

UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS  

UNIT II  TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM  
UNIT III  

TORSION  
9
Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– 
Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical 
springs, carriage springs.

UNIT IV  

DEFLECTION OF BEAMS  
9
Double Integration method – Macaulay’s method – Area moment method for computation of 
slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal 
theorems.

UNIT V  

THIN CYLINDERS, SPHERES AND THICK CYLINDERS  
9
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses 
and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – 
Deformation in spherical shells – Lame’s theorem.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
Series, 2010.

CE8394  

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

OBJECTIVES:
- The properties of fluids and concept of control volume are studied
- The applications of the conservation laws to flow through pipes are studied.
- To understand the importance of dimensional analysis
- To understand the importance of various types of flow in pumps.
- To understand the importance of various types of flow in turbines.
UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS
Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS

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

UNIT IV PUMPS

UNIT V TURBINES

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

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- To introduce different machining process and machine tool to develop components.

LIST OF EXPERIMENTS:
1. Lathe: Facing, Plain turning, Step Turning
2. Lathe: Taper Turning, Threading, Knurling
3. Lathe: Multi start Threading, Burnishing
4. Shaper: Cube
5. Shaper: Cube, V-Block
6. Drilling: Counter sinking, Counter Boring, Tapping
7. Milling Vertical: Surfacing, Pocket Milling
8. Milling Horizontal: Polygonal shape milling
9. Grinding: Surface & Cylindrical grinding
10. Slotting: Machining an internal spline

OUTCOMES:
Upon the completion of this course, student will have
- Ability to select appropriate turning process to obtain finished components.
- Ability to select appropriate milling process to obtain finished components.
- Ability to select appropriate shaper and slotting process to obtain finished components.
- Ability to select appropriate grinding process to obtain optimum surface finish.
- Ability to coordinate various machining process in sequence to get desired design in final components.

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>
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<tbody>
<tr>
<td>1</td>
<td>Lathe</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>Drilling Machine</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Shaper</td>
<td>2</td>
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<tr>
<td>4</td>
<td>Vertical Milling Machine</td>
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</tr>
<tr>
<td>5</td>
<td>Horizontal Milling Machine</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Surface Grinding Machine</td>
<td>1</td>
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<tr>
<td>7</td>
<td>Cylindrical Grinding Machine</td>
<td>1</td>
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<tr>
<td>8</td>
<td>Slotting Machine</td>
<td>1</td>
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</tbody>
</table>
OBJECTIVES:
- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

STRENGTH OF MATERIALS

LIST OF EXPERIMENTS
1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples.

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

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
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<tbody>
<tr>
<td>1</td>
<td>Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity</td>
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<tr>
<td>2</td>
<td>Torsion Testing Machine (60 NM Capacity)</td>
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<tr>
<td>3</td>
<td>Impact Testing Machine (300 J Capacity)</td>
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<tr>
<td>4</td>
<td>Brinell Hardness Testing Machine</td>
<td>1</td>
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<tr>
<td>5</td>
<td>Rockwell Hardness Testing Machine</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Spring Testing Machine for tensile and compressive loads (2500 N)</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Metallurgical Microscopes</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Muffle Furnace (800 C)</td>
<td>1</td>
</tr>
</tbody>
</table>
LIST OF EXPERIMENTS
1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/submersible pump.
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 60 PERIODS

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
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<tr>
<th>S. NO.</th>
<th>NAME OF THE EQUIPMENT</th>
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<tbody>
<tr>
<td>1</td>
<td>Orifice meter setup</td>
<td>1</td>
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<tr>
<td>2</td>
<td>Venturi meter setup</td>
<td>1</td>
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<tr>
<td>3</td>
<td>Rotameter setup</td>
<td>1</td>
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<tr>
<td>4</td>
<td>Pipe Flow analysis setup</td>
<td>1</td>
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<tr>
<td>5</td>
<td>Centrifugal pump/submersible pump setup</td>
<td>1</td>
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<tr>
<td>6</td>
<td>Reciprocating pump setup</td>
<td>1</td>
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<tr>
<td>7</td>
<td>Gear pump setup</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Pelton wheel setup</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Francis turbine setup</td>
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<tr>
<td>10</td>
<td>Kaplan turbine setup</td>
<td>1</td>
</tr>
</tbody>
</table>
UNIT I  DRAWING STANDARDS & FITS AND TOLERANCES  12

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

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

TOTAL:60 PERIODS

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

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

TEXT BOOK:

REFERENCES:
OBJECTIVES: The Course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

UNIT I
Listening as a key skill - its importance - speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

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

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

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

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

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

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:
REFERENCES:

MA8452 STATISTICS AND NUMERICAL METHODS

OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

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

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

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

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


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

REFERENCES:

TEXT BOOKS:

ME8491  ENGINEERING METALLURGY

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

UNIT I  ALLOYS AND PHASE DIAGRAMS
UNIT II HEAT TREATMENT

UNIT III FERROUS AND NON-FERROUS METALS

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

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVE:

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

UNIT I INTRODUCTION

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTER AIDED PROCESS PLANNING

UNIT III CELLULAR MANUFACTURING

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

UNIT V INDUSTRIAL ROBOTICS

OUTCOMES:
Student will be able to
- Describe about the classical production system, the components of CIM .
- Explain the concept of Computer Aided Process Planning (CAPP) and Material Requirements Planning (MRP)
- Illustrate the cellular manufacturing using Rank order, Clustering and Hollier method
- Explain Flexible Manufacturing system and applications of Automated Guided Vehicles in the implementation of CIM..
- Describe the configurations of Industrial Robots, and their part programming.
- Understand the use of computers in various Manufacturing support systems.
TEXT BOOKS:

REFERENCES:

PR8451 MECHANICS OF MACHINES

OBJECTIVES:
- To understand the principles in the formation of mechanisms and their kinematics.
- To understand the effect of friction in different machine elements.
- To understand the importance of balancing and vibration.

UNIT I KINEMATICS OF MACHINES

UNIT II GEARS and GEAR TRAINS

UNIT III FRICTION
Types of friction – Friction Drives -friction in screw threads – bearings – Friction clutches – Belt drives

UNIT IV BALANCING AND MECHANISM FOR CONTROL
Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines -Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines- Governors and Gyroscopic effects..

UNIT V VIBRATION

TOTAL: 45 PERIODS
OUTCOMES:
Student will be able to
- Understand the principles in the formation of mechanisms and their kinematics.
- Understand the construction features of Gears and Gear Trains.
- Understand the effect of friction in different machine elements.
- Understand the importance of balancing.
- Understand the importance of Governors and Gyroscopic effects.
- Understand the importance of vibration.

TEXT BOOKS:

REFERENCES:

PR8401 FLUID POWER DRIVES AND CONTROL L T P C
3 0 0 3

OBJECTIVES:
- To understand the working principle of hydraulic and pneumatic components and its selection
- To design hydraulic and pneumatic circuits for different applications

UNIT I INTRODUCTION TO FLUID POWER

UNIT II FLUID POWER DRIVES
Fluid Power drives – Pumps – working principle and construction details of Gear, vane and piston pumps, Hydraulic motors, Hydrostatic transmission drives and characteristics, Hydraulic supply components Pneumatic power supply – compressors, air distribution, air motors.

UNIT III FLUID POWER ELEMENTS
UNIT IV HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN 9

UNIT V ELECTRO PNEUMATICS AND PLC CIRCUITS 9
Use of electrical timers, switches, solenoid, relays and proximity sensors electro pneumatic sequencing - PLC – elements, functions and selection – PLC programming – Ladder diagram and different programming methods - Sequencing circuits.

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able
- To understand the fundamentals of pneumatics and hydraulics and its principles
- To understand constructional and operational features about the hydraulic and pneumatic drives system
- To identify pneumatic and hydraulic components and their functions
- To design basic and advanced pneumatic and hydraulic circuits for industrial applications
- To understand the basic concepts, elements and functions of Programmable Logic Controller

TEXT BOOKS:

REFERENCES:

PR8481 METALLURGY LABORATORY

OBJECTIVES:
- To train the students in observation and interpretation of Microstructure of Engineering materials.
- To train students in Heat treatment, hardenability and surface treatment of Engineering Materials
- To train the students in testing of Foundry sand

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)

55
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 alloy.
- 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 Test.

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 (Brinnel or Rockwell)</td>
<td>1</td>
</tr>
</tbody>
</table>

PR8411 FLUID POWER LABORATORY

OBJECTIVES:
- To study the functional aspects of different pneumatic and hydraulic components and its usage in circuits.
- To train the students in designing different pneumatic and hydraulic circuits for different application.

LIST OF EXPERIMENTS
1. Study and use of pneumatic and hydraulic elements.
2. Simulation of speed control circuits in a hydraulic trainer.
3. Simulation of hydraulic circuits in a hydraulic trainer.
4. Simulation of single and double acting cylinder circuits using different directional control values
5. One shot and regenerative pneumatic circuits
6. Sequencing of pneumatic circuits
7. Simulation of Electro-pneumatic latch circuits
8. Simulation of Logic pneumatic circuits
9. Simulation of electro pneumatic sequencing circuits
10. Simulation of PLC based electro pneumatic sequencing circuits
11. Simulation of pneumatic circuits using PLC

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students will have the
• Ability to understand the operational features of pneumatic and hydraulic elements.
• Ability to select and apply different pneumatics components to design fluid power circuit.
• Ability to select and apply different hydraulic components to design fluid power circuit.
• Ability to simulate the Electro-pneumatic latch circuits.
• Ability to simulate PLC based electro pneumatic circuits.

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>Hydraulic Trainer</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Electro Hydraulic Trainer</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>PLC Based Hydraulic Trainer</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Hydraulic Accumulator Intensifier, Press.</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Transparent Hydraulic &amp; Pneumatic Trainer</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Vane Pump Test Rig</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Pneumatic Trainer</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Electro Pneumatic Trainer</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>PLC Based Pneumatic Trainer</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Gear Pump Test Rig</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>
</tbody>
</table>
| 12    | Transverse vibration setup of
        a) cantilever  
        b) Free-Free beam  
        c) Simply supported beam. | 1 No.|

58
OBJECTIVES:

- To understand the basic principles of measurements
- To learn about various methods of measuring Mechanical parameters

UNIT I CONCEPT OF MEASUREMENT


UNIT II LINEAR AND ANGULAR MEASUREMENT


UNIT III FORM MEASUREMENT

Measurement of screw threads: Thread gauges, floating carriage micrometer measurement of gear tooth thickness: constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.

UNIT IV LASER AND ADVANCES IN METROLOGY

Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications.- computer aided inspection.

UNIT V MEASUREMENT OF MECHANICAL PARAMETERS

Force, torque, power:-mechanical, pneumatic, hydraulic and electrical type-Pressure measurement - Flow: Venturi, orifice, rotameter, pitot tube –Temperature: bimetallic strip, thermocouples, pyrometer, electrical resistance thermistor

OUTCOMES:

Upon completion of this course the student will be able

- Define the basic concepts and terminology in measurements.
- Differentiate the principle, operation of linear and angular measuring instruments
- Mathematically define the method of form measurements of screw threads, surface roughness and basic feature form.
- Explain the applications of laser on dimensional measurements &computer aided inspection.
- Illustrate the working principles of different measuring instruments for measuring mechanical parameters

TEXT BOOKS


REFERENCES

OBJECTIVE:
- To understand the principle, procedure and applications of Bulk Metal Forming and Sheet Metal Forming.

UNIT I  FUNDAMENTALS OF METAL FORMING  9

UNIT II FORGING AND ROLLING  9

UNIT III EXTRUSION AND DRAWING PROCESSES  9

UNIT IV SHEET METAL FORMING PROCESSES  9

UNIT V RECENT ADVANCES  9

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of this course, the students can able to
- To understand the fundamental mechanics of metal forming processes
- To learn the principle, classification, equipments used and applications of Rolling and Forging Processes
- To learn the principle, classification, equipment’s used and applications of Extrusion and Drawing Processes
- To understand the principle, procedure of various sheet metal forming processes
- To study about the recent advances in technology for metal forming

TEXT BOOKS:
2. Nagpal G.R. “Metal forming processes”, Khanna publishers, New Delhi, 2004

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

UNIT I  INTRODUCTION  9+6

UNIT II  DETACHABLE AND PERMANENT JOINTS  9+6
Design of Bolts under Static Load, Design of Bolt with Tightening/Initial Stress, Design of Bolts subject to Fatigue – Keys -Types, Selection of Square and Flat Keys-Design of Riveted Joints and Welded Joints

UNIT III  SHAFTS AND COUPLING  9+6
Design of Shaft –For Static and Varying Loads, For Strength and Rigidity-Design of Coupling-Types, Flange, Muff and Flexible Rubber Bushed Coupling

UNIT IV  GEARS AND BELT DRIVES  9+6
Design of Spur and Helical Gear drives-Design of Belt drives-Flat and V Belts

UNIT V  SPRINGS AND BEARINGS  9+6
Design of Helical Spring-Types, Materials, Static and Variable Loads-Design of Leaf Spring-Design of Journal Bearing -Antifriction Bearing-Types, Life of Bearing, Reliability Consideration, Selection of Ball and Roller Bearings

TOTAL: 75 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To understand the principle, procedure and applications of various foundry processes.

UNIT I CASTING PROCESS 9

UNIT II CASTING METALLURGY 9

UNIT III DESIGN OF GATING SYSTEMS 9
Gating systems and their characteristics; the effects of gates on aspiration; turbulence and dross trap; recent trends. Chvorinov's Rule - Riser design - NRL method of riser design; feeding distance;

UNIT IV RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT 9
Shell moulding, precision investment casting, CO2 moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semi-solid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry — Computer aided design of casting.

UNIT V TESTING OF CASTINGS 9

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students can able
- To understand of various steps in Casting Process.
- To analyze Casting Solidification and Castability of metals.
- To design different casting system and use different Foundry practices.
- To study of various recent trends in Casting methods.
- To perform different testing to study the defect in the casting and apply engineering skills to minimise the defects.

TEXT BOOKS:

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.

TOTAL : 45 PERIODS

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
OBJECTIVE:
- To familiarize the students with test procedures followed in foundry and to practice various types of welding processes.

LIST OF EXPERIMENTS

Welding
1. Study of different welding equipments and accessories: Gas, Electric Welding
2. Oxy-acetylene gas welding of Lap joint, Butt Joint and T Joint.
4. Welding of pipes in different positions.
5. Brazing practice – furnace brazing.
7. Thermit welding of thick material like rod plates etc.

Foundry
1. Preparation of green moulding sand using a 5 kg muller and testing for Compression, shear, tensile, transverse strengths, hardness
2. in green condition:
3. in dry condition after drying in oven at 150º C for one and half hour.
4. Permeability testing.
5. Determining the clay content.
6. Sieve analysis of dry silica sand.
7. Determining the moisture content by various methods.
8. Melting any non-ferrous metal and making simple castings - Demonstration.

TOTAL: 60 PERIODS

OUTCOMES:
Upon completion of this course, the students will have
- Ability to perform gas welding operations to form the metals
- Ability to perform arc welding operations to form the metals
- Ability to perform brazing operations.
- Ability to carry out the foundry practices and perform different test required to characteristic transfer materials.
- Ability to perform sand and die casting process.

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>5 Kg Muller</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Sand rammer</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Weighing balance</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Universal sand strength testing with all accessories</td>
<td>1 SET</td>
</tr>
<tr>
<td>5</td>
<td>Permeability tester</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Quick moisture tester</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Infra-red drier</td>
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</tr>
<tr>
<td>8</td>
<td>Sieve shaker with Sieves</td>
<td>1 SET</td>
</tr>
<tr>
<td>9</td>
<td>Crucible furnace</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Oxy acetylene gas welding equipment</td>
<td>1 SET</td>
</tr>
</tbody>
</table>
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>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Vernier Calipers 0-150 mm</td>
<td>5</td>
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<tr>
<td>2</td>
<td>Vernier Calipers 0-300 mm</td>
<td>2</td>
</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>1</td>
</tr>
<tr>
<td>16</td>
<td>Flangernic 0-25</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>Flangemic 25-50</td>
<td>1</td>
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<tr>
<td>18</td>
<td>Floating carriage micrometer</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>Thread plug gauges m24 x 3</td>
<td>1</td>
</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>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Item Description</td>
<td>Quantity</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------</td>
<td>----------</td>
</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 Calibrator</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>Precision level</td>
<td>1</td>
</tr>
<tr>
<td>26</td>
<td>Digital Micrometer</td>
<td>1</td>
</tr>
<tr>
<td>27</td>
<td>Digital Vernier 0-150 mm</td>
<td>1</td>
</tr>
<tr>
<td>28</td>
<td>Digital Ht. Guage</td>
<td>1</td>
</tr>
<tr>
<td>29</td>
<td>Bevel Protractor</td>
<td>1</td>
</tr>
<tr>
<td>30</td>
<td>CMM</td>
<td>1</td>
</tr>
<tr>
<td>31</td>
<td>Vision measuring system</td>
<td>1</td>
</tr>
<tr>
<td>32</td>
<td>Boredial gauge 16-35, 35-60</td>
<td>1 BOX</td>
</tr>
<tr>
<td>33</td>
<td>Depth Vernier 0-150mm</td>
<td>1</td>
</tr>
<tr>
<td>34</td>
<td>Depth micrometer with 6 rods</td>
<td>1</td>
</tr>
<tr>
<td>35</td>
<td>Internal micrometer with Extn sleeves</td>
<td>1</td>
</tr>
<tr>
<td>36</td>
<td>Precision Rollers 8</td>
<td>2</td>
</tr>
<tr>
<td>37</td>
<td>Surface plate</td>
<td>1</td>
</tr>
<tr>
<td>38</td>
<td>Bench centre</td>
<td>1</td>
</tr>
</tbody>
</table>

**HS8581**  
PROFESSIONAL COMMUNICATION  

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<td>1</td>
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</table>

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

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

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

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

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

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

**TOTAL:** 30 PERIODS
OUTCOMES:
At the end of the course Learners will be able to:
- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

Recommended Software
1. Globearena
2. Win English

REFERENCES:

IE8693               PRODUCTION PLANNING AND CONTROL            L T P C
                                  3 0 0 3

OBJECTIVES:
- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I              INTRODUCTION
Objectives and benefits of planning and control-Functions of production control-Types of production job- batch and continuous-Product development and design-Marketing aspect - Functional aspects Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II             WORK STUDY
Method study, basic procedure-Selection-Recording of process - Critical analysis, Development Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data Predetermined motion time standards.

UNIT III            PRODUCT PLANNING AND PROCESS PLANNING
Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning Steps in process planning-Quantity determination in batch production-Machine capacity, balancing Analysis of process capabilities in a multi product system.
UNIT IV PRODUCTION SCHEDULING
Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling Batch production scheduling-Product sequencing – Production Control systems-Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting Manufacturing lead time-Techniques for aligning completion times and due dates.

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To introduce the concepts and applications of CAD
- To introduce the various concepts and techniques used for Product design and to develop product design skills.

UNIT I  INTRODUCTION TO COMPUTER AIDED DESIGN  9
Introduction to Engineering Design – Various phases of systematic design – sequential engineering and concurrent engineering – Computer hardware & Peripherals – software packages for design and drafting.

UNIT II  COMPUTER GRAPHICS FUNDAMENTALS  9

UNIT III  GEOMETRIC MODELING  9

UNIT IV  PRODUCT DESIGN CONCEPTS  9

UNIT V  PRODUCT DATA MANAGEMENT  9

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students
- Will be able to design and develop a system or component systematically in various stages.
- Have the ability to select suitable hardware and software for particular applications.
- Have potential to create geometric modeling and assembly modeling based on requirement using computer graphics.
- Have acquired knowledge to design a component by considering different aspects like manufacturing, assembly, usage etc.
- Will be able to manage various product data.

TEXT BOOKS

REFERENCES
OBJECTIVES:
- To understand the theory of metal cutting
- To understand the concepts of gear manufacture
- To understand CNC machines constructional features, working and programming

UNIT I MECHANICS OF METAL CUTTING 10
Tool nomenclature – single point and multi point cutting tools – orthogonal & oblique cutting – cutting forces, Merchant circle diagram – force & velocity relationship.

UNIT II TOOL MATERIAL, TOOL WEAR AND TOOL LIFE 9

UNIT III GEAR MANUFACTURE 8

UNIT IV CNC MACHINES 9

UNIT V CNC PROGRAMMING 9

OUTCOMES:
Upon completion of this course, students will be able
- To apply the principles of metal cutting and mechanics in machining process.
- To select tool materials based on requirement.
- To understood the concepts of various gear manufacturing methods.
- To acquire knowledge on modern material removal process like EDM.
- To perform CNC and APT program for turning and machining centre.

TEXT BOOKS

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

UNIT I  LOCATING AND CLAMPING PRINCIPLES:

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

UNIT III  PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES

UNIT IV  BENDING AND DRAWING DIES

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

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

TOTAL: 45 PERIODS

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

REFERENCES:
1. ASTME Fundamentals of Tool Design Prentice Hall of India.

ME8692 FINITE ELEMENT ANALYSIS

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

UNIT I INTRODUCTION

UNIT II ONE-DIMENSIONAL PROBLEMS

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

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

UNIT V ISOPARAMETRIC FORMULATION

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

TEXT BOOKS:

REFERENCES:

PR8611 METAL FORMING LAB AND SPECIAL MACHINES LABORATORY

OBJECTIVES:
- To establish hands-on experience in sheet metal forming, bulge forming and Super plastic forming.
- To get hands on experience in machining gear, V-block, dovetail, etc.
- To study tool wear, acceptance test for machine tool

METAL FORMING LAB:
1. Construction Flow Stress – Strain curve
2. Erichsen cupping Test
3. Determination of interface friction factor using ring compression test
4. Construction of FLD of sheet metal
5. Water hammer forming
6. Determination of Power consumption in sheet rolling process
7. Determination of strain rate sensitivity index of given specimen
8. Superplastic forming studies on Pb-Sn alloys
9. Deep drawing
10. Forward Extrusion process
11. Micro-forming
12. Simulation studies on metal forming

SPECIAL MACHINES LAB:
1. Gear Hobbing
   a. Spur Gear
   b. Helical Gear
2. Planning Machine
   a. V-Block
   b. Dove Tail
3. Centreless Cylindrical Grinding
4. Milling Machine
   a. Spur Gear
5. Tool And Cutter Grinding
6. Tool Wear Studies
7. Acceptance Test Of Machine Tool As Per ISI Test Chart
8. EDM
9. Capstan And Turret Lathe
10. Measurement Of Cutting Force

TOTAL: 60 PERIODS

OUTCOMES:
Upon the completion of this course the students will have
- Ability to perform hydraulic metal forming.
- Ability to perform super plastic forming in metals.
- Ability to perform extrusion process in nonferrous metals.
- Ability to machine raw materials to prepare gear, V-block, etc.,
- Ability to conduct acceptance test for machine tool.

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>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Universal Testing Machine 10T</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Erichsen cupping Tester</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Hydraulic Press 50T</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Water hammer forming apparatus</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Two high Rolling mill</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Top open muffle furnace (Max 1200 oC)</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Dies for deep drawing</td>
<td>1 SET</td>
</tr>
<tr>
<td>8</td>
<td>Dies for Micro forming</td>
<td>1 SET</td>
</tr>
<tr>
<td>9</td>
<td>Dies for super plastic forming</td>
<td>1 SET</td>
</tr>
<tr>
<td>10</td>
<td>FEM package</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Dies for Constructing FLD of sheet metals</td>
<td>1 SET</td>
</tr>
</tbody>
</table>

PR8612 CNC MACHINE LABORATORY

OBJECTIVE:
To train the students to write CNC Programming to simulate tool path simulation for different components.

LIST OF EXPERIMENTS
1. Study of different control systems and NC codes.
2. Program for Turning, Facing operation.
3. Program for circular interpolation, Taper turning operation
4. Program for thread cutting operation
5. Program using Do-Loop and Sub-routine.
6. Program for profile milling operation, circular interpolation
7. Program for Circular, rectangular pocket milling
8. Program for drilling cycle
9. Program for tool compensation and Program offset
10. NC code generation using CAD software packages
11. Study of cam packages
12. Study of CNC Wire cut EDM

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students can able to
  - Perform programming on CNC machine using computer assisted and manual part programming.
  - Simulate tool path movement.
  - To machine components using basic turning process.
  - To machine industrial components using milling and drilling process.
  - To coordinate the turning and milling process to obtain desired industrial components

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>CNC Lathe / Turning Centre</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>CNC Milling Machine / Machining Centre</td>
<td>1</td>
</tr>
</tbody>
</table>

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.
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
Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram.,

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:

GE8077 TOTAL QUALITY MANAGEMENT

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

UNIT I INTRODUCTION

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

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

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

UNIT V QUALITY MANAGEMENT SYSTEM

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

REFERENCES:
4. ISO 9001-2015 standards

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 9

UNIT IV LIFE TESTING – RELIABILITY 9

UNIT V QUALITY AND RELIABILITY 9
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:

MF8761 COMPUTER AIDED SIMULATION AND ANALYSIS
LABORATORY

OBJECTIVES:
• To give exposure to software tools needed to analyze engineering problems.
• To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS:

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

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

OUTCOME:
• To train the students to make use of software for simulation and analysis for various applications in the field of manufacturing engineering.
TEXT BOOKS:

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

PR8711 MICROPROCESSOR AND MECHATRONICS LABORATORY

OBJECTIVES:
- To expose the students to use the microprocessor to perform simple operations / Programming
- To design and develop hydraulic pneumatic and electrical circuits using simulating systems
- To study the characteristic of different hydraulic, pneumatic and electrical components.

MICROPROCESSOR LABORATORY

LIST OF EXPERIMENTS
1. Addition and subtraction of two 16-bit numbers
2. Sorting a series of numbers in Ascending and Descending order
3. Conversion of Binary number to BCD
4. Conversion of BCD to Binary
5. Implementation of Block-Data transfer
6. Controlling stepper motor using Microprocessor
7. Verification of Logic gates
8. Design of adders and subtractors
9. Multiplexer and Demultiplexer
10. Applications of an OPAMP
11. Characteristics of common emitter transistor
12. Transfer and Drain Characteristics of FET amplifier

MECHATRONICS LABORATORY

LIST OF EXPERIMENTS
1. Design and testing of fluid power circuits to control
   (i) Velocity (ii) direction and (iii) force of single and double acting actuators
1. Design of circuits with logic sequence using Electro pneumatic trainer kits.
2. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software
3. Circuits with multiple cylinder sequences in Electro pneumatic using PLC
4. Speed Control of AC & DC drives
5. Servo controller interfacing for DC motor
6. PID controller interfacing
7. Stepper motor interfacing with 8051 Micro controller
   (ii) full step resolution (ii) half step resolution
8. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using appropriate softwares
9. Computerized data logging system with control for process variables like pressure flow and temperature.

TOTAL: 60 PERIODS
OUTCOMES:
Upon the completion of this course, students will have the

- Ability to use the microprocessor to perform simple programme
- Ability to use microprocessor, PID controller for interface
- Ability to perform testing on fluid power inverter
- Ability to simulate circuits using hydraulic, Pneumatic and electrical components.
- Ability to use the computerized data logging system.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

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<tr>
<th>S.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</td>
<td>1 Each</td>
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<tr>
<td>2</td>
<td>Basic Hydraulic Trainer Kit</td>
<td>1</td>
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<tr>
<td>3</td>
<td>Hydraulics and Pneumatics Systems Simulation Softwares</td>
<td>10 SET</td>
</tr>
<tr>
<td>4</td>
<td>8051 - Microcontroller kit with stepper motor and drive circuit</td>
<td>2 SET</td>
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<tr>
<td>5</td>
<td>Simulation Softwares and Sensors to measure Pressure, Flow rate, direction, speed, velocity and force</td>
<td>2 SET</td>
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ME8793 PROCESS PLANNING AND COST ESTIMATION

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

UNIT I INTRODUCTION TO PROCESS PLANNING 9
Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES 9
Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION 9
Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION 9
Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop
UNIT V  MACHINING TIME CALCULATION
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:

PR8811 PROJECT WORK

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

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

TOTAL: 300 PERIODS

OUTCOMES:
Students will be able to
- An ability to apply knowledge of mathematics, science and engineering
- An ability to design and conduct experiments as well as to analyze and interpret data
- An ability to design a system, component or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability
• An ability to function on multidisciplinary teams
• An ability to identify, formulate and solve engineering problems
• An understanding of professional and ethical responsibility
• An ability to communicate effectively
• The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context
• A recognition of need for, and an ability to engage in life-long learning
• A knowledge of contemporary issues
• An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
• An ability to demonstrate knowledge / understand the engineering and management principles and apply these projects as a member/Leader in a team to manage projects in multidisciplinary environments.

PR8001 SURFACE ENGINEERING

OBJECTIVES:
• To study the surface preparation techniques
• To import knowledge on thermal spraying process and electrodeposited coating
• To study the process of Hot dip and diffusion coating
• To induce the testing procedure for surface coating

UNIT I METAL CLEANING AND PREVIEW ON SURFACE ENGINEERING

UNIT II THERMAL SPRAYING PROCESSES AND ELECTRODEPOSITED COATINGS

UNIT III HOT DIP COATING AND DIFFUSION COATINGS

UNIT IV NON-METALLIC COATING OXIDE AND COVENSION COATINGS
UNIT V  QUALITY ASSURANCE, TESTING AND SELECTION OF COATINGS  


TOTAL: 45 PERIODS

OUTCOMES:  
Students will be able to  
- Understand the important of surface engineering to industries.  
- Understand the principles involved in thermal spray for coating.  
- Analyze the process and mechanism of different diffusion coating process  
- Understand the methods of non metallic coating  
- Select appropriate coatings for industrial application with the knowledge in testing procedure and quality assurance.

TEXT BOOKS:  

REFERENCES:  

PR8072  NEW PRODUCT DEVELOPMENT  

OBJECTIVES:  
- This course aims at introducing the students to the basic concepts of engineering design and product development with focus on the front end processes.  
- At the end of this course the student is expected to demonstrate an understanding of the overview of all the product development processes and knowledge of concept generation and selection tools.

UNIT I  INTRODUCTION  

Need for developing products – the importance of engineering design – types of design –the design process – relevance of product lifecycle issues in design –designing to codes and standards- societal considerations in engineering design –generic product development process – various phases of product development-planning for products –establishing markets- market segments- relevance of market research.
UNIT II     CUSTOMER NEEDS  9
Identifying customer needs – voice of customer – customer populations - hierarchy of human needs -
need gathering methods – affinity diagrams – needs importance- establishing engineering
characteristics- competitive benchmarking- quality function deployment- house of quality- product
design specification-case studies

UNIT III     CREATIVE THINKING  9
Creative thinking – creativity and problem solving - creative thinking methods - generating design
concepts-systematic methods for designing – functional decomposition – physical decomposition –
functional representation – morphological methods- TRIZ - axiomatic design

UNIT IV    DECISION MAKING AND PRODUCT ARCHITECTURE  9
Decision making – decision theory – utility theory – decision trees – concept evaluation methods –
Pugh concept selection method- weighted decision matrix – analytic hierarchy process –
introduction to embodiment design – product architecture – types of modular architecture –
steps in developing product architecture

UNIT V     DESIGN AND COST ANALYSIS  9
Industrial design – human factors design – user friendly design – design for serviceability –
design for environment – prototyping and testing – cost evaluation – categories of cost –
overhead costs – activity based costing – methods of developing cost estimates – manufacturing cost –
value analysis in costing

TOTAL: 45 PERIODS

TEXT BOOKS
9788177588217

REFERENCES
Learning, 2010, ISBN 0495668141

IE8651     RELIABILITY ENGINEERING  L T P C
3 0 0 3

OBJECTIVE:
To impart knowledge in reliability concepts, reliability estimation methods and reliability improvement
methods

UNIT I     RELIABILITY CONCEPT  9
Reliability definition – Reliability parameters- f(t), F(t) and R(t) functions- Measures of central
tendency – Bath tub curve – A priori and posteriori probabilities of failure – Component mortality -
Useful life.
UNIT II  LIFE DATA ANALYSIS  
Data classification – Non parametric methods: Ungrouped, Grouped, Complete, Censored data – 
Time to failure distributions – Probability plotting: Exponential, Weibull - Goodness of fit tests – 
Survival graphs.

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

UNIT IV  RELIABILITY MANAGEMENT  
Reliability testing: Failure terminated test – Time terminated test – Upper and lower MTBFs – 

UNIT V  RELIABILITY IMPROVEMENT  
Analysis of downtime – Repair time distribution – Maintainability prediction – Measures of 
maintainability – Availability definitions – System Availability – Replacement decisions – Economic 
life.

OUTCOME: 
The Student must apply and optimize reliability for time independent and time dependent failure 
models through various testing methods for various manufacturing amnesty process

TEXT BOOKS: 

REFERENCES: 

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

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

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

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

UNIT IV DIGITAL PRODUCTS AND LAW

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

TOTAL: 45 PERIODS

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

TEXT BOOKS

REFERENCES

GE8073 FUNDAMENTALS OF NANOSCIENCE

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

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

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

UNIT III NANOMATERIALS
UNIT IV  CHARACTERIZATION TECHNIQUES  9
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission
Electron Microscopy including high-resolution imaging, Surface Analysis techniques - AFM, SPM,
STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V  APPLICATIONS  7
NanoinfoTech: Information storage - nanocomputer, molecular switch, super chip, nanocrystal,
Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted
drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical
Systems (NEMS) - Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for
sunbarrier products - In Photostat, printing, solar cell, battery.

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

TEXT BOOKS :
1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and

REFERENCES:

PR8002  FUZZY LOGIC AND ANN  L T P C
3 0 0 3

OBJECTIVES:
- To impact knowledge on fuzzy logic principles
- To understand models of ANN
- To use the fuzzy logic and neural network for application related to design and manufacture

UNIT I  INTRODUCTION TO FUZZY LOGIC PRINCIPLES  9
Basic concepts of fuzzy set theory – operations of fuzzy sets – properties of fuzzy sets – Crisp
relations – Fuzzy relational equations – operations on fuzzy relations – fuzzy systems – propositional
logic – Inference – Predicate Logic – Inference in predicate logic – fuzzy logic principles – fuzzy

UNIT II  ADVANCED FUZZY LOGIC APPLICATIONS  9
Fuzzy logic controllers – principles – review of control systems theory – various industrial applications
of FLC adaptive fuzzy systems – fuzzy decision making – Multiobjective decision making – fuzzy
classification – means clustering – fuzzy pattern recognition – image processing applications –
syntactic recognition – fuzzy optimization.
UNIT III  INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS

UNIT IV  OTHER ANN ARCHITECTURES

UNIT V  RECENT ADVANCES

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course, the students will be able to
- Develop the skill in basic understanding on fuzzy logic.
- Develop the skill in basic understanding on neural network
- Explore the functional components of neural classification conducer and the functional components of fuzzy logic classification on controller.
- Develop and implement a basic trainable neural network (or) a fuzzy logic system to design and manufacturing.
- Understand the recent advances in fundamentals of genetic algorithm.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To understand the principle of measuring displacement, velocity, acceleration, vibration, force, stress and strain.
- To build mathematical model for control system.
- To familiar with bode plots.

UNIT I INTRODUCTION
Static and dynamic characteristics of measurement systems, standards and calibration, error and uncertainty analysis, statistical analysis of data, and curve fitting.

UNIT II MECHANICAL MEASUREMENTS AND INDUSTRIAL INSTRUMENTATION
Measurement of displacement, velocity (linear and rotational), acceleration, shock, vibration, force, torque power, strain, stress, pressure temperature.

UNIT III DATA DISPLAY AND RECORDING DEVICES
Data display-CRO, LED, LCD, magnetic tape recorders, x-y recorders, UV recorders, Oscilloscope recorders, digital printers and data loggers.

UNIT IV CONTROL
Introduction to control systems, mathematical model of physical systems in transfer function and state space forms, response of dynamic systems, concept of pole and zero of a system, realization of transfer functions.

UNIT V STABILITY ANALYSIS
Stability criteria bode plots, routh and Nyquist criteria.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course student can able to
- Understand the dynamic characteristics of measurement system.
- Understand the mechanical measurements and industrial instrumentation.
- Understand the working principle of data display and recording devices.
- Understand the working principle of control system.
- Perform Stability Analysis.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To understand the principle, importance and application of machine vision system in Manufacturing and measurement.

UNIT I INTRODUCTION TO MACHINE VISION  6
Machine Vision use of machine vision – tasks for a vision system – relation to other fields – place of vision in CIM.

UNIT II IMAGE ACQUISITION AND CONVERSION  6

UNIT III IMAGE PROCESSING DECISION MAKING  12
Processing of binary images – thresholding, geometrical properties, topological properties – processing of gray scale images statistical operations, spatial operations, segmentation edge detection, morphological operations – image analysis – factors extraction – decision making.

UNIT IV PATTERN RECOGNITION  9

UNIT V MACHINE VISION APPLICATIONS  12
Applications in user industries automotive, semiconductor, electronic manufacturing, printing industries etc. – generic applications founding manufacturing metrology, inspection assembly verification – application analysis and implementation.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course student can able to
- Understand the Machine vision principle.
- Understand the image acquisition and conversion principle.
- Understand the image processing procedures.
- Use machine vision techniques to pattern recognizing.
- Understand the use of machine vision in manufacturing industries in process implementation, assembly.

TEXT BOOK

REFERENCES:
1. Richard O.Duda, Peter E. Hurt, Pattern Classification and Scene Analysis,Johnweily Publisher, 2000.
OBJECTIVE:
- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I   LINEAR MODELS  15

UNIT II  TRANSPORTATION MODELS AND NETWORK MODELS  8

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

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

UNIT V  DECISION MODELS  10

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
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 Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

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

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

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

TOTAL: 45 PERIODS

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

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

GE8074 HUMAN RIGHTS

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:
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  9
RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

TOTAL: 45 PERIODS

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

REFERENCES:

PR8071 LEAN SIX SIGMA L T P C
3 0 0 3

OBJECTIVE:
To gain insights about the importance of lean manufacturing and six sigma practices.

UNIT I LEAN & SIX SIGMA BACKGROUND AND FUNDAMENTALS
Historical Overview – Definition of quality – What is six sigma -TQM and Six sigma - lean manufacturing and six sigma- six sigma and process tolerance – Six sigma and cultural changes – six sigma capability – six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ), Cost of Doing Nothing – assessment questions

UNIT II THE SCOPE OF TOOLS AND TECHNIQUES

UNIT III SIX SIGMA METHODOLOGIES

UNIT IV SIX SIGMA IMPLEMENTATION AND CHALLENGES
UNIT V EVALUATION AND CONTINUOUS IMPROVEMENT METHODS

Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates – continuous improvement – lean manufacturing – value, customer focus, Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S.

OUTCOMES:
Upon completion of this course student can able to
- Understand the fundamentals of Lean and Six sigma.
- Understand the tools and techniques used in analysis.
- Understand the six sigma methodologies.
- Understand the implementation and challenges in six sigma.
- Understand the evaluation and continuous improvement methods.

REFERENCES:
2. Fred Soleimannnejad, Six Sigma, Basic Steps and Implementation, Author House, 2004

ME8092 COMPOSITE MATERIALS AND MECHANICS

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

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING
UNIT II  FLAT PLATE LAMINATE CONSTITUTE EQUATIONS  9
Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of
Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced
Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate
Determination of Lamina stresses within Laminates.

UNIT III  LAMINA STRENGTH ANALYSIS  9
Generalized Hill’s Criterion for Anisotropic materials. Tsai-Hill’s Failure Criterion for
Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

UNIT IV  THERMAL ANALYSIS  9
Assumption of Constant C.T.E’s. Modification of Hooke’s Law. Modification of Laminate Constitutive
Equations. Orthotropic Lamina C.T.E’s. C.T.E’s for special Laminate Configurations –
Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-
Isotropic Laminates

UNIT V  ANALYSIS OF LAMINATED FLAT PLATES  9
Free Vibrations – Natural Frequencies

TOTAL: 45 PERIODS

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

TEXT BOOKS:
   CRC press in progress, 1994, -.

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, Penetrators, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

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:

TOTAL : 45 PERIODS
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:

MF8072 TOTAL PRODUCTIVE MAINTENANCE L T P C
3 0 0 3

OBJECTIVES:
At the end of this course the student should be able to understand
• To understand maintenance concepts
• To understand the modern practices in maintenance

UNIT I MAINTENANCE CONCEPTS
Objectives and functions – Tero technology – Reliability Centered Maintenance (RCM) – maintainability prediction – availability and system effectiveness- maintenance costs – maintenance organization

UNIT II MAINTENANCE MODELS
Minimal repair – maintenance types – balancing PM and breakdown maintenance- PM schedules: deviations on both sides of target values – PM schedules: functional characteristics – replacement models

UNIT III TOTAL PRODUCTIVE MAINTENANCE

UNIT IV MAINTENANCE LOGISTICS

UNIT V ONLINE MONITORING

TOTAL: 45 PERIODS
OUTCOMES:
- Implementation the concept of total productive maintenance to the industries
- Effectively use the total productive maintenance for online monitoring of processes

TEXT BOOKS

REFERENCES:

PR8005 PRODUCTION MANAGEMENT

OBJECTIVES:
- To study the evolution of Management
- To study the functions and Production management
- To learn the application of the principles in an organization


UNIT II INVENTORY MANAGEMENT Purpose of Inventory – Cost related to inventors – Basic EOQ model – variations in EOQ model – Finite Production quality discounts – ABC Analysis – MRP Analysis.


TOTAL: 45 PERIODS
OUTCOMES:
Upon the completion of this course, students will
- Understand the principles of management and personnel management.
- Understand the principle of inventory management.
- Understand the principles of operations management.
- Understand the principles of financial management.
- Understand the principles of marketing management.

TEXT BOOKS:

REFERENCES:

PR8006 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT  L T P C
3  0  0  3

OBJECTIVE:
- To enable students to understand and interpret the basic financial statements, to comprehend the basics in managing finance and to know pricing mechanism.

UNIT I INTRODUCTION

UNIT II FINANCIAL ACCOUNTING

UNIT III PROFIT VALUE ANALYSIS
Cost volume profit analysis – relevant costs in decision making profit management analysis – break even analysis – margin of safety, Angle of incidence & multi product break even analysis.

UNIT IV WORKING CAPITAL MANAGEMENT

UNIT V CAPITAL BUDGETING
Significance of capital budgeting – payback period – present value method – Accounting rate of return method, Internal Rate of Return.

TOTAL: 45 PERIODS
OUTCOMES:
Upon the completion of this course, students will
• Understand the principles of Engineering Economics.
• Able to prepare and interpret financial statements.
• Able to perform Profit analysis.
• Able to manage the working capital.
• Understand the logic behind the capital budgeting.

TEXTBOOKS:

REFERENCES:

EE8091 MICRO ELECTRO MECHANICAL SYSTEMS

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

UNIT I INTRODUCTION

UNIT II SENSORS AND ACTUATORS-I

UNIT III SENSORS AND ACTUATORS-II
UNIT IV  MICROMACHINING
Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching
– Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies
- Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of
sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS –
Foundry process.

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi,
   2002.

REFERENCES:
   Smart Devices", John Wiley & Son LTD,2002
4. Nadim Maluf,“ An Introduction to Micro Electro Mechanical System Design”, Artech House,
   2000.
   Springer 2012.

PR8007  DESIGN OF MACHINE TOOL STRUCTURE  L T P C
3 0 0 3

OBJECTIVES:
• To understand different machine tools used for machining.
• To understand the design criteria for machine tool structures.
• To know the designing of slideways
• To understand the vibration in the machine tool during operation.

UNIT I  INTRODUCTION
Classification of machining processes, machine tools – machine tool construction – factors –
performance criteria – trends in modern machine tool – kinematic arrangement of different types of
machine tools – work holding and tool holding devices – calculation of cutting forces and power
requirements for turning, milling, boring and grinding – force distribution on different parts of drilling,
milling and grinding machine tools.
UNIT II  STRENGTH AND RIGIDITY OF MACHINE TOOL STRUCTURES

UNIT III  SLIDEWAYS

UNIT IV  SPINDLES AND SPINDLE SUPPORTS

UNIT V  MACHINE TOOL DYNAMICS

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course, students will

- Understand the construction features of machine tool structure.
- Have ability to design machine tools based on strength and rigidity.
- Understand the mechanism of slide ways.
- Understand the construction features of spindles and spindle supports.
- Understand the principles of machine tool dynamics.

TEXT BOOKS:

REFERENCES:
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  

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

TEXT BOOKS:

REFERENCES:

MG8892 MARKETING MANAGEMENT  

OBJECTIVE:
- To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation. The course will enable a student to take up marketing as a professional career.
UNIT I  MARKETING PROCESS  9
Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

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

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

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

UNIT V  ADVERTISING, SALES PROMOTION AND DISTRIBUTION  9

TOTAL: 45 PERIODS

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

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  
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  
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  

UNIT IV  CONTROL TECHNIQUES  
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  
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:
OBJECTIVE:
• To provide an insight on the fundamentals of supply chain networks, tools and techniques.

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

UNIT II SUPPLY CHAIN NETWORK DESIGN

UNIT III LOGISTICS IN SUPPLY CHAIN

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

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

TOTAL: 45 PERIODS

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

TEXTBOOK:

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

UNIT I  HUMAN VALUES

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