ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM
B.E. MANUFACTURING ENGINEERING

THE VISION OF THE DEPARTMENT OF MANUFACTURING ENGINEERING:
To be outstanding institute where students can gain acumen and to brew them so that they unswervingly meet the needs of the society.

THE MISSION OF THE DEPARTMENT OF MANUFACTURING ENGINEERING:
- To foster the growth of its members and develop them in new vistas promoting them to their fullest cognition.
- To be nationally recognized as the leader of Manufacturing Engineering in education and research.
- Bring augmentation to the Department, College and University.
- Discern the potential of its members.
- Have its members vivaciously conscripted nationally by employers and graduate programs.
- To evoke new ideas in the minds of its members and infuse nascent technology to modern era of manufacturing.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
To qualify as Manufacturing Engineering Graduates, the candidates are expected to meet the following Program Educational Objectives (PEOs) within 5 years after graduation:

I. To be employed in jobs related manufacturing sectors at National and Global levels.
II. To be engaged in life-long learning, certification from professional organizations and active participation in professional societies/activities.
III. To be successful in their carrier and take up leadership role in their professional life.
IV. To become an experts and provide solutions to the industrial problems in the manufacturing sectors.
V. Become an entrepreneur/ startups and to establish an industry to provide job to others.
PROGRAMME OUTCOMES (POs):

The Programme Outcomes (POs) of the Manufacturing Engineering graduates are given below:

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<tr>
<th>PO</th>
<th>Graduate Attribute</th>
<th>Programme Outcome</th>
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<tbody>
<tr>
<td>1</td>
<td>Engineering knowledge</td>
<td>Engineering/Fundamental knowledge in mathematics, engineering, sciences, computer science, humanities, and social science</td>
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<td>2</td>
<td>Problem analysis</td>
<td>Identify, formulate and solve industrial problems with the knowledge gained.</td>
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<td>3</td>
<td>Design/development of solutions</td>
<td>Design a component or system and provide solutions by understanding its current status to improve its performance and satisfying its constraints.</td>
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<td>4</td>
<td>Conduct investigations of complex problems</td>
<td>Conduct experimentation and collect, analyze as well as interpret the data in a systematic way.</td>
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<td>5</td>
<td>Modern tool usage</td>
<td>Ability to apply various modern tools and techniques to improve the efficiency of the system.</td>
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<td>6</td>
<td>The Engineer and society</td>
<td>Conduct themselves to uphold the professional and social obligations.</td>
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<td>7</td>
<td>Environment and sustainability</td>
<td>Design and develop the systems with environment consciousness and sustainable manufacturing.</td>
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<td>8</td>
<td>Ethics</td>
<td>Behave and practice ethically in the professional carrier.</td>
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<td>9</td>
<td>Individual and team work</td>
<td>Demonstrate leadership skills and also be able to function as a team player.</td>
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<td>Communication</td>
<td>Communicate professionally in both oral and written forms.</td>
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<tr>
<td>11</td>
<td>Project management and finance</td>
<td>Ability to manage through effective economic planning and control.</td>
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<tr>
<td>12</td>
<td>Life-long learning</td>
<td>Creating interest in the lifelong learning attitude.</td>
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PROGRAM SPECIFIC OUTCOMES (PSOs):

On successful completion of Manufacturing Engineering degree program, the graduate shall have the following Program Specific Outcomes (PSOs).

1. Ability to apply the knowledge gained in the fundamentals of manufacturing engineering in a systematic manner with ethics and sustainability.
2. Ability to understand, devise methodologies to solve problems and come out with best possible solutions in manufacturing engineering as an individual and as a team.
3. Ability to apply fundamental aspects of manufacturing engineering to innovate and to create new products and processes with sustainable manufacturing.
### PEO / PO MAPPING:

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<th>PROGRAMME EDUCATIONAL OBJECTIVES</th>
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### MAPPING OF COURSE OUTCOME AND PROGRAMME OUTCOME

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## ANNA UNIVERSITY, CHENNAI
### UNIVERSITY DEPARTMENTS
#### B.E. MANUFACTURING ENGINEERING
##### REGULATIONS – 2019
###### CHOICE BASED CREDIT SYSTEM
##### CURRICULA AND SYLLABI FOR I TO VIII SEMESTERS

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*Audit Course is optional.

* Students will have to undergo industrial training / Internship during previous vacation period.

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**TOTAL CREDIT: 168 CREDITS**
# HUMANITIES AND SOCIAL SCIENCES (HSMC) – MANAGEMENT AND OTHERS

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### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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### AUDIT COURSES (AC)

Registration for any of these courses is optional to students

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COURSE OBJECTIVES:
The first semester English course entitled ‘Technical English’ aims to,
- Familiarise first year students of engineering and technology with the fundamental aspects of technical English.
- Develop all the four language skills by giving sufficient practice in the use of the skills in real life contexts.
- Enhance the linguistic and communicative competence of first year engineering and technology students.

UNIT I   INTRODUCING ONESELF  12
Listening: Listening and filling a form, listening to speeches by specialists from various branches of engineering and completing activities such as answering questions, identifying the main ideas of the listening text, style of the speaker (tone and tenor) – Speaking: Introducing oneself – introducing friend/ family - Reading: Descriptive passages (from newspapers / magazines) - Writing: Writing a paragraph (native place, school life) - Vocabulary Development: One word substitution

UNIT II   DIALOGUE WRITING  12
Listening: Listening to conversations (asking for and giving directions) – Speaking: making conversation using (asking for directions, making an enquiry), Role plays-dialogues - Reading: Reading a print interview and answering comprehension questions - Writing: Writing a checklist, Dialogue writing - Grammar: Simple past – question formation (Wh- questions, Yes or No questions, Tag questions) – Vocabulary Development: Stress shift, lexical items related to the theme of the given unit.

UNIT III   FORMAL LETTER WRITING  12
Listening: Listening to speeches by famous people and identifying the central message of the speech – answering multiple-choice questions – Speaking: Giving short talks on a given topic - Reading: Reading motivational essays on famous engineers and technologists (answering open-ended and closed questions) - Writing: Writing formal letters/ emails (Complaint letters) - Grammar: Future Tense forms of verbs, subject and verb agreement - Vocabulary Development: Collocations – Fixed expressions

UNIT IV   WRITING COMPLAINT LETTERS  12

UNIT V   WRITING DEFINITIONS AND PRODUCT DESCRIPTION  12
Listening: Listening to a product description (labeling and gap filling) exercises - Speaking: Describing a product and comparing and contrasting it with other products - Reading: Reading graphical material for comparison (advertisements) - Writing: Writing Definitions (short and long) – compare and contrast paragraphs - Grammar: Adjectives – Degrees of comparison - compound nouns - Vocabulary Development: Use of discourse markers – suffixes (adjectival endings).

TOTAL : 60 PERIODS

LEARNING OUTCOMES
At the end of the course the students will have gained,
- Exposure to basic aspects of technical English.
- The confidence to communicate effectively in various academic situations.
- Learnt the use of basic features of Technical English.
TEXT BOOK:

ASSESSMENT PATTERN:
• Assessments will assess all the four skills through both pen and paper and computer based tests.
• Assessments can be pen and paper based, quizzes.

MA5158 ENGINEERING MATHEMATICS – I
(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

COURSE OBJECTIVES:
• To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
• To familiarize the students with differential calculus.
• To familiarize the student with functions of several variables. This is needed in many branches of engineering.
• To make the students understand various techniques of integration.
• To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES 12

UNIT II DIFFERENTIAL CALCULUS 12

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

UNIT IV 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 V MULTIPLE INTEGRALS 12

TOTAL :60 PERIODS
COURSE OUTCOMES:
At the end of the course the students will be able to
- Use the matrix algebra methods for solving practical problems.
- Apply differential calculus tools in solving various application problems.
- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS:

REFERENCES:

PH5151 ENGINEERING PHYSICS
(Common to all branches of B.E / B.Tech programmes)

COURSE OBJECTIVES:
- To make the students in understanding the importance of mechanics.
- To equip the students on the knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics and lasers.
- To enable the students in understanding the importance of quantum physics.
- To elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.

UNIT I MECHANICS

UNIT II ELECTROMAGNETIC WAVES
Gauss’s law – Faraday’s law - Ampere’s law - The Maxwell’s equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.
UNIT III  OSCILLATIONS, OPTICS AND LASERS  9

UNIT IV  BASIC QUANTUM MECHANICS  9
Photons and light waves - Electrons and matter waves - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle.

UNIT V  APPLIED QUANTUM MECHANICS  9
The harmonic oscillator - Barrier penetration and quantum tunneling - Tunneling microscope - Resonant diode - Finite potential wells - particle in a three dimensional box - Bloch’s theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students should able to
• Understanding the importance of mechanics.
• Express the knowledge of electromagnetic waves.
• Know the basics of oscillations, optics and lasers.
• Understanding the importance of quantum physics.
• Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

TEXT BOOKS

REFERENCES

CY5151  ENGINEERING CHEMISTRY  (COMMON TO ALL BRANCHES)  L T P C  3 0 0 3

COURSE OBJECTIVES:
• To introduce the basic concepts of polymers, their properties and some of the important applications.
• To impart knowledge on the basic principles and preparatory methods of nanomaterials.
• To facilitate the understanding of the laws of photochemistry, photoprocesses and instrumentation & applications of spectroscopic techniques.
• To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
• To inculcate sound understanding of water quality parameters and water treatment techniques.
UNIT I  POLYMER CHEMISTRY  9

UNIT II  NANO CHEMISTRY  9

UNIT III  PHOTOCHEMISTRY AND SPECTROSCOPY  9

UNIT IV  ENERGY CONVERSIONS AND STORAGE  9
Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant – fast breeder reactor. Solar energy conversion - solar cells. Wind energy. Batteries - types of batteries – primary battery (dry cell), secondary battery (lead acid, nickel-cadmium and lithium-ion-battery). Fuel cells – H₂-O₂ and microbial fuel cell. Explosives – classification, examples: TNT, RDX, Dynamite; Rocket fuels and propellants – definition and uses.

UNIT V  WATER TECHNOLOGY  9

TOTAL:  45 PERIODS

COURSE OUTCOMES:
- To recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
- To demonstrate the knowledge of water and their quality in using at different industries.
TEXT BOOKS:

REFERENCES:

GE5151 ENGINEERING GRAPHICS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Drawing free hand sketches of basic geometrical shapes and multiple views of objects.
2. Drawing orthographic projections of lines and planes.
3. Drawing orthographic projections of solids.
4. Drawing development of the surfaces of objects.
5. Drawing isometric and perspective views of simple solids.

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 FREE HANDSKETCHING
Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by different methods – 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- Free hand sketching of multiple views from pictorial views of objects

UNIT II
PROJECTION OF POINTS, LINES AND PLANE SURFACES
Orthographic projection- principles-Principle 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 trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

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

UNIT IV
PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of solids in simple vertical position when the cutting plane is inclined to 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. Development of lateral surfaces of solids with cut-outs and holes.
UNIT V  
ISOMETRIC AND PERSPECTIVE PROJECTIONS  
12
Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)  
3
Introduction to drafting drafting and demonstration of their use

TOTAL (L: 15 + P: 60)=75 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:

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

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PHYSICS LABORATORY: (Any Seven Experiments)

COURSE OBJECTIVES:
- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves and band gap determination.

LIST OF EXPERIMENTS:
1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of Young's modulus
3. Uniform bending – Determination of Young’s modulus
4. Lee’s disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box - Determination of Band gap of a semiconductor.
13. Photoelectric effect
14. Michelson Interferometer.
16. Melde’s string experiment

COURSE OUTCOMES:
Upon completion of the course, the students will be able
- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids

CHEMISTRY LABORATORY: (Minimum of 8 experiments to be conducted)

COURSE OBJECTIVES:
- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chlorine and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS:
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 lodometry.
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-
Phenanthrolone / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Phase change in a solid.

TOTAL: 30 PERIODS

COURSE OUTCOMES:
- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and
  DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To determine the molecular weight of polymers by viscometric method.
- To quantitatively analyse the impurities in solution by electroanalytical techniques
- To design and analyse the kinetics of reactions and corrosion of metals

TEXT BOOKS:

GE5162 WORKSHOP PRACTICES LABORATORY
(Common to all Branches of B.E. / B.Tech. Programmes) 0 0 4 2

COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common
   household plumbing work; Sawing; planing; making joints in wood materials used in
   common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple
   processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of
   common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic
   components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES

PLUMBING WORK:
- Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers,
  elbows and other components which are commonly used in household.
- Preparing plumbing line sketches.
- Laying pipe connection to the suction side of a pump
- Laying pipe connection to the delivery side of a pump.
- Connecting pipes of different materials: Metal, plastic and flexible pipes used in
  household appliances.

WOOD WORK:
- Sawing,
- Planing and
- Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-400 025
Wood Work Study:
   a) Studying joints in door panels and wooden furniture
   b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

WIRING WORK:
   a) Wiring Switches, Fuse, Indicator and Lamp etc. such as in basic household,
   b) Wiring Stair case light.
   c) Wiring tube – light.
   d) Preparing wiring diagrams for a given situation.

Wiring Study:
   a) Studying an Iron-Box wiring.
   b) Studying a Fan Regulator wiring.
   c) Studying an Emergency Lamp wiring.

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:
   a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
   b) Practicing gas welding.

BASIC MACHINING WORK:
   a) (simple)Turning.
   b) (simple)Drilling.
   c) (simple)Tapping.

ASSEMBLY WORK:
   a) Assembling a centrifugal pump.
   b) Assembling a household mixer.
   c) Assembling an air conditioner.

SHEET METAL WORK:
   a) Making of a square tray

FOUNDRY WORK:
   a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:
   a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:
   a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:
   a) Studying a FM radio.
   b) Studying an electronic telephone.

TOTAL (P: 60) = 60 PERIODS
COURSE OUTCOMES:

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

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

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HS5251 PROFESSIONAL COMMUNICATION

COURSE OBJECTIVES:
The course entitles ‘Professional Communication’ aims to,

- Improve the relevant language skills necessary for professional communication.
- Develop linguistic and strategic competence in workplace context.
- Enhance language proficiency and thereby the employability of budding engineers and technologists.

UNIT I TECHNICAL COMMUNICATION
12
Listening: Listening to telephone conversations (intent of the speaker and note taking exercises)-
Speaking: Role play exercises based on workplace contexts, introducing oneself-
Reading: Reading the interview of an achiever and completing exercises (skimming, scanning and predicting)-
Writing: Writing a short biography of an achiever based on given hints-
Grammar: Asking and answering questions, punctuation in writing, prepositional phrases-
Vocabulary Development: use of adjectives.

UNIT II SUMMARY WRITING
12
Listening: Listening to talks/lectures both general and technical and summarizing the main points-
Speaking: Participating in debates-
Reading: Reading technical essays/ articles and answering comprehension questions-
Writing: Summary writing-
Grammar: Participle forms, relative clauses-
Vocabulary Development: Use of compound words, abbreviations and acronyms.

UNIT III PROCESS DESCRIPTION
12
Listening: Listening to a process description and drawing a flowchart-
Speaking: Participating in Group Discussions, giving instructions-
Reading: Reading instruction manuals-
Writing: Writing process descriptions-
Grammar: Use of imperatives, active and passive voice, sequence words-
Vocabulary Development: Technical jargon
UNIT IV REPORT WRITING
12
Listening: Listening to a presentation and completing gap-filling exercises- Speaking: Making formal presentations- Reading: Reading and interpreting charts/tables and diagrams- Writing: Interpreting charts/tables and diagrams, writing a report- Grammar: Direct into indirect speech, use of phrases- Vocabulary Development: reporting words

UNIT V WRITING JOB APPLICATIONS
12
Listening: Listening to a job interview and completing gap-filling exercises- Speaking: Mock interview, telephone interviews- Reading: Reading a job interview, SOP, company profile and completing comprehension exercises- Writing: job applications and resumes and SOPs-Grammar: Present perfect and continuous tenses- Vocabulary Development: Technical vocabulary.

TOTAL : 60 PERIODS

LEARNING OUTCOMES:
At the end of the second semester the learners should be able to,
- Read and comprehend technical texts effortlessly.
- Write reports of a technical kind.
- Speak with confidence in interviews and thereby gain employability

TEXT BOOK:

ASSESSMENT PATTERN:
- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5252 ENGINEERING MATHEMATICS – II
(Common to all branches of B.E. / B.Tech. Programmes in II Semester)

COURSE OBJECTIVES:
- To acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
- To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To acquaint the students with Differential Equations which are significantly used in Engineering problems.
- To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS
12

UNIT II ANALYTIC FUNCTION
12
Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by functions – Bilinear transformation $w = c + z, a z, 1 / z, z^2$.
UNIT III    COMPLEX INTEGRATION 12

UNIT IV    DIFFERENTIAL EQUATIONS 12
Method of variation of parameters – Method of undetermined coefficients – Homogenous equations of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

UNIT V    LAPLACE TRANSFORMS 12

TOTAL : 60 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to:
- Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
- Construct analytic functions and use their conformal mapping property in application problems.
- Evaluate real and complex integrals using the Cauchy’s integral formula and residue theorem.
- Apply various methods of solving differential equation which arise in many application problems.
- Apply Laplace transform methods for solving linear differential equations.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I  INTRODUCTION TO COMPUTING AND PROBLEM SOLVING 9


SUGGESTED ACTIVITIES:

- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Installing Python.
- Simple programs on print statements, arithmetic operations.

SUGGESTED EVALUATION METHODS:

- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

UNIT II  CONDITIONALS AND FUNCTIONS 9


SUGGESTED ACTIVITIES:

- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of a simple calculator.
- Developing simple applications like calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
- External learning - Recursion vs. Iteration.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.
- Group discussion on external learning.

UNIT III  SIMPLE DATA STRUCTURES IN PYTHON 10

SUGGESTED ACTIVITIES:
- Implementing python program using lists, tuples, sets for the following scenario:
  Simple sorting techniques
  Student Examination Report
  Billing Scheme during shopping.
- External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.
- Group Discussion on external learning component.

UNIT IV  STRINGS, DICTIONARIES, MODULES  10

SUGGESTED ACTIVITIES:
- Implementing Python program by importing Time module, Math package etc.
- Creation of any package (student’s choice) and importing into the application.

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.

UNIT V  FILE HANDLING AND EXCEPTION HANDLING  7
Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

SUGGESTED ACTIVITIES:
- Developing modules using Python to handle files and apply various operations on files.
- Usage of exceptions, multiple except blocks - for applications that use delimiters like age, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.
- Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

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TOTAL 45 PERIODS
TEXT BOOKS:

REFERENCES:

EE5251 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE OBJECTIVES:
- To understand the basic concepts of electric circuits, magnetic circuits and wiring.
- To understand the operation of AC and DC machines.
- To understand the working principle of electronic devices and circuits.

UNIT I BASIC CIRCUITS AND DOMESTIC WIRING

UNIT II THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS

UNIT III ELECTRICAL MACHINES

UNIT IV BASICS OF ELECTRONICS
Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics-Rectifier circuits-Wave shaping.

UNIT V CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES
Working principle and characteristics - BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS
COURSE OUTCOMES:

CO1 To be able to understand the concepts related with electrical circuits and wiring.
CO2 To be able to study the different three phase connections and the concepts of magnetic circuits.
CO3 Capable of understanding the operating principle of AC and DC machines.
CO4 To be able to understand the working principle of electronic devices such as diode and zener diode.
CO5 To be able to understand the characteristics and working of current controlled and voltage controlled devices.

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TEXT BOOKS:

REFERENCES:

GE5152 ENGINEERING MECHANICS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Applying the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Applying the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Applying the concepts of locating centroids/center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Applying the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Applying the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

UNIT I STATICS OF PARTICLES
UNIT II EQUILIBRIUM OF RIGID BODIES (9+3)

UNIT III DISTRIBUTED FORCES (9+3)
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration, Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration

UNIT IV FRICTION (9+3)

UNIT V DYNAMICS OF PARTICLES (9+3)

TOTAL (L: 45 + T: 15)=60 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Apply the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Apply the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Apply the concepts of locating centroids / center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

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GE5161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

COURSE OBJECTIVES:
- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To articulate where computing strategies support in providing Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:
1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python data structures.
CO6: Apply Python features in developing software applications.
COURSE OBJECTIVES:
1. To impart hands on experience in verification of circuit laws and measurement of circuit parameters.
2. To train the students in performing various tests on electrical motors.
3. It also gives practical exposure to the usage of CRO, power sources & function generators.

LIST OF EXPERIMENTS
1. Verification of Kirchhoff’s Law.
2. Steady state response of AC and DC circuits (Mesh, Node Analysis).
3. Frequency response of RLC circuits.
5. Regulation of single phase transformer.
6. Performance characteristics of DC shunt generator.
7. Performance characteristics of single phase induction motor.
10. Half wave and full wave Rectifiers.
11. Application of Zener diode as shunt regulator.
12. Characteristics of BJT and JFET.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
1. To become familiar with the basic circuit components and know how to connect them to make a real electrical circuit;
2. Ability to perform speed characteristic of different electrical machines.
3. Ability to use logic gates and Flip flops.

MA5355 TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS

COURSE OBJECTIVES:
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
- To introduce Fourier series analysis which is central to many applications in engineering;
- To develop the analytic solutions for partial differential equations used in engineering by Fourier series;
- To acquaint the student with Fourier transform techniques used in a wide variety of situations in which the functions used are not periodic;
- To develop Z-transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS
Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange’s Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II FOURIER SERIES
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Parseval’s identity – Harmonic Analysis.
UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION 12

UNIT IV FOURIER TRANSFORM 12

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 12

TOTAL : 60 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
- Solve partial differential equations which arise in application problems.
- Analyze the functions as an infinite series involving sine and cosine functions.
- Obtain the solutions of the partial differential equations using Fourier series.
- Obtain Fourier transforms for the functions which are needed for solving application problems.
- Manipulate discrete data sequences using Z transform techniques.

TEXT BOOKS:

REFERENCES:
UNIT II TRANSVERSE LOADINGS ON BEAMS AND STRESSES IN BEAM

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

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

UNIT V THICK & THIN SHELLS & PRINCIPAL STRESSES
Stresses in thin cylindrical shell due to internal pressure, circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame’s theory – Application of theories of failure – Stresses on inclined planes – principal stresses and principal planes – Mohr’s circle of stress.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Apply the principle concepts behind stress, strain and deformation of solids for various engineering applications.
2. Analyze the transverse loading on beams and stresses in beam for various engineering applications.
3. Analyze the torsion principles on shafts and springs for various engineering applications.
4. Analyze the deflection of beams for various engineering applications.
5. Analyze the thin and thick shells and principal stresses in beam for various engineering applications.

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ME5351  COMPUTER AIDED DESIGN  L T P C  3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

1. Applying the fundamental concepts of computer graphics and its tools in a generic framework.
2. Creating and manipulating geometric models using curves, surfaces and solids.
3. Applying concept of CAD systems for 3D modeling and visual realism.
4. Creating and adding geometric tolerances in assembly modeling.
5. Applying CAD standard practices in engineering design.

UNIT I  FUNDAMENTALS OF COMPUTER GRAPHICS  9
Product cycle - Design process - Computer Aided Design – Computer graphics – co-ordinate systems - 2D and 3D transformations- homogeneous coordinates - graphic primitives (point, line, circle drawing algorithms) - Clipping- viewing transformation.

UNIT II  GEOMETRIC MODELING  9
Representation of curves - Hermite cubic spline curve, Bezier curve, B-spline curves, Surface Modeling – Surface Entities, Representation of Surface, Bezier Surface, B-Spline Surface and Coons Surface. Solid Modeling - Solid Entities, Solid Representation, Boundary Representation (B-Rep), Sweeps Representation, Constructive Solid Geometry (CSG).

UNIT III  VISUAL REALISM  9

UNIT IV  PART ASSEMBLY  9
Mass properties - Assembly modeling – Inference of position and orientation –Geometric Dimensioning and Tolerancing – Functional importance of various types of fits, Geometrical dimensioning and Tolerancing, Tolerance stacking – types and remedies.

UNIT V  CAD STANDARDS  9
Standards for computer graphics- Graphical Kernel System (GKS) - Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, ACIS and DXF - communication standards.

TOTAL  = 45 PERIODS

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

1. Apply the fundamental concepts of computer graphics and its tools in a generic framework.
2. Create and manipulating geometric models using curves, surfaces and solids.
3. Apply concept of CAD systems for 3D modeling and visual realism.
4. Create and adding geometric tolerances in assembly modeling.
5. Apply standard CAD practices in engineering design.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:

- To impart knowledge on basics of metal cutting.
- To describe the basic principles of machine tools and processes
- To elaborate abrasive and finishing operations.
- To be acquainted with design principles of jigs and fixtures and its applications.
- To outline basics of automation and structure of machine tools.

UNIT I INTRODUCTION TO MANUFACTURING AND MACHINING

Introduction to manufacturing and machining - classification of metal removal processes and machine tools - Mechanics of machining (Metal Cutting) - Geometry of single point cutting tools - Mechanism of chip formation - Orthogonal and oblique cutting - Machining forces and Merchants Circle Diagram and Analytical and experimental determination of cutting forces - Dynamometers for measuring cutting forces - Power - Cutting temperature - causes, effects, assessment and control - cutting fluid application - Machinability and surface finish - Failure of cutting tools and tool life - Cutting tool materials.

UNIT II MACHINE TOOLS AND PROCESSES


UNIT III ABRASIVE MACHINING AND FINISHING OPERATIONS

Abrasive Processes (Grinding) - Basic principles, Purpose and application of grinding - Selection of wheels and their conditioning - Classification of grinding machines and their uses - Super finishing processes - Honing, lapping and super finishing - Gear and thread Finishing

UNIT IV JIGS AND FIXTURES

Work holding devices, tool Holding devices and attachments - Jigs and Fixtures for machine shops Purposes of jigs and fixtures and their design principles - Application of typical jigs and fixtures case studies.

UNIT V MACHINE TOOL STRUCTURE TESTING AND AUTOMATION


TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students shall be able to:

- CO1: Apply the knowledge in the basics of metal cutting.
- CO2: Apply suitable machining processes based on requirements.
- CO3: To distinguish different finishing operations.
- CO4: Design jigs and fixtures as per requirements.
- CO5: Test the machine tool structure and differentiate various automation.
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**TEXT BOOKS:**

**REFERENCES:**

**MF5351 THERMODYNAMICS**

**COURSE OBJECTIVES:**
- To describe the basic concepts and first law of thermodynamics.
- To analyse the second law of thermodynamics.
- To evaluate the properties of pure substances.
- To gain knowledge on the concepts of conduction, convection and radiation.
- To apply the concepts of thermodynamics in IC engines, boilers, turbines, refrigeration and air-conditioning.

**UNIT I BASICS CONCEPTS AND FIRST LAW OF THERMODYNAMICS**
Basic concepts; Continuum and macroscopic approach; thermodynamic systems (closed and open); thermodynamic properties and equilibrium; state of a system, state postulate for simple compressible substances, paths and processes on state diagrams; concepts of heat and work, different modes of work; zeroth law of thermodynamics; concept of temperature. First Law of Thermodynamics; Concept of energy and various forms of energy; internal energy, enthalpy; specific heats; first law applied to elementary processes, closed systems and control volumes, steady and unsteady flow analysis.

**UNIT II SECOND LAW OF THERMODYNAMICS**
Second law of thermodynamics; Limitations of the first law of thermodynamics, concepts of heat engines and heat pumps/refrigerators, Kelvin-Planck and Clausius statements and their equivalence; reversible and irreversible processes; Carnot cycle and Carnot theorems; thermodynamic temperature scale; Clausius inequality and concept of entropy; the principle of increase of entropy, T-s diagrams; second law analysis of control volume; availability and irreversibility; third law of thermodynamics.
UNIT III  PROPERTIES OF PURE SUBSTANCE  
Thermodynamic properties of pure substances in solid, liquid and vapour phases; P-v-T behaviour of simple compressible substances, thermodynamic property tables and charts, psychrometric charts ideal and real gases: Vander waals equations - Reduced property - Compressibility chart - Properties of mixture of gases - Dalton’s law and Gibbs - Internal energy, Enthalpy and specific heats of gas mixtures.

UNIT IV  HEAT TRANSFER  

UNIT V  APPLICATIONS  

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course the students shall be able to:
- CO1. Apply first law of thermodynamics to engineering applications.
- CO2. Differentiate first and second law of thermodynamics.
- CO3. Estimate the properties of real and ideal gas mixtures using thermodynamic charts.
- CO4. Evaluate the heat transfer through conduction, convection and radiation
- CO5. Analyse the operation of IC engine, boilers, turbine, refrigerator etc.

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TEXT BOOKS:

REFERENCES:

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DIRECTOR
COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:
1. Applying standard drawing practices using fits and tolerances.
4. Preparing standard drawing layout for modeled parts or assemblies with BoM.

PART I DRAWING STANDARDS & FITS AND TOLERANCES 4

PART II 2D DRAFTING 56
Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed Drawing.
1. Bearings – Bush Bearing
3. Couplings – Flange, Oldham’s, Muff, Gear couplings.
5. Engine parts – Piston, Connecting Rod, Crosshead (vertical and horizontal), Stuffing box, Multi-plate clutch.

Total: 20% of classes for theory classes and 80% of classes for practice
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 CAD software.

TOTAL (L: 4 + P: 56) = 60 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Apply standard drawing practices using fits and tolerances.
3. Model orthogonal views of assembled components.
4. Prepare standard drawing layout for modeled parts or assemblies with BoM.

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Director
Centre for Academic Courses
Anna University, Chennai-600 025
COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:
1. Selecting appropriate tools, equipments and machines to complete a given job.
2. Performing various welding process using GMAW.
3. Performing various machining process such as rolling, drawing, turning, shaping, drilling, milling.
5. Analyzing the defects in the cast and machined components.

LIST OF EXPERIMENTS
1. Fabricating simple structural shapes using Gas Metal Arc Welding machine.
2. Preparing green sand moulds with cast patterns.
3. Casting aluminum parts using stir casting machine.
4. Reducing the thickness of the plates using rolling machine.
5. Reducing the diameter of on circular parts using wire drawing process machine.
6. Taper Turning and Eccentric Turning on circular parts using lathe machine.
7. Knurling, external and internal thread cutting on circular parts using lathe machine.
8. Shaping – Square and Hexagonal Heads on circular parts using shaper machine.
11. Cutting spur and helical gear using milling machine.
15. Broaching components using broaching machine.

TOTAL = 60 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Select appropriate tools, equipments and machines to complete a given job.
2. Perform various welding process using GMAW.
3. Perform various machining process such as rolling, drawing, turning, shaping, drilling, milling.
5. Analyze the defects in the cast and machined components.

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COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues.

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 – bio geographical 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 – soil 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 47 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  7

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

TOTAL: 45 PERIODS

COURSE OUTCOMES:
• To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
• To identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
• To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
• To recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.
• To demonstrate the knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:

REFERENCES:

CE5251 FLUID MECHANICS AND MACHINERY

COURSE OBJECTIVE:
To introduce the students about properties of the fluids, behaviour of fluids under static conditions and to impart basic knowledge of the dynamics of fluids and to expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends with an exposure to the significance of boundary layer theory and its thicknesses with expose to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps.
UNIT I  FLUID PROPERTIES AND FLOW CHARACTERISTICS  10
Properties of fluids- Pressure Measurements-Buoyancy and floatation-Flow characteristics-Eulerian and Lagrangian Principle of fluid flow- concept of control volume and system – Reynold’s transportation theorem- continuity equation, energy equation and momentum equation-Applications.

UNIT II  FLOW THROUGH PIPES AND BOUNDARY LAYER  9

UNIT III  DIMENSIONAL ANALYSIS AND MODEL STUDIES  7
Fundamental dimensions - Dimensional homogeneity - Rayleigh’s method and Buckingham Pi theorem - Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.

UNIT IV  TURBINES  10

UNIT V  PUMPS  9
Classification of pumps- Centrifugal pumps– working principle - Heads and efficiencies– Velocity triangles- Work done by the impeller - performance curves - Reciprocating pump working principle – indicator diagram and it’s variations – work saved by fitting air vessels.

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to
CO1  Understand the difference between solid and fluid, its properties and behaviour in static conditions.
CO2  Understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.
CO3  Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies.
CO4  Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.
CO5  Understand the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface.

TEXT BOOKS:

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ME5452 MECHANICS OF MACHINES

COURSE OBJECTIVES:
1. To understand the principles in the formation of mechanisms and their kinematics.
2. To learn the basic concepts of toothed gearing and kinematics of gear trains.
3. To study the effect of friction in different machine elements.
4. To analyze the forces and torque acting on simple mechanical systems
5. To understand the importance of balancing and vibration.

UNIT I KINEMATIC ANALYSIS IN SIMPLE MECHANISMS AND CAMS 9

UNIT II TOOTHED GEARING AND GEAR TRAINS 9

UNIT III FRICTION ASPECTS IN MACHINE COMPONENTS 9
UNIT IV  STATIC AND DYNAMIC FORCE ANALYSIS  

UNIT V  BALANCING OF ROTATING MASSES AND VIBRATION  

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Design the linkages and the cam mechanisms for specified output motions.
2. Determine the gear parameters of toothed gearing and speeds of gear trains in various applications.
3. Evaluate the frictional torque in screw threads, clutches, brakes and belt drives.
4. Determine the forces on members of mechanisms during static and dynamic equilibrium conditions.
5. Determine the balancing masses on rotating machineries and the natural frequencies of free and forced vibratory systems.

TEXT BOOK

REFERENCES

MF5401  CASTING AND WELDING TECHNOLOGY  
L T P C  3 0 0 3

COURSE OBJECTIVES:
• To impart the basics of casting.
• To introduce various casting processes
• To be acquainted with design of gating system and to obtain defect free castings
• To elaborate various welding methods including advanced techniques, with emphasis on basic principles, limitations and application.
• To outline metallurgical aspects of welding and its defects.

UNIT I  BASICS OF CASTING  
Metals cast in the foundry- Ingot casting; Continuous casting and Shape casting-Factors determine the selection of a casting alloy-Introduction to shape casting process & steps involved-Patterns: Definition, classification, materials used for pattern, various pattern allowances and their importance—Sand molding: Types of base sand, requirement of base sand-testing-Binder-Additives, need and types- Preparation of sand molds: Molding machines- Jolt type, squeeze type and sand slinger--Cores: Definition, need, types. Method of making cores
UNIT II CASTING PROCESSES
Study of important molding process with advantages & limitations of casting processes: classification of casting Processes-Sand mould: Green sand- Core sand- Dry sand- Sweep mould-CO₂ mold--Casting using metal molds: Gravity die casting, Pressure die casting, Centrifugal casting, squeeze casting, Slush casting, Thixocasting-Precision Moulds: Shell mold, Investment mold, Plaster mold, Cement bonded mold.,

UNIT III GATING SYSTEM SOLIDIFICATION AND CASTING DEFECTS
Concept of gating (Top, bottom, parting line, horn gate) and risering (Open, blind) -Functions and types. -Melting Furnaces-Solidification: definition, nucleation, solidification variables, directional Solidification-Need and methods. Degasification in liquid Metals-Sources of gas, degasification methods. -Fettling and cleaning of castings: Basic steps involved. -Sand casting defects- causes, features and remedies.

UNIT IV WELDING PROCESSES

UNIT V METALLURGICAL ASPECTS IN WELDING AND ITS DEFECTS
Structure of welds, Formation of different zones during welding, Heat Affected Zone (HAZ), Parameters affecting HAZ. Effect of carbon content on structure and properties of steel, Shrinkage in welds & Residual stresses-Pre and Post Weld Treatments- Welding defects- Detection, causes & remedy.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course the students shall be able to:
- CO1: Gain basic knowledge in casting.
- CO2: Select suitable casting process for application requirement.
- CO3: Apply gating design and mould design knowledge to overcome defects in casting.
- CO4: Select suitable welding process according to the requirements.
- CO5: Apply metallurgical aspects of welding to overcome defects in welding.

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TEXT BOOKS:

REFERENCES:
ML5351 ENGINEERING MATERIALS AND METALLURGY

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Constructing the phase diagram and using of iron-iron carbide phase diagram for microstructure formation.
2. Selecting and applying various heat treatment processes and its microstructure formation.
3. Applying the different types of ferrous and non-ferrous alloys and their uses in engineering field.
4. Applying the different polymer, ceramics and composites and their uses in engineering field.
5. Applying the various testing procedures and failure mechanism in engineering field.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

UNIT II HEAT TREATMENT

UNIT III FERROUS AND NON-FERROUS METALS
Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) – stainless and tool steels – HSLA - Maraging steels – Grey, white, malleable, spheroidal – alloy cast irons, Copper and its alloys – Brass, Bronze and Cupronickel – Aluminium and its alloys; Al-Cu – precipitation strengthening treatment – Titanium alloys, Mg-alloys, Ni-based super alloys – shape memory alloys- Properties and Applications

UNIT IV NON-METALLIC MATERIALS

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS

TOTAL = 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Construct the phase diagram and using of iron-iron carbide phase diagram for microstructure formation.
2. Select and applying various heat treatment process and its microstructure formation.
3. Apply the different types of ferrous and non-ferrous alloys and their uses in engineering field.
4. Apply the different polymer, ceramics and composites and their uses in engineering field.
5. Apply the various testing procedures and failure mechanism in engineering field.

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MF5411 METALLURGY LABORATORY

COURSE OBJECTIVES:
- To impart practical knowledge of heat treatment processes.
- To elaborate the effect of various parameters on heat treatment process
- To get conversant with the microstructural changes
- To familiarize with hardness evaluation
- To gain practical knowledge on heat treatment of various materials.

LIST OF EXPERIMENTS:
1. Annealing and normalising of hardened steels
2. Spheroidization annealing of high carbon steels
3. Effect of quenching media on hardening of steel
4. Effect of tempering temperature and time on tempering of steel
5. Effect of carbon percentage on the hardness of steel
6. Carburizing – Low carbon steel
7. Case hardness depth measurements
8. Austempering treatment
9. Hardenability test – Jominy End Quench Test
10. Heat treatment of cast iron
11. Heat treatment of Stainless Steels and High speed steels
12. Heat treatment of non-ferrous alloys

TOTAL: 30 PERIODS
COURSE OUTCOMES:
At the end of this course students can able to:
CO1. Demonstrate the various heat treatment processes.
CO2. Evaluate the microstructural changes and hardness during heat treatment.
CO3. Analyse the influence of various parameters on heat treatment process
CO4. Differentiate the heat treatment process of ferrous and non-ferrous alloys.
CO5. Work in R&D activity in the field of materials science

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CE5361 STRENGTH OF MATERIALS AND FLUID MACHINERY LABORATORY

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

PART – I STRENGTH OF MATERIALS

LIST OF EXPERIMENTS
1. Tension test on mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metal beam (Rockwell and Brinell Hardness Tests)
4. Compression test on helical spring
5. Deflection test on carriage spring

PART – II FLUID MECHANICS AND MACHINES LABORATORY

LIST OF EXPERIMENTS

A. FLOW MEASUREMENT
1. Verification of Bernoulli’s theorem
2. Flow through orifice/venturi meter
3. Friction factor for flow through pipes
4. Impact of jet on fixed plate

B. METACENTER
5. Determination of metacentric height

C. PUMPS
6. Characteristics of centrifugal pumps
7. Characteristics of gear pump
8. Characteristics of submersible pump
9. Characteristics of reciprocating pump

D. TURBINES
10. Characteristics of Pelton wheel turbine

TOTAL: 60 PERIODS
COURSE OUTCOMES:
On completion of the course, the student is expected to be able to
1. Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
2. Use the measurement equipment’s for flow measurement.
3. Perform test on different fluid machinery.
4. Verify and apply Bernoulli equation for flow measurement like orifice/venturi meter.
5. Measure friction factor in pipes and compare with Moody diagram and verify momentum conservation law.
6. Determine the performance characteristics of rotodynamic pumps.
7. Determine the performance characteristics of positive displacement pumps.
8. Determine the performance characteristics of turbine.

REFERENCES:

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L - Low, M – Medium, H - High

Attested
COURSE OBJECTIVES:

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi’s Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM - Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES
Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning-
Continuous process improvement –Juran Trilogy, PDSA cycle, SS and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I
The seven traditional tools of quality - New management tools - Six-sigma Process Capability-

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

UNIT V QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to apply TQM concepts in a selected enterprise.
CO2: Ability to apply TQM principles in a selected enterprise.
CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
CO4: Ability to understand Taguchi’s Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
CO5: Ability to apply QMS and EMS in any organization.

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REFERENCES:

MF5501  METROLOGY AND COMPUTER AIDED INSPECTION  L T P C
3 0 0 3

COURSE OBJECTIVES:
- To impart the basics of metrology, measurement concepts and perform measurement tasks accurately.
- To identify the right measurement practices for linear and angular measurements.
- To be familiarized with the right instrument and method of measurement for surface finish and form measurements.
- To describe the various measurement techniques using laser metrology.
- To gain knowledge on computer aided inspection and advances in metrology.

UNIT I  BASIC CONCEPTS OF MEASUREMENTS
Important terminologies - Elements of measurements, need for measurement - Factors influencing measurements - Precision and Accuracy - Methods of measurement - Errors in measurements - Causes - Standards and Calibration - Types-Handling of measuring instruments - Do's and Don’ts - Maintenance of Instruments - Clean room.

UNIT II  LINEAR AND ANGULAR MEASUREMENTS

UNIT III  SURFACE FINISH AND FORM MEASUREMENTS
Measurement of various elements of screw threads and gears - Radius measurement - Surface finish measurement - Straightness, Flatness and roundness- Principles - Application – Computerized form measuring equipments.

UNIT IV  LASER METROLOGY

UNIT V  COMPUTER AIDED INSPECTION AND ADVANCES IN METROLOGY

TOTAL: 45 PERIODS
COURSE OUTCOMES:
At the end of this course, the student shall be able to:
- CO1: Recognize the basics of metrology, measurement concepts and perform measurement tasks accurately.
- CO2: Identify the right measurement practices for linear and angular measurements.
- CO3: Identify the right instrument and method of measurement for surface finish and form measurements
- CO4: Describe various measurement techniques using laser metrology.
- CO5: Recognize the computer aided inspection and advances in metrology.

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TEXT BOOKS:

REFERENCES:

MF5502 METAL AND POWDER FORMING L T P C 3 0 0 3

COURSE OBJECTIVES:
- To describe types of deformations and classification of forming processes.
- To classify and explain bulk forming processes.
- To describe sheet metal forming processes
- To distinguish differences between conventional forming and special forming processes.
- To elaborate various stages involved in the powder forming processes.

UNIT I INTRODUCTION 9
Mechanical behavior of materials- Elastic and plastic deformations - Classification of forming processes - Temperature in metal working: Cold, Warm and hot working - Introduction to the theory of plastic deformation.

UNIT II BULK FORMING 9
Introduction - Plastic deformation in forging, rolling, extrusion, rod/wire, tube drawing and swaging processes and their applications - Effect of friction, calculation of forces, work done, process parameters, equipment’s and defects - Design for manufacturing - Economics of bulk forming.

Attested
Director
Centre for Academic Courses
Anna University, Chennai 600 025
UNIT III  SHEET METAL FORMING  9

UNIT IV  SPECIAL FORMING  9
Orbital forging - Isothermal forging - Hot and cold Isostatic pressing - High speed extrusion - High speed forming machines - Rubber pad forming - Water hammer forming - Fine blanking - Incremental forming and comparing the above with conventional forming.

UNIT V  POWDER FORMING  9

COURSE OUTCOMES:
At the end of this course the students will be able to:
- CO1: Illustrate deformation types and classification of forming processes.
- CO2: Describe bulk forming processes and their applications.
- CO3: Elaborate different sheet metal forming processes and their applications.
- CO4: Compare and distinguish conventional and special forming processes.
- CO5: Discuss powder forming processes and its applications

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TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Designing machine members subjected to static loads.
2. Designing shafts, couplings, welded joints, riveted joints and bearings for various applications.
3. Designing helical springs, flywheels, connecting rods and crankshafts for various applications.
4. Designing flexible elements like belt, ropes and chain drives for engineering applications.
5. Designing spur, helical gear drives and multi speed gear box for power transmission.

UNIT I STEADY STRESSES IN MACHINE MEMBERS 9+3
Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading -Factor of safety - theories of failure – Design based on strength and stiffness.

UNIT II SHAFTS, COUPLINGS, JOINTS AND BEARINGS 9+3
Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, key ways and splines –Rigid and flexible couplings. Threaded fasteners, Welded joints and riveted joints for structures, Sliding contact and rolling contact bearings (Simple problems)

UNIT III ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9+3
Various types of springs, optimization of helical springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT IV DESIGN FOR FLEXIBLE ELEMENTS 9+3
Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT V SPUR GEARS, HELICAL GEARS AND GEAR BOXES 9+3

TOTAL: 60 PERIODS

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

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Design machine members subjected to static loads.
2. Design shafts, couplings, welded joints, riveted joints and bearings for various applications.
3. Design helical springs, flywheels, connecting rods and crankshafts for various applications.
4. Design flexible elements like belt, ropes and chain drives for engineering applications.
5. Design spur, helical gear drives and multi speed gear box for power transmission.

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ME5514 DYNAMICS LABORATORY

COURSE OBJECTIVES:
- To gain practical experience in studying gear trains and mechanisms
- To get exposure in determining mass moment of inertia and studying gyroscopes and cams
- To expose the students to different types of governors
- To impart knowledge to determine natural frequency of free and forced vibratory systems

LIST OF EXPERIMENTS
2. Kinematics of Crank Rocker, Double crank, Double rocker, Slider Crank and Oscillating cylinder mechanisms. Kinematics of single and double universal joints.
3. Determination of Mass moment of inertia of Fly wheel and Axle system.
4. Determination of Mass Moment of Inertia of axisymmetric bodies using Turn table apparatus.
7. Governor - Determination of range sensitivity and effort for Watts, Porter, Proell, and Hartnell Governors.
8. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
11. Determination of torsional natural frequency of single and double rotor systems - Undamped and Damped Natural frequencies.
12. Vibration of Equivalent Spring mass system – undamped and damped vibration.
15. Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. measure gear parameters and velocity ratios of gear trains
2. determine mass moment of inertia of flywheel and axle system, axisymmetric bodies and pendulum
3. determine gyroscopic couple and various parameters of governors
4. determine natural frequency of free and forced vibratory systems
### COURSE OBJECTIVES:
- To familiarize the basic concepts in various methods of engineering measurement techniques and applications.
- To make students familiar with the fundamental principles of measuring techniques by practicing exercises on various measuring instruments.
- To gain knowledge on metallographic study of the given samples and heat treatment study of steel.
- To familiarize the importance of measurement and inspection in manufacturing industries.
- To train the students with advanced metrological devices.

### LIST OF EXPERIMENTS - METROLOGY LAB:
1. Checking the straightness of component using Autocollimator.
3. Tool Makers microscope-Element measurement of components.
5. Exercises in Microhite.
9. Study Exercises in Video measuring system and CMMs.
10. Study Exercises on 3D Roughness measurement - Non Contact.

**TOTAL : 60 PERIODS**

### COURSE OUTCOMES:
At the end of this course the student will be able to:
- **CO1**: Recognize the importance of various technical terms and perform measurement tasks accurately.
- **CO2**: Identify the right instrument and method of measurement for a particular application.
- **CO3**: Follow the right procedure for measurement of various components depending upon the applications.
- **CO4**: Describe the microstructure features of specimens and correlate with their macroscopic behaviour.
- **CO5**: Recognize the fundamental concepts of measurement, standards, calibration, maintenance of laboratory facilities and handling of equipments.
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COURSE OBJECTIVES:
- To familiarize students with real life situations in industrial organizations
- To accelerate the learning process
- To train the students in utilizing their knowledge in a realistic way
- To gain practical knowledge on organization structure
- To experience and understand real life situations

DURATION:
The students have to undergo practical industrial training for four weeks (During Fourth Semester holidays) in recognized industrial establishments.

I. At the end of the training they have to submit a report with following information:
1. Profile of the Industry,
2. Product range,
3. Organization structure,
4. Plant layout,
5. Processes/Machines/Equipment/devices,
6. Personnel welfare schemes,
7. Details of the training undergone,
8. Projects undertaken during the training, if any
9. Learning points.

II. End Semester examination will be a Viva-Voce Examination during Fifth Semester

COURSE OUTCOMES:
At the end of the course the student will be able to
- Recognize the different forms of organization
- Realize the functions of management
- Foresee group dynamics
- Discuss the modern concepts in industrial management.
- Develop skills to read, write and comprehend

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COURSE OBJECTIVES:
- To classify non-traditional machining processes and describe mechanical energy based non-traditional machining processes.
- To differentiate chemical and electro chemical energy based processes.
- To describe thermo-electric energy based processes
- To explain nano finishing processes.
- To introduce hybrid non-traditional machining processes and differentiate hybrid non-traditional machining processes.

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9
Introduction - Need for non-traditional machining processes - Classification of non-traditional machining processes - Applications, advantages and limitations of non-traditional machining processes - Abrasive jet machining, Abrasive water jet machining, Ultrasonic machining their principles, equipment, effect of process parameters, applications, advantages and limitations.

UNIT II CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES 9
Principles, equipments, effect of process parameters, applications, advantages and limitations of Chemical machining, Electro-chemical machining, Electro-chemical honing, Electro-chemical grinding, Electro chemical deburring.

UNIT III THERMO-ELECTRIC ENERGY BASED PROCESSES 9
Principles, equipments, effect of process parameters, applications, advantages and limitations of Electric discharge machining, Wire electric discharge machining, Laser beam machining, Plasma arc machining, Electron beam machining, Ion beam machining.

UNIT IV NANO FINISHING PROCESSES 9
Principles, equipments, effect of process parameters, applications, advantages and limitations of Abrasive flow machining – Chemo mechanical polishing, Magnetic abrasive finishing, Magnetorheological finishing, Magneto rheological abrasive flow finishing.

UNIT V HYBRID NON-TRADITIONAL MACHINING PROCESSES 9
Introduction - Various hybrid non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Selection and comparison of different non-traditional machining processes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course the students shall be able to:
- CO1: Formulate different types of non-traditional machining processes and evaluate mechanical energy based non-traditional machining processes.
- CO2: Illustrate chemical and electro chemical energy based processes.
- CO3: Evaluate thermo-electric energy based processes.
- CO4: Interpret nano finishing processes.
- CO5: Analyse hybrid non-traditional machining processes and differentiate non- traditional machining processes.

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REFERENCES:

MF5652 ADDITIVE MANUFACTURING L T P C 3 0 0 3

COURSE OBJECTIVES:
- To introduce the development of Additive Manufacturing (AM), various business opportunities and applications
- To familiarize various software tools, processes and techniques to create physical objects that satisfy product development / prototyping requirements, using AM.
- To be acquainted with vat polymerization and material extrusion processes.
- To be familiar with powder bed fusion and direct energy deposition.
- To gain knowledge on applications of binder jetting, material jetting and laminated object manufacturing processes

UNIT I INTRODUCTION 9

UNIT II DESIGN FOR ADDITIVE MANUFACTURING (DFAM) 9

UNIT III VAT POLYMERIZATION AND MATERIAL EXTRUSION 9

UNIT IV POWDER BED FUSION AND DIRECT ENERGY DEPOSITION 9
UNIT V  OTHER ADDITIVE MANUFACTURING PROCESSES


COURSE OUTCOMES:
At the end of this course students shall be able to:
- CO1: Recognize the development of AM technology and how AM technology propagated into various businesses and developing opportunities.
- CO2: Acquire knowledge on process of transforming a concept into the final product in AM technology.
- CO3: Elaborate the vat polymerization and material extrusion processes and its applications.
- CO4: Acquire knowledge on process and applications of powder bed fusion and direct energy deposition.
- CO5: Evaluate the advantages, limitations, applications of binder jetting, material jetting and laminated object manufacturing processes.

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COURSE OBJECTIVES:
- To introduce the evolution, types and principles of CNC machine tools
- To familiarize the students with constructional features of CNC machine tools
- To acquaint the students with various drives and axis measuring systems used in CNC machine tools
- To gain knowledge on manual part program and generation of CNC part program using CAM packages
- To familiarize the students with various tooling and work holding devices used in CNC machine tools

UNIT I  INTRODUCTION TO CNC MACHINE TOOLS  9
Evolution of CNC Technology - principles - features - advantages - applications - CNC and DNC concept - CNC controllers - characteristics - interpolators - types of CNC Machines - construction / operation, machine specification of turning centre - machining centre (3 and higher axes) - grinding machine - vertical turret lathe - turn-mill centre – multitask machines

UNIT II  STRUCTURE OF CNC MACHINE TOOL  9
CNC Machine building - structural details - configuration and design - guide ways – Friction, Anti friction and other types of guide ways - elements used to convert the rotary motion to a linear motion - Screw and nut - recirculating ball screw - spindle assembly - torque transmission elements - gears - timing belts - flexible couplings - Bearings.

UNIT III  DRIVES AND CONTROLS  9

UNIT IV  CNC PROGRAMMING  9
Coordinate system - structure of a CNC part program - G & M Codes - tool length compensation - cutter radius and tool nose radius compensation - mirror image - canned cycles- programming for machining centre and turning centre for well known controllers - generation of CNC codes from CAM packages.

UNIT V  TOOLING AND WORK HOLDING DEVICES  9
Cutting tool materials for CNC machine tools- hard metal insert tooling- inserts and tool holder classification - qualified - semi qualified and preset tooling - ATC - APC - tooling for machining and turning centre - silent tool - work holding devices for rotating and fixed work parts- use of probes in CNC machines - economics of CNC - maintenance of CNC machines.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students shall be able to:
- CO1: Recognize the evolution, types and principle of CNC machine tools
- CO2: Acquire knowledge on constructional features of CNC machine tools
- CO3: Identify drives and axis measuring system used in CNC machine tools
- CO4: Demonstrate competency in manual part program and generation of CNC part program using CAM packages
- CO5: Elaborate various tooling and work holding devices used in CNC machine tools

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REFERENCES:

MF5611 COMPUTER AIDED MANUFACTURING AND ENGINEERING LABORATORY L T P C
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COURSE OBJECTIVES:
- To familiarize students with manual CNC part programming for milling and turning machines
- To generate part programs using CNC programming and simulation s/w for CNC Lathe, CNC Milling
- To get hands on experience by machining the parts on actual machines like CNC Lathe, CNC milling machine and CNC Wire EDM
- To introduce robot programming method
- To present the concept of printing parts using additive manufacturing

LIST OF EXPERIMENTS:
1. Study of different CNC control systems and CNC codes.
2. Programming and simulation for turning, taper turning, circular interpolation, thread cutting, facing and parting operations.
4. Programming and simulation for machining of internal surfaces in CNC Lathe.
5. Programming and simulation for 3D profile milling, drilling, rigid tapping, boring operation.
6. Programming and simulation for circular and rectangular pocket milling.
8. CNC code generation using machine simulation / CAM software packages – CNC Lathe.
9. CNC code generation using simulation / CAM software packages - CNC Milling machine / Machining centre.
10. Programming for CNC Wire cut EDM.
11. Robot programming for Material handling applications.
12. Understanding assembly, polishing and palletizing for different types of robots using software.
13. Experiment on extrusion based 3D printing machine

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students shall be able to:
- CO1: Display competency in manual CNC part programming for milling and turning machines
- CO2: Exhibit generation of part programs using CNC programming and simulation s/w for CNC Lathe, CNC Milling
- CO3: Demonstrate machining the parts on actual machines CNC Lathe, CNC Milling Machine and CNC Wire EDM.
- CO4: Describe the Robot programming methods
- CO5: Acquire knowledge on printing parts using additive manufacturing
LIST OF EQUIPMENTS REQUIRED:
2. CNC programming and machine simulation software for turning and milling.
3. CAM software for turning and for milling - for automatic code generation of Lathe, Mill and Wire cut EDM.
4. CNC Production type turning centre.
5. CNC Machining centre-3 axes.
6. CNC Wire Cut EDM.
7. 3D scanner with s/w.
9. Extrusion based additive manufacturing machine

MF5612 ADVANCED MANUFACTURING LABORATORY

COURSE OBJECTIVES:
- To familiarize the students with advanced machine tools.
- To familiarize the students with extrusion based additive manufacturing
- To acquaint the students with traditional and nontraditional machining process
- To introduce the manufacture of polymer composites.
- To introduce the concepts of Thin film based deposition process.

Simple exercises using the following machines:
1. CNC Turning Centre
2. CNC Wire cut EDM
3. 5 Axis CNC Machining Centre
4. Abrasive Waterjet Machine (AWJM)
5. Extrusion based additive manufacturing
6. Micro machining of 3D parts using mechanical micro machining system
7. Electro Chemical Micro Machine (ECMM)
8. Resin Transfer Moulding System
9. Physical Vapor Deposition Unit (PVD)

COURSE OUTCOMES:
At the end of this course, the students shall be able to:
- CO1: Acquire knowledge on advanced machine tools.
- CO2: Demonstrate extrusion based additive manufacturing.
- CO3: Discuss traditional and nontraditional machining process.
- CO4: Demonstrate the manufacture of polymer composites.
- CO5: Value thin film based deposition process.
COURSE OBJECTIVES:

- To introduce Students to the latest trends in manufacturing planning and control System
- To gain knowledge on design of forecasting systems and different forecasting methods
- To impart the basic concepts of resource requirements
- To outline the need and approaches to computer aided process planning
- To familiarize the functions of shop floor control and associated systems.

UNIT I MANUFACTURING PLANNING AND CONTROL


UNIT II FORECASTING


UNIT III RESOURCE PLANNING


UNIT IV COMPUTER AIDED PROCESS PLANNING


UNIT V SHOP FLOOR CONTROL


TOTAL: 45 PERIODS
COURSE OUTCOMES:
At the end of this course, the students shall be able to:
- CO1: Be familiarized with the latest trends in manufacturing planning and control System
- CO2: Perceive design of forecasting systems and different forecasting methods
- CO3: Be acquainted with the basic concepts of resource requirements
- CO4: Recognize the need and approaches of computer aided process planning
- CO5: Evaluate the functions of shop floor control and associated systems.

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ONLINE COURSE MATERIALS
1. Course Material from NPTEL: http://nptel.ac.in/courses/112102101/

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Selecting sensors to develop mechatronics systems.
2. Explaining the architecture and timing diagram of microprocessor, and also interpret and develop programs.
3. Designing appropriate interfacing circuits to connect I/O devices with microprocessor.
4. Applying PLC as a controller in mechatronics system.
5. Designing and develop the apt mechatronics system for an application.
UNIT I  INTRODUCTION AND SENSORS  

UNIT II  8085 MICROPROCESSOR  

UNIT III  PROGRAMMABLE PERIPHERAL INTERFACE  

UNIT IV  PROGRAMMABLE LOGIC CONTROLLER  
Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.

UNIT V  ACTUATORS AND MECHATRONICS SYSTEM DESIGN  

TOTAL  = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Select sensors to develop mechatronics systems.
2. Explain the architecture and timing diagram of microprocessor, and also interpret and develop programs.
3. Design appropriate interfacing circuits to connect I/O devices with microprocessor.
4. Apply PLC as a controller in mechatronics system.
5. Design and develop the apt mechatronics system for an application.

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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Applying the working principles of fluid power systems and hydraulic pumps.
2. Applying the working principles of hydraulic actuators and control components.
3. Designing and develop hydraulic circuits and systems.
4. Applying the working principles of pneumatic power system and its components.
5. Solving problems and troubles in fluid power systems.

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS 9
Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids
- Properties of fluids and selection – Basics of Hydraulics – Pascal’s Law – Principles of flow
- Friction loss – Work, Power and Torque- Problems, Sources of Hydraulic power : Pumping Theory—
- Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance,
Selection criteria of pumps – Fixed and Variable displacement pumps – Problems

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS 9
Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning –
Rotary actuators-Hydraulic motors - Control Components : Direction Control, Flow control and
pressure control valves – Types, Construction and Operation – Accessories : Reservoirs, Pressure
Switches – Filters –types and selection- Applications – Fluid Power ANSI Symbols – Problems

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

UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS 9
Properties of air –Air preparation and distribution – Filters, Regulator, Lubricator, Muffler, Air
control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit –
classification- single cylinder and multi cylinder circuits-Cascade method –Integration of fringe
circuits, Electro Pneumatic System – Elements – Ladder diagram – timer circuits-Problems,
Introduction to fluidics and pneumatic logic circuits

UNIT V TROUBLE SHOOTING AND APPLICATIONS 9
Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic
systems, Conditioning of hydraulic fluids Design of hydraulic circuits for Drilling, Planning, Shaping,
Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for metal working,
handling, clamping counter and timer circuits. – Low cost Automation – Hydraulic and Pneumatic
power packs.

TOTAL = 45 PERIODS

Note: (Use of standard Design Data Book is permitted in the University examination)

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Apply the working principles of fluid power systems and hydraulic pumps.
2. Apply the working principles of hydraulic actuators and control components.
3. Design and develop hydraulic circuits and systems.
4. Apply the working principles of pneumatic power system and its components.
5. Solve problems and troubles in fluid power systems.

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ME5761 MECHATRONICS LABORATORY L T P C 0 0 4 2

COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:
1. Measuring of physical quantity such as displacement, force and temperature, and also the operation of signal conditioning circuits.
2. Applying a suitable sensor and image processing technique for Mechatronics Systems.
3. Designing appropriate circuits to automate and control the Hydraulic, Pneumatic, and Electric actuators.
4. Applying PLC, PID and microcontroller as a control unit in the Mechatronics System.
5. Developing a model of robot by using simulation software, and also execute real-time control over a Robot by IoT.

LIST OF EXPERIMENTS:
2. Experiments on the application of Sensors – LDR, Optocoupler, Ultrasonic, Infrared, Hall effect and MEMS Accelerometer.
4. Modeling and Analysis of basic Hydraulic, Pneumatic, Electro-Pneumatic, Electrical and Electronic Circuits by using simulation software.
5. Actuation of double acting cylinder by using Hydraulic, Pneumatic and Electro-Pneumatic circuits.
7. PLC Automation with Timers and Counters – Cylinder Sequencing – Sorting of Objects on Conveyor Belt.
8. DC Drives – Speed and Direction Control by using Microcontroller.
9. AC Drives – Speed and Direction Control by using Microcontroller.
10. Stepper Motor – Position, Speed and Direction Control.
15. Actuation and control of Robot by using Internet of Things (IoT).

TOTAL = 60 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Measure of physical quantity such as displacement, force and temperature, and also the operation of signal conditioning circuits.
2. Apply a suitable sensor and image processing technique for Mechatronics Systems.
3. Design appropriate circuits to automate and control the Hydraulic, Pneumatic, and Electric actuators.
4. Apply PLC, PID and microcontroller as a control unit in the Mechatronics System.
5. Develop a model of robot by using simulation software, and also execute real-time control over a Robot by IoT.

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MF5711 PROJECT I

TOTAL: 60 PERIODS

COURSE OBJECTIVES:
- To apply the knowledge of science and engineering fundamentals for the solution of complex engineering problems.
- To identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using engineering science.
- To design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
- To identify the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
- To demonstrate knowledge while understanding the engineering principles, and apply them to one’s own work, as a member and as a leader in a team; manage the projects in multidisciplinary environments.

Each and every student may choose a nagging workplace problem, research problems and socially relevant problems that have been difficult for them to solve. At the end of the semester, they have to submit a report for evaluation.

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 jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students shall be able to:
- CO1: Explore the variables that affect creativity and innovation.
- CO2: Identify the concepts to relevant research problems or practical applications
- CO3: Design and fabricate the creative and innovative ideas into working model using principles of engineering science
- CO4: Enhance professional skills to communicate in both oral and written forms and be proficient in working in diverse teams of individuals
- CO5: Recognize the importance of leadership skills.
MF5811  PROJECT II  L T P C  0 0 1 6 8

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.
- To develop good communication skills and team work.
- To familiarize students with real life situations
- To accelerate learning process

A project topic must be selected by the students in consultation with their guides. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and fabrication of a device for a specific application, a research project with a focus on an application needed by the industry/society, a computer project, a management project or a design project. 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 jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

COURSE OUTCOMES:

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

- CO1: Manage the selection and initiation of individual projects and of portfolios of projects in the enterprise.
- CO2: Demonstrate a strong working knowledge of ethics and professional responsibility.
- CO3: Conduct project planning activities that accurately forecast project costs, timelines, and quality.
- CO4: Implement processes for successful resource, communication, and risk and change management.
- CO5: Demonstrate effective organizational leadership and change management skills for projects and project teams.
**COURSE OBJECTIVES:**

- To introduce types of plastics and properties
- To equip the students with the knowledge of processes utilized in developing materials or making components using plastics
- To introduce joining and machining of plastics
- To impart knowledge in preparation of polymer composites.
- To develop the competence in major industrially practiced plastic processing techniques with sustainability.

**UNIT I  INTRODUCTION TO PLASTICS**  
9  

**UNIT II  PROCESSING OF THERMOPLASTICS AND THERMOSETS**  
9  

**UNIT III  JOINING AND MACHINING OF PLASTICS**  
9  

**UNIT IV  REINFORCED PLASTICS**  
9  
Reinforced plastics (Composites) - Hand layup – Sprayup- Vaccum and Pressure bag moulding-Matched die molding. -Continuous laminating - Pultrusion - Injection molding- Filament winding - Prepregs -Sheet molding compound -Bulk molding compound- principle, advantages, disadvantages and applications.

**UNIT V  SUSTAINABLE PLASTICS**  
9  

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

The students shall be able to

- **CO1:** Identify various processing methods used for different types of plastics and their useful properties in daily life.
- **CO2:** Select suitable process for application requirements.
- **CO3:** Select various machining variables used for joining and machining plastic components.
- **CO4:** Select suitable process for polymer matrix composites.
- **CO5:** Be concerned with sustainable practice and its requirement

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PR5072 PRODUCTION OF AUTOMOTIVE COMPONENTS

COURSE OBJECTIVES:
- To impart knowledge in various manufacturing methods in developing automotive components.
- To study the concepts of automobile engineering.
- To impart the knowledge in various parts of automotive engine.
- To understand the concepts of fuel and transmission system.
- To learn the recent developments in automobile industries.

UNIT I ENGINE
Working principle of two strokes, four stroke and wankel engines – wet and dry liners – Piston and Piston rings – types – classification. Production of Cylinder block, Cylinder head, liners, oil pan, piston and piston rings and testing.

UNIT II ENGINE COMPONENTS
Working principle of crank shaft – Cam shaft – valve operating mechanisms – carburetors - spark plug– connecting rod - Production of Connecting rod , Crankshaft , push rod and rocker arm ,valves, tappets , carburetors and spark plugs.

UNIT III FUEL AND TRANSMISSION SYSTEM

UNIT IV CHASSIS AND SUSPENSION SYSTEM
Working principle of – Suspension system – leaf spring and shock absorbers – wheel housing – design concepts of chassis (aerodynamics and cross worthiness) - Production of Brake shoes, leaf spring, wheel disc, wheel rim –usage of non-metallic materials for chassis components.
UNIT V   RECENT ADVANCEMENTS  
Application of sensors and actuators – Emission control system – catalytic converter – Hydro forming of exhaust manifold and lamp housing – stretch forming of Auto body panels – MMC liners – thermal barrier coating of Engine head and valves – Selection of materials for Auto components – sensors and actuators- exhaust gas recycler (EGR)

TOTAL: 45 PERIODS 

COURSE OUTCOMES:
At the end of the course, students will be able to:
CO1: Acquire knowledge of production of various automotive components.
CO2: Learn the working principles of engines.
CO3: Get knowledge about various engine components.
CO4: Learn working of Fuel and Transmission System and its types.
CO5: Acquire knowledge of recent development in automobile industries.

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ME5071    AUTOMOBILE ENGINEERING  

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Explaining various types of automobiles, their power packs and types of vehicle bodies.
2. Analyzing the various types of power train and fuel supply and management systems.
3. Analyzing the various types of transmission systems for a vehicle.
4. Analyzing the working parameters of various braking and suspension system in a vehicle.
5. Analyzing the working parameters of various electrical and electronic devices in a vehicle.

UNIT I   INTRODUCTION TO AUTOMOBILE AND TYPES  
An overview of different types of automobiles and their power sources. Specifications, Performance Parameters, Types of power delivery, Safety standards, Trends in automobile design. Two and Types, Regulations, Car body construction. Bus Body Details, General consideration relating to chassis layout. Introduction to MV Act, Pollution Norms,
UNIT II POWERTRAIN AND FUEL MANAGEMENT SYSTEMS 9
Reciprocating Engine systems, Hybrid systems. Pollutant emissions and their control; Catalytic converter systems, Electronic Engine Management systems for SI and CI engines. Liquid and gaseous alternate fuels - Alcohol, LPG, CNG, and Hydrogen

UNIT III CLUTCH AND TRANSMISSION SYSTEMS 9
Clutch system and types, Gear box and types - manual, automatic, and AMT, propeller shafting, Differential, Axles - function, and types, Wheels, Tyres - types, construction and specification, suspension system - types and functioning,

UNIT IV BRAKING AND SUSPENSION SYSTEMS 9
Braking system - requirements and types, Steering system - working, types and steering geometry parameters. Wheel balancing & Alignment Wind Tunnel testing, Servicing of Vehicles,

UNIT V ELECTRICAL AND ELECTRONIC SYSTEMS 9
Introduction to Battery, Alternator, and Starter Motor systems, working principle, and circuity, Safety systems - seat belts, air-bag, ABS, Modern electronic features in vehicles like tyre pressure monitoring, ESP, EBD, Automatic headlamp ON, Rain sensing wipers, speed sensing auto locking, OBD. HVAC system

TOTAL = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Explain various types of automobiles, their power packs and types of vehicle bodies.
2. Analyze the various types of power train and fuel supply and management systems.
3. Analyze the various types of transmission systems for a vehicle.
4. Analyze the working parameters of various braking and suspension system in a vehicle.
5. Analyze the working parameters of various electrical and electronic devices in a vehicle.

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COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:

1. Applying the principles of locating and clamping in Jigs and fixtures and various components related to Press tools.
2. Designing various types of Jigs for given components and draw multiple views of the same with dimensions and parts List.
3. Designing various types of Fixtures for given components and draw multiple views of the same with dimensions and parts List.
4. Designing various parts of cutting dies and draw the standard dimensioned views.
5. Designing various parts of forming dies and draw the standard dimensioned views.

UNIT I PRINCIPLES OF JIGS, FIXTURES AND PRESS WORKING

UNIT II JIGS
Design and development of jigs for given component - Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs

UNIT III FIXTURES
Design and development of fixtures for given component- General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures

UNIT IV DESIGN OF CUTTING DIES
Complete design and preparation of standard views of simple blanking, piercing, compound and progressive dies -fine Blanking dies

UNITV DESIGN OF BENDING, FORMING, DRAWING AND MISCELLANEOUS DIES
Difference between bending forming and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back- Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies

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

1. Apply the principles of locating and clamping in Jigs and fixtures and various components related to Press tools.
2. Design various types of Jigs for given components and draw multiple views of the same with dimensions and parts List.
3. Design various types of Fixtures for given components and draw multiple views of the same with dimensions and parts List.
4. Design various parts of cutting dies and draw the standard dimensioned views.
5. Design various parts of forming dies and draw the standard dimensioned views.
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PR5071 PROCESSING OF PLASTICS AND POLYMERS L T P C

COURSE OBJECTIVES:
- To expose the students to the basics of plastics and their applications.
- To expose the students to the basics of polymers and their applications.
- To impart knowledge about various plastic and polymer processing techniques.
- To enlighten the students about the various polymer mixing and blending techniques.
- To impart knowledge about various properties of polymers and its testing methods.

UNIT I INTRODUCTION TO PLASTICS

UNIT II INTRODUCTION TO POLYMERS
Chemistry and Classification of Polymers – Glass transition temperature, thermal expansion and its effects, molecular weight, stress strain behaviour. Types of polymers - plastics and rubbers . Applications of various types of polymers.

UNIT III PROCESSING OF PLASTICS AND POLYMERS

UNIT IV POLYMER MIXING AND BLENDING
UNIT V  POLYMER TESTING
Mechanical-static and dynamic: tensile, flexural, compressive, abrasion, endurance, fatigue, hardness, tears, resilience, impact, toughness. Conductivity-thermal and electrical, dielectric constant, dissipation factor, power factor, electric resistance, Surface resistivity, volume resistivity, swelling, ageing resistance, environmental stress, Cracking resistance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to:
CO1: acquire knowledge of plastics and their applications are well known to the students.
CO2: acquire knowledge of polymers and their applications are well known to the students.
CO3: acquire knowledge of uses and techniques of plastics and polymer processing are well known to the students.
CO4: expose about various polymer mixing and blending techniques is well known to the students.
CO5: collect Information of various properties of polymers and its testing methods are well known to the students.

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GE5076  PROFESSIONAL ETHICS IN ENGINEERING  L T P C
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COURSE OBJECTIVES:
- Identify the core values that shape the ethical behavior of an engineer.
- Utilize opportunities to explore one’s own values in ethical issues.
- Become aware of ethical concerns and conflicts.
- Enhance familiarity with codes of conduct.
- Increase the ability to recognize and resolve ethical dilemmas.

UNIT I  ENGINEERING ETHICS
UNIT II  ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics - Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III  ENGINEER’S RESPONSIBILITY FOR SAFETY

UNIT IV  RESPONSIBILITIES AND RIGHTS

UNIT V  GLOBAL ISSUES

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students should be able to:
CO1: Use ethical theories in the professional life
CO2: Do social experimentation with engineering approaches
CO3: Follow safety norms in the engineering practices
CO4: Confidence in their approaches and claim their rights
CO5: Take moral leadership with the knowledge in global practices

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COURSE OBJECTIVES:
- To acquaint the students with the overview of NDT
- To elaborate the concept and procedure for liquid and magnetic penetrant testing and evaluate through practical study
- To introduce the concept and procedure for radiograph testing methods and evaluate through practical study
- To brief the concepts and procedures for Ultrasonic testing methods and their applications
- To impart knowledge in other methods of NDT and electrical method with case study

UNIT I  OVERVIEW OF NDT
NDT Vs Mechanical testing: Need for NDT - Factors influencing the reliability of NDE – Materials and characterization – Discontinuities in manufacturing processes - visual inspection: Basics, Optical aids - Direct and Indirect VT – Inspection objectives, inspection checkpoints, sampling plan, inspection pattern – classification of indications for acceptance criteria - Codes, Standards and Specifications (ASME,ASTM,AWS etc.)-case study.

UNIT II  LIQUID PENETRANT & MAGNETIC INSPECTION

UNIT III  RADIOGRAPHIC METHODS

UNIT IV  ULTRASONIC TESTING
Ultrasonic testing: principle – Advantages – disadvantages – Applications - Generation of Ultrasonic waves - general characteristics of ultrasonic waves: methods and instruments for ultrasonic materials testing- Time of Flight Diffraction-case study

UNIT V  ELECTRICAL AND OTHER METHODS
Electrical methods: Eddy current methods: potential - drop methods, applications- Advanced Methods: Acoustic emission inspection -Leak detection-Thermal inspection- Strain measurement and analysis-case study.

COURSE OUTCOMES:
At the end of this course, the students should be able to:
- CO1: Discuss the basics of NDT and its industrial standards
- CO2: Acquire knowledge on the concept and procedure for liquid and magnetic penetrant testing.
- CO3: Interpret the given mechanical components to inspect using radiograph testing methods techniques
- CO4: Apply ultrasonic techniques based on materials and its application.
- CO5: Describe the applications of electrical and other NDT methods.
TEXT BOOKS:

REFERENCES:
UNIT IV ROBOT KINEMATICS AND DYNAMICS
9
Forward Kinematics and Inverse Kinematics, Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 & 3 Dimension) - D-H Parameters Coordinate reference frame, Velocity and Forces - Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design - Derivations and problems.

UNIT V ROBOT INTELLIGENCE & ECONOMIC ANALYSIS
9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students should be able to:
• CO1: Describe the basic concepts in a robotic system
• CO2: Design an end effector considering the selection and design criteria
• CO3: Recognize the use of sensors and machine vision for robots
• CO4: Acquire knowledge on robot kinematic and dynamic system
• CO5: Discuss the applications of robot intelligence

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TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
- Developing the basic concepts of quality control procedures.
- Impart knowledge to design and implement Statistical Process control in any industry.
- Design and implement acceptance sampling inspection methods in industry.
- Study the process and machine capability.
- Develop the applications of various charts.

UNIT I QUALITY FUNDAMENTALS
Importance of quality- evolution of quality- definitions of quality- dimensions of quality- quality control- quality assurance- areas of quality- quality planning- quality objectives and policies- quality costs- economics of quality- Quality loss function- quality Vs productivity- Quality Vs reliability.

UNIT II CONTROL CHARTS FOR VARIABLES
Process variation- preliminary decisions- control limits and their computation- construction and application of X bar, R and S charts - warning and modified control limits- process adjustment for trend- Comparison of process variation with specification limits- O.C. curve for X bar chart.

UNIT III STATISTICAL PROCESS CONTROL
Process stability- process capability study using control charts- capability indices- Cp, Cpk and Cpm – capability analysis using histogram and normal probability plot- machine capability study- gauge capability study- setting statistical tolerances for components and assemblies- individual measurement charts- X-chart, moving average and moving range chart, multi-vari chart.

UNIT IV CONTROL CHARTS FOR ATTRIBUTES
Limitations of variable control charts- Control charts for fraction non-conforming- p and np charts, variable sample size, operating characteristic function, run length- Control chart for nonconformities (defects)- c, u, ku charts, demerits control chart- applications.

UNIT V ACCEPTANCE SAMPLING
Need- economics of sampling- sampling procedure- single and double sampling- O.C. curves- Average outgoing quality- Average sample number- Average total inspection- Multiple and sequential sampling- Standard sampling plans- MIL Standards, Dodge-Roming, IS 2500.

COURSE OUTCOMES:
CO1: Students will become familiar with details of quality costs, economies and planning.
CO2: Control the quality of processes using control charts for variables in manufacturing/service industries.
CO3: Good understanding and in depth knowledge has been imparted in the process capability study.
CO4: Control the occurrence of defects in product or services industries.
CO5: Determination of acceptance sampling procedures are practiced.

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TEXT BOOKS:
REFERENCES:

IE5653 RELIABILITY ENGINEERING

COURSE OBJECTIVES:
- Describe reliability concepts.
- Teach the students in filling the life data into theoretical distribution.
- Teach the students in reliability evaluation of various configuration.
- Describe knowledge in reliability monitoring methods.
- Appraise effectively various techniques to improve reliability of the system.

UNIT I RELIABILITY CONCEPT
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

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

UNIT V RELIABILITY IMPROVEMENT

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Students will be able to conduct failure data analysis.
CO2: Students will be able to estimate reliability of standard systems as well as complex systems.
CO3: Students will be able to explore reliability management tools and techniques.
CO4: Students will be able to contribute in maintainability and availability demonstration programs.
CO5: Students will be able to take decisions on inspection and replacement.

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TOTAL: 45 PERIODS
TEXT BOOK:

REFERENCE:

ME5081 PROCESS PLANNING AND COST ESTIMATION L T P C 3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Creating a process plan for a given Product.
2. Preparing cost elements for a given product.
3. Allocating overhead to different departments.
5. Analyzing the costs for machining a product.

UNIT I PROCESS PLANNING

UNIT II FUNDAMENTAL OF ESTIMATING AND ELEMENTS OF COST

UNIT III OVERHEADS AND DEPRECIATION
Overheads, Allocation or Distribution of Overhead Cost, Depreciation and Methods to Calculate it, Interest on Capital, Idleness Costs, Repair and Maintenance Cost

UNIT IV ESTIMATION OF CASTING, FORGING & WELDING COSTS
Estimation of cost for Casting processes, Welding processes and Forging processes.

UNIT V ESTIMATION OF MACHINING TIME AND COST
Estimation of Machining Time and Cost – Lathe operations, Drilling, Milling, Shaping, Planing, and Grinding operations.

TOTAL = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Create a Process Plan for a given Product.
2. Prepare Cost elements for a given Product.
3. Allocate Overhead to different departments.
5. Analyze the costs for machining a product.

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GE5552 ENGINEERING MANAGEMENT

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Explaining basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. Applying various functions of management in professional organization.
3. Applying organizational theory in professional organization.
4. Applying the principles of productivity and operations management in professional organization.
5. Applying modern concepts and marketing in management in professional organization.

UNIT I INTRODUCTION TO MANAGEMENT
Definition and functions of Management - Approaches to the study of Management – Mintzberg’s Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Corporate Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Pros and cons.

UNIT II FUNCTIONS OF MANAGEMENT
Planning: Characteristics; Nature; Importance; Steps; Limitation – Organizing: Features; Process; Principles; Types – Departmentalization: Functional – Divisional (Product; Customer; Geographic) – Staffing: Systems Approach; Recruiting and Selection Process – Directing (Leading): Traits; Style; Managerial Grid (Blake-Mounton, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Types; Audit (External, Internal, Merits) – Decision Making: Elements; Characteristics; Process; Classification – Controlling techniques.

UNIT III ORGANIZATION THEORY
Human Resource Development (HRD): Goals – Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Need and Motivation Theories: Maslow’s Hierarchy of Needs Theory; Herzberg’s Motivation-Hygiene Theory; McClelland’s Needs Theory of Motivation – Change Management: Concept of Change; Lewin’s Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.
UNIT IV  PRODUCTIVITY AND OPERATIONS MANAGEMENT  9
Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Operations Management Tools: (Simple problems in) Transportation Model (Balanced); Assignment Model (Hungarian); Network Model (Shortest path); Critical Path Method; Decision Trees.

UNIT V  MODERN CONCEPTS AND MARKETING MANAGEMENT  9
Concept, features, merits and demerits of: SWOT Analysis; Business Process Re-engineering (BPR); Supply Chain Management (SCM) – Marketing: Concept; Functions; Importance; Segmentation; Mix; Problems of Marketing in Small Enterprise; Competitive Analysis and Advantage – E-marketing.

TOTAL = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. Apply various functions of management in professional organization.
3. Apply organizational theory in professional organization.
4. Apply the principles of productivity and operations management in professional organization.
5. Apply modern concepts and marketing in management in professional organization.

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MF5003  PRECISION ENGINEERING  L T P C
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COURSE OBJECTIVES:
- To introduce various technologies with respect to its precision and accuracy.
- To operate high precision machineries with ease.
- To explore new areas in error control of cutting tools.
- To elaborate the influence and effects of using precision technologies.
- To outline the applications and exploitation of MEMS in various fields.
UNIT I  ELEMENTS OF PRECISION ENGINEERING

Introduction - Precision, Accuracy & Smoothness - Need - Development of overall machining precision - Classes of achievable machining Accuracy - Precision machining - High precision Machining - Ultra precision Machining - application of precision machining - Materials for tools and machine elements - carbides - ceramic, CBN & diamond - Tool and work material compatibility.

UNIT II  PRECISION MACHINE COMPONENTS


UNIT III  ERROR CONTROL

Error - Sources - Static stiffness - Variation of the cutting force - total compliance - Different machining methods - Thermal effects - heat source - heat dissipation - Stabilization - decreasing thermal effects - forced vibration on accuracy - clamping & setting errors - Control - errors due to locations - principle of constant location surfaces.

UNIT IV  PRECISION MANUFACTURING


UNIT V  MEMS

Introduction - MEMS - characteristics - principle - Design - Application: automobile, defence, health care, Industrial, aerospace etc.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
At the end of this course the student shall be able to:
- CO1: Gain knowledge on elements of precision engineering.
- CO2: Be familiarized with precision machine components.
- CO3: Describe the concept of error control.
- CO4: Apply the concepts of precision manufacturing.
- CO5: Be acquainted with MEMS and its applications.

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TEXT BOOKS:

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MF5004 SYSTEM SIMULATION

COURSE OBJECTIVES:
- To familiarize the importance of applying simulation techniques for solving various problems on discrete event systems.
- To teach various random number generation techniques, its use in simulation, tests and validity of random numbers etc.
- To introduce various simulation languages and comparisons.
- To impart knowledge on the fundamentals of evolutionary algorithms and acquire skills to develop new powerful algorithms.
- To introduce the principles and operations of various systems and how to analyze them.

UNIT I INTRODUCTION

UNIT II RANDOM NUMBERS/VARIATES
Generation of Random numbers - Applications - Pseudo random numbers - methods of generating random variates - random variates for uniform, normal, binominal, Poisson, exponential distributions. Test for random numbers such as Kolmogorov smirnov, chi square, Autocorrelation - Poker's test.

UNIT III DESIGN OF SIMULATION EXPERIMENTS
Problem formulation – data collection and reduction – logic developments – initial conditions – run length, tabular method of simulation –Introduction to simulation model building for queuing, production, inventory and maintenance using higher level languages.

UNIT IV DISCRETE SYSTEM SIMULATION LANGUAGES
Need for simulation language - Comparison of various simulation languages and simulation packages.

UNIT V QUEUING POLICIES, ALGORITHMS AND CASE STUDIES

TOTAL : 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students should be able to:
- CO1: Identify the problem and build an appropriate simulation model.
- CO2: Recognize the type of model to be built suiting to the industrial situation and choose right measures of performances for evaluation and analysis.

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Centre for Academic Courses
Anna University, Chennai-600 025
• CO3: Discuss the findings with statistical analysis and successfully compromise the management in implementing their proposed ideas to produce superior results.
• CO4: Locate the simulation models developed in other simulation software and involve in expert suggestions to improvise the same.
• CO5: Discuss simulation situations through their own models and show the effects of altering them.

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WEB REFERENCE BOOKS: http://www.bcnn.net.
UNIT III MACHINING
Design considerations for: Turned parts – Drilled parts – Milled, planed, shaped and slotted parts– Ground parts.

UNIT IV WELDING

UNIT V ASSEMBLY

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Apply economic process selection principles and general design principles for manufacturability in the development and design of products for various engineering applications. Also, apply design consideration principles of casting in the design of cast products.
2. Apply design consideration principles of forming in the design of extruded, stamped, and forged products.
3. Apply design consideration principles of machining in the design of turned, drilled, milled, planed, shaped, slotted, and ground products.
4. Apply design consideration principles of welding in the design of welded products.
5. Apply design consideration principles of assembly in the design of assembled products.

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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Explaining the history, concepts and terminology of PLM.
2. Applying the functions and features of PLM/PDM.
3. Applying different modules offered in commercial PLM/PDM tools.
4. Implementing PLM/PDM approaches for industrial applications.
5. Integrating PLM/PDM with legacy data bases, CAx & ERP systems.

UNIT I  INTRODUCTION TO PLM  9
Introduction to PLM, Need for PLM, opportunities of PLM, Different views of PLM - Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (CPDM), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM). PLM/PDM Infrastructure – Network and Communications, Data Management, Heterogeneous data sources and applications.

UNIT II  PLM/PDM FUNCTIONS AND FEATURES  9

UNIT III  DETAILS OF MODULES IN A PDM/PLM SOFTWARE  9
Case studies based on top few commercial PLM/PDM tools – Teamcenter, Windchill, ENOVIA, Aras PLM, SAP PLM, Arena, Oracle Agile PLM and Autodesk Vault.

UNIT IV  ROLE OF PLM IN INDUSTRIES  9
Case studies on PLM selection and implementation (like auto, aero, electronic) - other possible sectors, PLM visioning, PLM strategy, PLM feasibility study, change management for PLM, financial justification of PLM, barriers to PLM implementation, ten step approach to PLM, benefits of PLM for–business, organization, users, product or service, process performance

UNIT V  BASICS ON CUSTOMISATION/INTEGRATION OF PDM/PLM SOFTWARE  9
PLM Customization, use of EAI technology (Middleware), Integration with legacy data base, CAD, SLM and ERP

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Explain the history, concepts and terminology of PLM
2. Apply the functions and features of PLM/PDM
3. Apply different modules offered in commercial PLM/PDM tools.
4. Implement PLM/PDM approaches for industrial applications.
5. Integrate PLM/PDM with legacy data bases, CAx & ERP systems

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ME5082  PRODUCT DESIGN AND DEVELOPMENT  L T P C  3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Applying the principles of generic development process; conducting customer need analysis; and setting product specification for new product design and development.
2. Generating, selecting, screening, and testing concepts for new product design and development.
3. Applying the principles of product architecture and industrial design to design and develop new products.
4. Applying the principles of DFMA and Prototyping to design and develop new product.
5. Applying the concepts of economics principles; project management practices in the development of new product.

UNIT I  INTRODUCTION TO PRODUCT DEVELOPMENT, CUSTOMER NEED ANALYSIS, PRODUCT SPECIFICATION  9

UNIT II  CONCEPT GENERATION, SELECTION, AND TESTING  9
Concept Generation: The Activity of Concept Generation - Concept Selection: Concept Screening; Concept Scoring – Concept Testing.

UNIT III  PRODUCT ARCHITECTURE AND INDUSTRIAL DESIGN  9
Product Architecture: Implications of the Architecture; Establishing the Architecture; Delayed Differentiation; Platform Planning; Related System-Level Design Issues – Industrial Design: Assessing the Need for Industrial Design; Impact of Industrial Design; The Industrial Design Process; Management of the Industrial Design Process; Assessing the Quality of Industrial Design.

UNIT IV  DFM AND PROTOTYPING  9
Design for Manufacturing: Estimate the Manufacturing Costs; Reduce the Costs of Components; Reduce the Costs of Assembly; Reduce the Costs of Supporting Production; Consider the Impact of DFMA– Prototyping: Type; Uses; Principles; Technologies; Planning for Prototypes.

UNIT V  PRODUCT DEVELOPMENT ECONOMICS AND MANAGING PROJECTS  9
Product Development Economics: Elements of Economic Analysis; Economic Analysis Process - Managing Projects: Understanding and Representing Tasks; Baseline Project Planning; Accelerating Projects; Project Execution.

TOTAL = 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Apply the principles of generic development process; conduct customer need analysis; and set product specification for new product design and development.
2. Generate, select, screen, and test concepts for new product design and development.
3. Apply the principles of product architecture and industrial design to design and develop new products.
4. Apply the principles of DFMA and Prototyping to design and develop new product.
5. Apply the concepts of economics principles; project management practices in the development of new product.

TEXT BOOKS:

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MF5072 SUSTAINABLE MANUFACTURING  L T P C  3 0 0 3

COURSE OBJECTIVES:
- To impart knowledge on sustainable manufacturing polices
- To introduce the best practices for sustainable manufacturing,
- To introduce lean manufacturing practices
- To be acquainted with selection of sustainable machinery with lower energy consumption.
- To provide knowledge in hazardous management and recyclability.

UNIT I SUSTAINABLE MANUFACTURING AND POLICIES  9

UNIT II SUSTAINABILITY MANUFACTURING BEST PRACTICES  9
Introduction to best practices of sustainability manufacturing – Manufacturability issues in sustainable product design - Environmentally conscious design/manufacturing processes - Societal impact - Product functionality, serviceability, maintainability, upgradability - Innovative product/process designs for sustainability - Preservation of sustainable development.
UNIT III LEAN MANUFACTURING AND GREEN ENERGY

Introduction to lean Manufacturing - Lean manufacturing tools - Comparison of conventional manufacturing and lean Manufacturing - Advantages and Limitations of lean Manufacturing. Introduction to green energy concepts - Green house effect - Global warming - Climate change - Environmental degradation – Environmental pollution – Pollution due to manufacturing industries - Remedies.

UNIT IV SUSTAINABLE MACHINERY AND ENERGY CONSUMPTION

Selection of appropriate machine, materials, energy, resource utilisation for sustainability manufacturing – Performance evaluation of different machinery and its components in terms of energy consumption - Causes for inefficient operations of machinery – Scope for energy conservation - World energy consumption - Determination of power demand and consumption - Comparison of power generation cost using renewable and non-renewable sources.

UNIT V HAZARDOUS MANAGEMENT AND RECYCLABILITY


TOTAL : 45 PERIODS

COURSE OUTCOMES:
At the end of this course the student shall be able to:
- CO1: Identify the best practices for sustainable manufacturing in industries,
- CO2: Describe the various policies for sustainability manufacturing,
- CO3: Implement lean principles to reduce industrial wastes
- CO4: look for selection of sustainable machinery with lower energy consumption.
- CO5: Recognize hazardous management techniques and safe practices.

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TEXT BOOKS:

REFERENCES:
MF5005  ELECTRONICS MANUFACTURING TECHNOLOGY  L T P C
3 0 0 3

COURSE OBJECTIVES:
- To impart knowledge on wafer preparation and PCB fabrication
- To introduce Through Hole Technology (THT) and Surface Mount Technology (SMT) with various types of electronic components
- To elaborate various steps in Surface Mount Technology (SMT)
- To be acquainted with various testing and inspection methods of populated PCBS
- To outline repair, rework and quality aspects of Electronic assemblies.

UNIT I  INTRODUCTION TO ELECTRONICS MANUFACTURING  9
History, definition, wafer preparation by growing, machining, and polishing, diffusion, microlithography, etching and cleaning, Printed circuit board fabrication, types, single sided, double sided, multi-layer and flexible printed circuit board

UNIT II  COMPONENTS AND PACKAGING  9
Introduction to packaging, types - Through hole technology (THT) and Surface mount technology (SMT), Through hole components - axial, radial, multi leaded, odd form Surface-mount components - active, passive. Interconnections - chip to lead interconnection, die bonding, wire bonding, TAB, flip chip, chip on board, multi chip module, direct chip array module, leaded, leadless, area array and embedded packaging, miniaturization and trends.

UNIT III  SURFACE MOUNT TECHNOLOGY  9
SMT Process, SMT equipment and material handling systems, handling of components and assemblies - moisture sensitivity and ESD, safety and precautions needed, IPC and other standards, stencil printing process - solder paste material, storage and handling, stencils and squeegees, process parameters, quality control. Component placement - equipment type, flexibility, accuracy of placement, soldering - wave soldering, reflow process, process parameters, profile generation and control, adhesive, underfill and encapsulation process

UNIT IV  INSPECTION AND TESTING  9
Inspection techniques, equipment and principle - AOI, X-ray. Defects and Corrective action - stencil printing process, component placement process, reflow soldering process, electrical testing of PCB assemblies - In circuit test, functional testing, fixtures and jigs.

UNIT V  REPAIR, REWORK, QUALITY AND RELIABILITY OF ELECTRONICS ASSEMBLIES  9
Repair and rework of PCB - Coating removal, base board repair, conductor repair, thermal, mechanical effects and thermal management, Reliability fundamentals, reliability testing, failure analysis, design for manufacturability, assembly, reworkability, testing, reliability, and environment.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students should be able to:
- CO1: Perceive wafer preparation and PCB fabrication
- CO2: Recognize the importance of Through Hole Technology (THT) and Surface Mount Technology (SMT)
- CO3: Demonstrate various steps in Surface Mount Technology (SMT)
- CO4: Identify various testing and inspection methods of populated PCBS
- CO5: Discuss various techniques in repair, rework, quality and reliability of electronics Assemblies

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TEXT BOOKS:

REFERENCES:

IE5073 LEAN SIX SIGMA

COURSE OBJECTIVES:
- Explain the basics of Lean and Six Sigma.
- Teach the need and the process of integrating Lean and Six sigma.
- Summarize to identify and select the resources required for LSS Projects and selection of projects including Team building.
- Teach the DMAIC process and study the various tools for undertaking LSS projects.
- Illustrate to institutionalize the LSS efforts.

UNIT I INTRODUCTION TO LEAN AND SIX SIGMA
Introduction to Lean- Definition, Purpose, Features of Lean; Top seven wastes, Need for Lean management, The philosophy of lean management, Creating a lean enterprise, Elements of Lean, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six sigma, origin of six sigma, Six sigma concept and Critical success factors for six sigma.

UNIT II INTEGRATION OF LEAN AND SIX SIGMA
Evolution of lean six sigma, the synergy of Lean and six sigma, Definition of lean six sigma, the principles of lean six sigma, Scope for lean six sigma, Features of lean six sigma. The laws of lean six sigma, Key elements of LSS, the LSS model and the benefits of lean six sigma. Initiation - Top management commitment – Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition, Infrastructure tools, structure of transforming event and Launch preparation.

UNIT III PROJECT SELECTION AND TEAM BUILDING
Resource and project selection, Selection of Black belts, Training of Black belts and Champions, Identification of potential projects, top down (Balanced score card) and Bottom up approach – Methods of selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Predicting and improving team performance, Nine team roles and Team leadership.

UNIT IV THE DMAIC PROCESS AND TOOLS
The DMAIC process – Toll gate reviews; The DMAIC tools; Define tools – Project definition form, SIPOC diagram; Measure tools – Process mapping, Lead time/cycle time, Cause and Effect matrix, Idea – generating and organizing tools – Brainstorming, Nominal group technique and Multi-voting; Data collection and accuracy tools- Check sheet, Gauge R&R; Understanding and eliminating variation- run charts; Analyze tools - Scatter plots, ANOVA, Regression analysis, Time trap analysis; Improve tools – Mistake proofing, Set up time reduction (SMED) and the pull system; Control tools – statistical process control.
UNIT V INSTITUTIONALIZING AND DESIGN FOR LSS

Institutionalizing lean six sigma – improving design velocity, creating cycle time base line, valuing projects, gating the projects, reducing product line complexity, Design for lean six sigma, QFD, Theory of Inventive Problem solving (TRIZ), Robust design; Case study presentations.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1: The students will be able to understand what is Lean and Six sigma and their importance in the globalized competitive world.

CO2: The students will be able to understand the importance of integrating Lean and Six sigma and also the process of their integration.

CO3: The students will be able to plan the Resources required to undertake the LSS projects and also acquire how to select the suitable projects and the teams.

CO4: The students will be able apply DMAIC methodology to execute LSS projects and in this regard they will be acquainted with various LSS tools.

CO5: The students will be able to understand the process of institutionalizing the LSS effort and also understand the Design for LSS.

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TEXT BOOK:

REFERENCES:
UNIT III WIND ENERGY
Wind data and energy estimation – Betz limit - Site selection for wind farms – characteristics
Horizontal axis wind turbine – components - Vertical axis wind turbine – Wind turbine generators

UNIT IV BIO-ENERGY
Bio resources – Biomass direct combustion – thermochemical conversion - biochemical
conversion-mechanical conversion - Biomass gasifier - Types of biomass gasifiers - Cogeneration
-- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol
production - Applications.

UNIT V OCEAN AND GEOThERMAL ENERGY
Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations –
Geothermal energy – Geothermal energy sources - Types of geothermal power plants –
Applications - Environmental impact.

TOTAL = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Describe the current energy scenario in terms of conventional renewable energy and future
   plan.
2. Apply the principle of various solar energy generating devices.
3. Apply the principle of various wind energy devices.
4. Apply the principle of various bio energy devices.
5. Apply the principle of various ocean and geothermal energy devices.

TEXT BOOKS:
   Francis, 2006.

REFERENCES:
   Science, 2015.
   Hill, 2009.

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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Selecting suitable material for MEMS and Microsystems, and explain the scaling laws involved in miniaturization.
2. Explaining the various micro-manufacturing processes.
3. Applying the working principle of electrostatic and thermal based MEMS sensors and actuators in the design of MEMS devices.
4. Applying the working principle of piezo-resistive, piezo-electric and magnetic effect in the design of MEMS devices.
5. Designing the elements of Micro-fluidic systems, and select suitable MEMS devices for Industrial applications.

UNIT I BASIC ENGINEERING FOR MEMS
9

UNIT II MICROMANUFACTURING TECHNIQUES
9
Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition, Physical Vapour Deposition-Sputtering, Deposition by Epitaxy, Etching, Bulk Micromanufacturing, Micromachining Processes, LIGA Process, Microsystem Assembly and Testing.

UNIT III ELECTROSTATIC AND THERMAL BASED MEMS
9

UNIT IV PIEZO-RESISTIVE / ELECTRIC AND MAGNETIC BASED MEMS
9

UNIT V MICROFLUIDICS AND APPLICATIONS OF MEMS
9
Microfluidics - Fluid Mechanics Concepts, Design and Fabrication of Channels, Valves, Pumps, Case Studies - Accelerometer, Gyros, RF MEMS and MOEMS.

TOTAL = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Select suitable material for MEMS and Microsystems, and explain the scaling laws involved in miniaturization.
2. Explain the various micro-manufacturing processes.
3. Apply the working principle of electrostatic and thermal based MEMS sensors and actuators in the design of MEMS devices.
4. Apply the working principle of piezo-resistive, piezo-electric and magnetic effect in the design of MEMS devices.
5. Design the elements of Micro-fluidic systems, and select suitable MEMS devices for Industrial applications.

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MF5006 INDUSTRIAL INSPECTION MAINTENANCE AND SAFETY
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3 0 0 3

COURSE OBJECTIVES:
- To detect defects and defectives and to improve the quality of the products.
- To Involve in sampling technique practices to eliminate defects and ensure high quality products
- To introduce new inspection techniques and equipment’s in industry.
- To impart knowledge on safety engineering practices.
- To familiarize various techniques in preventive and predictive maintenance of machines.

UNIT I FUNDAMENTALS OF INSPECTION
Inspection-Introduction, Need for inspection, Inspection types, Types of Defects, Modes of Inspection

UNIT II SAMPLING TECHNIQUES
Probability sampling: Simple Random Sampling (SRS), Stratified Sampling, Cluster Sampling, Systematic Sampling, Multistage Sampling (in which some of the methods above are combined in stages)
Non Probability sampling: volunteer samples, haphazard (convenience) samples
Quality and risk decisions: Single sampling plan, Double sampling plans, Multi sampling plan, OC curves - Problems on sampling

UNIT III STAGES IN INDUSTRIAL INSPECTION
Inspection of raw materials, inline inspection, Off line Inspection, Industrial Inspection System, Industrial Plant Inspection, Inspection and Test Plan, Shop Inspection, Vendor Inspection, Industrial Quality Control, Factory Acceptance Test, Inspection scope, Industrial Test Systems, Industrial Test Calibration

UNIT IV MAINTENANCE TECHNIQUES
UNIT V
INSPECTION OF EQUIPMENTS AND SAFETY PRACTICES

Development of policies, Preparation of Inspection guidelines, Condition monitoring, Maintenance programme, Service and Repair, Safe work practices, Safety and condition assessing check list, Equipment installation and servicing procedures, Accident prevention programs, Risk analysis, Hazard analysis, safety at work place-Indoor and outdoor

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students shall be able to:

- CO1: Recognize the fundamental concepts of inspection, the need, types and importance.
- CO2: Identify various random sampling plans and apply them in industrial cases.
- CO3: Discuss various types of inspections and various ways of using them.
- CO4: Describe various inspection techniques.
- CO5: Recognize various industrial inspection, maintenance and safety policies.

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WEB REFERENCE:
https://www.inspection-for-industry.com/

MF5007
TOTAL PRODUCTIVE MAINTENANCE
L T P C
3 0 0 3

COURSE OBJECTIVES:
- To familiarize students with the major concepts on maintenance
- To introduce the models used in maintenance
- To train students with the concept of total productive maintenance
- To introduce some of the methods used in maintenance management
- To familiarize the students with some of the inspection and monitoring methods used
UNIT I  MAINTENANCE CONCEPTS  9
Introduction - TPM pillars -Objectives and functions -Productivity, Quality, Reliability and Maintainability (PQRM) - Terotechnology - Reliability Centered Maintenance - Predictive Maintenance - Condition Based Maintenance - maintainability prediction - availability and system effectiveness-maintenance costs - maintenance organization.

UNIT II  MAINTENANCE MODELS  9
Minimal repair - As Good As New policy - 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  9
Zero breakdowns - Zero Defects and TPM - maximizing equipment effectiveness – Autonomous maintenance program - five pillars of TPM - TPM small group activities - TPM organization - Management Decision - Educational campaign - Creation of Organizations - Establishment of basic policies and goals - Formation of master plan - TPM implementation.

UNIT IV  MAINTENANCE LOGISTICS  9
Human factors in maintenance - maintenance manuals - maintenance staffing methods - queuing applications - simulation - spare parts management - maintenance planning and scheduling.

UNIT V  ONLINE MONITORING  9

COURSE OUTCOMES:
At the end of this course, the students shall be able to:
• CO1: Classify the major concepts of maintenance
• CO2: Recognize various models used in maintenance
• CO3: Gain knowledge on total productive maintenance
• CO4: Discuss the methods used in maintenance management
• CO5: Gain knowledge on the inspection and monitoring methods used

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REFERENCES:
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Identify measurement parameters and analyze errors of measurements.
2. Select and apply suitable transducer for a particular measurement.
3. Identify measurement parameters and select the appropriate sensor for it.
4. Explain the working of various types of control systems of apply for specific applications.
5. Apply the principle of automatic control systems to control various parameter(s).

UNIT I MEASUREMENTS AND ERROR ANALYSIS

UNIT II INSTRUMENTS
Transducer, Modifying (intermediate) and Terminal stages – Mechanical and electrical transducers, preamplifiers – charge amplifiers – filters – attenuators – D’ Arsonval – CRO – Oscillographs –recorders – microprocessor based data logging, processing and output

UNIT III PARAMETERS FOR MEASUREMENT

UNIT IV CONTROL SYSTEMS

UNIT V APPLICATION OF CONTROL SYSTEMS
Governing of speed, kinetic and process control – pressure, temperature, fluid level, flow-thrust and flight control – photo electric controls – designing of measurement and control systems for different applications

Total (L: 45) = 45 Periods

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Identify measurement parameters and analyze errors of measurements.
2. Select and apply suitable transducer for a particular measurement.
3. Identify measurement parameters and select the appropriate sensor for it.
4. Explain the working of various types of control systems of apply for specific applications.
5. Apply the principle of automatic control systems to control various parameter(s).

TEXT BOOKS:

REFERENCES:
ME5076  MARKETING MANAGEMENT  L T P C  3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Explaining the basic concepts in marketing.
2. Explaining the various buying behaviour methods.
3. Analyzing the various product pricing concepts.
4. Analyzing the various marketing planning principles and its strategies.
5. Describing the trends of advertising, sales promotion methods.

UNIT I  CONCEPTS IN MARKETING  9

UNIT II  BUYING BEHAVIOUR AND MARKET SEGMENTATION  9
Cultural, Demographic factors, Motives, Types, Buying Decisions, Segmentation factors, Demographic, Psychographic and Geographic Segmentation, Process, Patterns. Services marketing and Industrial marketing.

UNIT III  PRODUCT, PRICE AND MARKETING RESEARCH  9

UNIT IV  MARKETING PLANNING AND STRATEGY FORMULATION  9

UNIT V  ADVERTISING, SALES PROMOTION AND DISTRIBUTION  9

TOTAL= 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Explain the basic concepts in marketing.
2. Explain the various buying behaviour methods.
3. Analyze the various product pricing concepts.
4. Analyze the various marketing planning principles and its strategies.
5. Describe the trends of advertising, sales promotion methods.

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Centre for Academic Courses
Anna University, Chennai-600 025
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ME5751  
FINITE ELEMENT ANALYSIS  
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COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:
1. Developing mathematical models for Boundary Value Problems and their numerical solution.
2. Applying concepts of Finite Element Analysis to solve one dimensional problem.
3. Determining field variables for two dimensional scalar variable problems.
4. Determining field variables for two dimensional vector variable problems.
5. Applying the need for Isoparametric transformation and the use of numerical integration.

UNIT I  
INTRODUCTION

UNIT II  
ONE-DIMENSIONAL PROBLEMS

UNIT III  
TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

UNIT IV  
TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS
UNIT V ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS


TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Develop mathematical models for Boundary Value Problems and their numerical solution
2. Apply concepts of Finite Element Analysis to solve one dimensional problems
3. Determine field variables for two dimensional scalar variable problems
4. Determine field variables for two dimensional vector variable problems
5. Apply the need for Isoparametric transformation and the use of numerical integration

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MF5008 FLEXIBLE MANUFACTURING SYSTEMS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To introduce the concepts of Flexible Manufacturing Systems
- To gain knowledge on computer control and software for Flexible Manufacturing Systems
- To outline flexible manufacturing system simulation and database
- To familiarize the principles of group technology and justify flexible manufacturing systems
- To implement flexible manufacturing systems in various applications and to impart knowledge on factories of the future.

UNIT I PLANNING AND SCHEDULING OF FLEXIBLE MANUFACTURING SYSTEMS

UNIT II  COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING SYSTEMS  9

UNIT III  FLEXIBLE MANUFACTURING SYSTEM SIMULATION AND DATA BASE  9

UNIT IV  GROUP TECHNOLOGY AND JUSTIFICATION OF FLEXIBLE MANUFACTURING SYSTEMS  9
Introduction - Matrix Formulation - Mathematical Programming Formulation - Graph Formulation - Knowledge Based System for Group Technology - Economic Justification of FMS - Application of Possibility Distributions in FMS Systems - Justification.

UNIT V  IMPLEMENTATION OF FMS AND FACTORIES OF THE FUTURE  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students shall be able to:
- CO1: Be familiarized with concepts of Flexible Manufacturing Systems
- CO2: Perceive Computer Control and Software for Flexible Manufacturing Systems
- CO3: Be acquainted with Flexible Manufacturing System Simulation and Database
- CO4: Evaluate principles of Group Technology and justify Flexible Manufacturing Systems
- CO5: Describe various flexible manufacturing systems and their applications.

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TEXT BOOK

REFERENCES
COURSE OBJECTIVES:

- Provide knowledge of optimization techniques and approaches.
- Formulate a real-world problem as a mathematical programming model.
- Enable the students apply mathematical, computational and communication skills needed for the practical utility of Operations Research.
- Knowledge to solve networking problems.
- Knowledge to solve various inventory problems.
- Gain knowledge on solving different waiting line models.

UNIT I  LINEAR PROGRAMMING

UNIT II  ADVANCES IN LINEAR PROGRAMMING

UNIT III  NETWORK ANALYSIS

UNIT IV  INVENTORY MODELS
Purchase model with no shortages – Manufacturing model with no shortages - Model with price breaks - Reorder point model - Probabilistic inventory model

UNIT V  QUEUING THEORY
Queueing theory terminology – Single server, multi server- limited and unlimited queue capacity-limited and unlimited population –limited and infinite queue length.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Learned to translate a real-world problem, given in words, into a mathematical Formulation.

CO2: An understanding of the role of algorithmic thinking in the solution of operations research problems.

CO3: Be able to build and solve Transportation Models and Assignment Models, maximal flow problem, minimum spanning tree and shortest path problem.

CO4: Able to handle issues in various Inventory models.

CO5: The students acquire capability in applying and using of queuing models for day today problem.

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IE5651 MANUFACTURING AUTOMATION

COURSE OBJECTIVES:
- Define automation and justification in manufacturing.
- Explain the control technologies in automation.
- Explain the concept of fixed automation using transfer lines.
- Describe the programmable automation such as CNC and industrial robotics.
- Use of automated material handling, storage and data capture.

UNIT I MANUFACTURING OPERATIONS
Automation in production systems, principles and strategies, Product/production relationships, Production concepts and mathematical models, manufacturing economics.

UNIT II CONTROL TECHNOLOGIES
Automated systems – elements, functions, levels, Continuous Vs discrete control, Computer process control, Sensors, Actuators, ADC, DAC, Programmable logic controllers – ladder logic diagrams.

UNIT III TRANSFER LINES
Automated production lines – applications, Analysis – with and without buffers, automated assembly systems, line unbalancing concept.

UNIT IV NUMERICAL CONTROL AND ROBOTICS

UNIT V AUTOMATED HANDLING AND STORAGE
Automated guided vehicle systems, AS/RS, Carousel storage, Automatic data capture - Bar code technology.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Selection of automated equipment with cost justification.
CO2: Ability to understand control technologies.
CO3: Selection of buffer size and location in transfer lines.
CO4: Ability to prepare a simple CNC program, select a robot configuration for given application.
CO5: Recommend an appropriate automated material handling, storage and data capture method.

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REFERENCES:
COURSE OBJECTIVES:
- To introduce the various aspects of Purchasing.
- To introduce concepts of stores management.
- To familiarize the students about basic inventory management
- To introduce MRP, aggregate planning, JIT concepts.
- To illustrate the usefulness of quantitative techniques in materials management.

UNIT I  PURCHASING MANAGEMENT
Introduction to materials management – objectives – organization — value analysis – make or buy decisions-Purchasing and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Vendor rating methods- Imports – Buyer and Seller relationship.

UNIT II  STORES MANAGEMENT

UNIT III  BASIC INVENTORY MANAGEMENT
Basic EOQ Models- Assumptions- Quantity discount model- Q system- P system- Reorder level-ABC analysis- Deterministic and Probabilistic models- Finite Production

UNIT IV  ADVANCED INVENTORY MANAGEMENT

UNIT V  O.R TECHNIQUES IN MATERIAL MANAGEMENT

COURSE OUTCOMES:
At the end of the course, students will be able to:
- CO1: Identify a suitable vendor for a given requirement.
- CO2: Design stores layout, select materials handling equipment.
- CO3: Select a suitable inventory system for a given requirement.
- CO4: Develop suitable aggregate planning strategies.
- CO5: Identify suitable quantitative technique for a given situation.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
- Describe an idea about ERP.
- Grasp the activities of ERP project management cycle.
- Understanding the emerging trends in ERP developments.
- Creating awareness of core and extended modules of ERP.
- Understand the ERP trending concepts.

UNIT I INTRODUCTION
Overview of enterprise systems – Evolution - Risks and benefits - Fundamental technology - Issues to be consider in planning design and implementation of cross functional integrated ERP systems.

UNIT II ERP SOLUTIONS AND FUNCTIONAL MODULES
Overview of ERP software solutions- Small, medium and large enterprise vendor solutions, BPR, and best business practices - Business process Management, Functional modules.

UNIT III ERP IMPLEMENTATION

UNIT IV POST IMPLEMENTATION
Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation.

UNIT V EMERGING TRENDS ON ERP

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Knowledge of ERP implementation cycle.
CO2: Awareness of core and extended modules of ERP.
CO3: Able to understand ERP implementation steps.
CO4: Able to understand post implementation procedure.
CO5: Able to understand ERP trending concepts.

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COURSE OBJECTIVES:
- To introduce digital twin concepts and their applications in industry.
- To familiarize with trends in discrete Industry
- To be acquainted with digital twin in process industry.
- To impart knowledge in Industry 4.0
- To elaborate the advantages of digital twin.

UNIT I  INTRODUCTION  9
Digital twin - Definition, types of Industry & its key requirements, Importance, Application of Digital Twin in process, product, service industries, History of Digital Twin, DTT role in industry innovation, Technologies/tools enabling Digital Twin

UNIT II  DIGITAL TWIN IN A DISCRETE INDUSTRY  9

UNIT III  DIGITAL TWIN IN A PROCESS INDUSTRY  9

UNIT V  INDUSTRY 4.0  9
Industrial Revolutions, Industry 4.0 – Definition, principles, Application of Industry 4.0 in process & discrete industries, Benefits of Industry 4.0, challenges in Industry 4.0, Smart manufacturing, Internet of Things, Industrial Gateways, Basics of Communication requirements.

UNIT V  ADVANTAGES OF DIGITAL TWIN  9
Improvement in product quality, production process, process Safety, identify bottlenecks and improve efficiency, achieve flexibility in production, continuous prediction and tuning of production process through Simulation, reducing the time to market.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students shall be able to:
- CO1: Acquire knowledge on digital twin and its importance.
- CO3: Value digital twin in process industry.
- CO4: Operate Industry 4.0 and Smart Manufacturing in Industry.
- CO5: Discover the advantages of digital twin.

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REFERENCES:

ME5075 ENTREPRENEURSHIP DEVELOPMENT

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Explaining the types, characteristics of entrepreneurship and its role in economic development.
2. Applying the theories of achievement motivation and the principles of entrepreneurship development program to enterprise.
3. Selecting the appropriate form of business ownership in setting up an enterprise.
4. Applying the fundamental concepts of finance and accounting to enterprise.
5. Identifying sickness in industry, selecting the appropriate corrective measures, and identifying the growth strategies in enterprise.

UNIT I ENTREPRENEURSHIP

UNIT II MOTIVATION

UNIT III BUSINESS

UNIT IV FINANCING AND ACCOUNTING

UNIT V SUPPORT TO ENTREPRENEURS

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Explain the types, characteristics of entrepreneurship and its role in economic development.
2. Apply the theories of achievement motivation and the principles of entrepreneurship development program.
3. Select the appropriate form of business ownership in setting up an enterprise.
4. Apply the fundamental concepts of finance and accounting to enterprise.
5. Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise.
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IE5074 MACHINE LEARNING ALGORITHMS

COURSE OBJECTIVES:
- To understand basic concepts of learning.
- To understand decision tree learning.
- To evaluate hypotheses.
- To understand Bayesian learning.
- To understand computational learning theory.

UNIT I CONCEPT LEARNING
A Concept Learning Task: Notation, The Inductive Learning Hypothesis, Concept Learning as Search, FIND-S: Algorithm for finding a Maximally Specific Hypothesis: Version Spaces and the CANDIDATE-ELIMINATION Algorithm; Convergence of CANDIDATE-ELIMINATION Algorithm to the correct Hypothesis; Appropriate Training Examples for learning; Applying Partially Learned Concept, Inductive Bias: A Biased Hypothesis Space; An Unbiased Learner; The Futility of Bias-Free Learning.

UNIT II DECISION TREE LEARNING
Decision Tree Representation, Appropriate problems for decision tree learning, The basic decision tree Learning Algorithm, Hypothesis Space Search in decision tree learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning: Over fitting the Data; Incorporating Continuous-Valued Attributes; Alternative Measures for Selecting Attributes; Handling Training Examples with Missing Attribute Values; Handling Attributes with differing Costs.

UNIT III EVALUATING HYPOTHESES
UNIT IV  BAYESIAN LEARNING
Bayes Theorem, Bayes Theorem and Concept Learning, Maximum Likelihood and Least-Squared Error Hypotheses, Maximum Likelihood Hypotheses for predicting probabilities: Gradient search to maximize likelihood in a neural net. Minimum description length principle, Bayes Optimal Classifier, Gibbs Algorithm, Naive Bayes Classifier, Bayesian Belief Networks: Conditional Independence; Representation; Inference; Learning Bayesian Belief Networks; Gradient Ascent Training of Bayesian Networks; Learning the structure of Bayesian Networks; The EM Algorithm: Estimating Means of \( k \) Gaussians; General Statement of EM Algorithm; Derivation of the \( k \) Means Algorithm.

UNIT V  COMPUTATIONAL LEARNING THEORY
Introduction, probably learning an approximately correct hypothesis: The Problem Setting; Error of a Hypothesis; Learnability. Sample Complexity for Finite Hypothesis Spaces: Agnostic Learning and Inconsistent Hypotheses; Conjunctions of Boolean learnability of Other Concept Classes. Sample Complexity for infinite hypothesis spaces: Shattering a set of Instances; The Vapnik-Chervonenkis Dimension; Sample Complexity and the VC Dimension. The mistake bound model of learning: Mistake bound for the FIND-S Algorithm; Mistake bound for the HALVING Algorithm; Optimal Mistake Bounds; WEIGHTED-MAJORITY Algorithm.

COURSE OUTCOMES:
CO1: Ability to understand basic concepts of learning.
CO2: Ability to understand decision tree learning.
CO3: Ability to evaluate hypotheses.
CO4: Ability to understand Bayesian learning.
CO5: Ability to understand computational learning theory.

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TEXT BOOK:

IE5075  PRINCIPLES OF COMPUTER INTEGRATED MANUFACTURING SYSTEMS

COURSE OBJECTIVES:
- Define flexible automation and describe its components.
- Explain the process of computer aided design.
- Relate the enablers of CAD and CAM integration and business function.
- Tell the fundamentals of integrated management systems.
- Correlate CIM with DBMS.

UNIT I  GT AND FMS
Part families, production flow analysis, cellular manufacturing, ROC, Flexible manufacturing systems- components, FMS applications, FMS analysis – Bottleneck model.

UNIT II  COMPUTER-AIDED DESIGN
Fundamentals of CAD – design process, manufacturing database – Computer graphics –functions, constructing the geometry, transformation, wire frame Vs solid modelling.
UNIT III MANUFACTURING SUPPORT SYSTEMS
Product design and CAD, CAD/CAM and CIM, Computer aided process planning- Variant and
generative approaches, Concurrent engineering and design for manufacture, Lean production,
Agile manufacturing.

UNIT IV FUNDAMENTALS OF COMMUNICATIONS
Information, Communications matrix, Computer communications, Network architecture, Tools and
techniques.

UNIT V DATABASE AND CIM MANAGEMENT
Manufacturing data, database technology, Database management, Management of CIM – role,
cost justification, expert systems

COURSE OUTCOMES:
CO1: Analyze a cellular and flexible manufacturing system for its performance measures.
CO2: Gain knowledge in the basics of computer aided design.
CO3: Make competitive manufacturing systems with the use of appropriate tools and techniques.
CO4: Develop integrated manufacturing system with the required network structure and
manufacturing database.
CO5: Able to understand DBMS concepts.

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TEXT BOOK:
1. Mickel P Groover, “Automation production systems and computer integrated manufacturing”,

REFERENCE:

IE5071 DECISION SUPPORT AND INTELLIGENT SYSTEMS

COURSE OBJECTIVES:
• Explain the fundamental terms, concepts and theories associated with the phases of
Decision Support Systems.
• Describe the uses of various mathematical models, data warehousing and mining.
• Discuss and develop skills in the analysis, design and implementation of group support
systems and knowledge management systems.
• Illustrate expert system as a subsystem of DSS.
• Track the knowledge representation methods.

UNIT I INTRODUCTION
Managerial decision making, system modeling and support - preview of the modeling process-
phases of decision making process.

UNIT II ANALYSIS
DSS components- Data warehousing, access, analysis, mining and visualization-modeling and
analysis-DSS development.
UNIT III TECHNOLOGIES
Group support systems- Enterprise DSS- supply chain and DSS - Knowledge management methods, technologies and tools.

UNIT IV EXPERT SYSTEMS
Artificial intelligence and expert systems - Concepts, structure, types - Knowledge acquisition and validation - Difficulties, methods, selection.

UNIT V SEMANTIC NETWORKS
Representation in logic and schemas, semantic networks, production rules and frames, inference techniques, intelligent system development, implementation and integration of management support systems.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1: Make decisions in the semi structured and unstructured problem situations.
CO2: Able to apply data warehousing and data mining principles in basic applications.
CO3: Develop knowledge management system with simple tools and techniques.
CO4: Develop intelligent based DSS.
CO5: Able to use logical and analytical thinking

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TEXT BOOK:

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AD5091 CONSTITUTION OF INDIA

COURSE OBJECTIVES:
- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I INTRODUCTION
History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES
UNIT III  ORGANS OF GOVERNANCE
Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive
President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges,
Qualifications Powers and Functions

UNIT IV  EMERGENCY PROVISIONS

UNIT V  LOCAL ADMINISTRATION
District’s Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of
Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila
Pachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level-
Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed
officials-Importance of grass root democracy

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedom from
civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to understand structure and functions of local administration.

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TEXT BOOKS:
4. The Constitution of India (Bare Act), Government Publication, 1950

AD5092  VALUE EDUCATION

COURSE OBJECTIVES:
- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self destructive habits with value education
- Interpret social empowerment with value education

UNIT I  INTRODUCTION TO VALUE EDUCATION
Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of
humanism, Moral and non-moral valuation, Standards and principles, Value judgements

UNIT II  IMPORTANCE OF VALUES
Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence,
Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity,
Patriotism, Love for nature, Discipline
UNIT III  INFLUENCE OF VALUE EDUCATION
Personality and Behaviour development - Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth.

UNIT IV  REINCARNATION THROUGH VALUE EDUCATION

UNIT V  VALUE EDUCATION IN SOCIAL EMPOWERMENT
Equality, Non violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

TOTAL: 45PERIODS

COURSE OUTCOMES:
CO1 – Gain knowledge of self-development
CO2 – Learn the importance of Human values
CO3 – Develop the overall personality through value education
CO4 – Overcome the self destructive habits with value education
CO5 – Interpret social empowerment with value education

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AD5093  PEDAGOGY STUDIES  L T P C
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COURSE OBJECTIVES:
• Understand the methodology of pedagogy.
• Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
• Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
• Illustrate the factors necessary for professional development.
• Identify the Research gaps in pedagogy.

UNIT I  INTRODUCTION AND METHODOLOGY:
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II  THEMATIC OVERVIEW
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.
UNIT III  EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES  
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers’ attitudes and beliefs and Pedagogic strategies.

UNIT IV  PROFESSIONAL DEVELOPMENT  
Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V  RESEARCH GAPS AND FUTURE DIRECTIONS  
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact. 

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- Understand the methodology of pedagogy.
- Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Know the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

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REFERENCES:

AD5094  STRESS MANAGEMENT BY YOGA

COURSE OBJECTIVES:
- Develop healthy mind in a healthy body thus improving social health also improve efficiency.
- Invent Do’s and Don’t’s in life through Yam.
- Categorize Do’s and Don’t’s in life through Niyam.
- Develop a healthy mind and body through Yog Asans.
- Invent breathing techniques through Pranayam.
UNIT I  INTRODUCTION TO YOGA  9
Definitions of Eight parts of yog. (Ashtanga)
UNIT II  YAM  9
Do’s and Don’t’s in life.
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan
UNIT III  NIYAM  9
Do’s and Don’t’s in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha
UNIT IV  ASAN  9
Various yog poses and their benefits for mind & body
UNIT V  PRANAYAM  9
Regularization of breathing techniques and its effects - Types of pranayam

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency
CO2 – Learn Do’s and Don’t’s in life through Yam
CO3 – Learn Do’s and Don’t’s in life through Niyam
CO4 – Develop a healthy mind and body through Yog Asans
CO5 – Learn breathing techniques through Pranayam

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REFERENCES:
1. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
2. “Yogic Asanas for Group Training-Part-I” : Janardan Swami Yogabhyasi Mandal, Nagpur

AD5095  PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS  L T P C
3 0 0 0

COURSE OBJECTIVES:
- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- Discover wisdom in students

UNIT I  NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I  9
Verses- 19, 20, 21, 22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

UNIT II  NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II  9
Verses- 52, 53, 59 (don't's) - Verses- 71,73,75,78 (do's)
UNIT III  APPROACH TO DAY TO DAY WORK AND DUTIES  9
Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV  STATEMENTS OF BASIC KNOWLEDGE – I  9
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V  PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA  9
Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

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1. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari’s ThreeSatakam , Niti-sringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram,Publication Department, Kolkata,2016

AD5097  ESSENCE OF INDIAN KNOWLEDGE TRADITION  L T P C
3 0 0 0

COURSE OBJECTIVES
The course will introduce the students to
- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I  INTRODUCTION TO CULTURE  9
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II  INDIAN LANGUAGES AND LITERATURE  9
Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III  RELIGION AND PHILOSOPHY  9
Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)
UNIT IV  FINE ARTS IN INDIA (ART, TECHNOLOGY & ENGINEERING)  9
Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India.

UNIT V  EDUCATION SYSTEM IN INDIA  9
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45 PERIODS

COURSE OUTCOMES
After successful completion of the course the students will be able to
- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
- Acquire the information about the fine arts in India.
- Know the contribution of scientists of different eras.
- Understand education systems in India

REFERENCES:
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989

AD5098 SANGA TAMIL LITERATURE APPRECIATION L T P C 3 0 0 0

COURSE OBJECTIVES:
The main learning objective of this course is to make the students an appreciation for:
1. Introduction to Sanga Tamil Literature.
2. ‘Agathinai’ and ‘Purathinai’ in Sanga Tamil Literature.
3. ‘Attruppadai’ in Sanga Tamil Literature.
4. ‘Puranaanuru’ in Sanga Tamil Literature.
5. ‘Pathitrupaththu’ in Sanga Tamil Literature.

UNIT I  SANGA TAMIL LITERATURE AN INTRODUCTION  9
Introduction to Tamil Sangam – History of Tamil Three Sangams – Introduction to Tamil Sangam Literature – Special Branches in Tamil Sangam Literature - Tamil Sangam Literature’s Grammar - Tamil Sangam Literature’s parables.

UNIT II  ‘AGATHINAI’ AND ‘PURATHINAI’  9

UNIT III  ‘ATTRUPPADAI’.  9
COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate ‘Agathinai’ and ‘Purathinai’ in their personal and societal life.
3. Appreciate and apply the messages in ‘Attruppadai’ in their personal and societal life.
4. Appreciate and apply the messages in ‘Purananuru’ in their personal and societal life.
5. Appreciate and apply the messages in ‘Pathitrupaththu’ in their personal and societal life.

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HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 LANGUAGE AND COMMUNICATION LT P C 3 0 0 3

COURSE DESCRIPTION
This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non-verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

OBJECTIVES
✓ To familiarize students with the concept of communication using linguistic and non-linguistic resources.
✓ To help students ask critical questions regarding facts and opinions.
✓ To provide students with the material to discuss issues such as language and power structures.
✓ To help students think critically about false propaganda and fake news.

LEARNING OUTCOMES

- Students will be able to use linguistic and non-linguistic resources of language in an integrated manner for communication.
- Students will be able to analyse communication in terms of facts and opinions.
- Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I  LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION: 9

a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality

c) Gestures and Body language, pictures and symbols, cultural appropriacy
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II  STRUCTURE OF WRITING/CONVERSATION: 9

a) Language skills and the communication cycle: speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing

UNIT III  POWER STRUCTURE AND LANGUAGE USE: 9

a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV  MEDIA COMMUNICATION: 9

a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas

UNIT V  PERSUASIVE COMMUNICATION AND MISCOMMUNICATION: 9

a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

TOTAL: 45 PERIODS

TEXT BOOKS:

OBJECTIVES:
- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.

UNIT I
DEFINITION AND CLASSIFICATION OF VALUES
Extrinsic values - Universal and Situational values - Physical - Environmental - Sensuous - Economic - Social - Aesthetic - Moral and Religious values

UNIT II
CONCEPTS RELATED TO VALUES
Purusartha - Virtue - Right - duty - justice - Equality - Love and Good

UNIT III
IDEOLOGY OF SARVODAYA
Egoism - Altruism and universalism - The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

UNIT IV
SUSTENANCE OF LIFE
The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V
VIEWS ON HIERARCHY OF VALUES
The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

TOTAL: 45 PERIODS

OUTCOMES:
CO1: Able to understand definition and classification of values.
CO2: Able to understand purusartha.
CO3: Able to understand sarvodaya idea.
CO4: Able to understand sustenance of life.
CO5: Able to understand views of hierarchy of values.

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TEXTBOOKS:
2. Little, William: An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)
OBJECTIVES:
- Illustrate human relations at work its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
- Identify the essential qualities for progressing in career.

UNIT I UNDERSTANDING AND MANAGING YOURSELF
Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE
Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

UNIT III STAYING PHYSICALLY HEALTHY
Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY
Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST

OUTCOMES:
Students will be able to
CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.

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TEXT BOOK:

REFERENCES:
COURSE DESCRIPTION
Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people's psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES
The major objectives of this course is
- To develop students’ awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT I INTRODUCTION

UNIT II SENSORY & PERCEPTUAL PROCESSES
Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

UNIT III COGNITION & AFFECT

UNIT IV THINKING, PROBLEM-SOLVING & DECISION MAKING

UNIT V PERSONALITY & INTELLIGENCE
Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

REFERENCES
and intelligence (pp. 249-284). New York: Plenum Press.

HU5175 EDUCATION, TECHNOLOGY AND SOCIETY L T P C
3 0 0 3

COURSE DESCRIPTION
This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:
The course aims
➢ To help learners understand the basics of different types of technology utilised in the field of education
➢ To make them realize the impact of education in society
➢ To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES
By the end of the course, learners will be able to
➢ Understand the various apps of technology apps and use them to access, generate and present information effectively.
➢ Apply technology based resources and other media formats equitably, ethically and legally.
➢ Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM
Gurukul to ICT education – Teacher as facilitator – Macaulay’s Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES

UNIT III TECHNOLOGICAL ADVANCEMENTS
Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY
Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS
Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL: 45 PERIODS

TEACHING METHODS
Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.
EVALUATION
As this is a content-based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end-semester examination. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)
(a) Written Test (40 marks)
(b) Assignment: Write a real-time report of the technology use in any school/college (15 marks)
(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)
(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)
(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES
1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

HU5176 PHILOSOPHY

OBJECTIVES
- To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
- To foster critical thinking and imagination by dealing with inter-related concepts in literature and science.
- To bridge the gap between the sciences and humanities through introspective analyses.
- To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one’s self and others.

UNIT I KNOWLEDGE

UNIT II ORIGIN

UNIT III WORD

UNIT IV KNOWLEDGE AS POWER/OPPRESSION
UNIT V  SELF KNOWLEDGE/BRAHMAN


OUTCOMES:
On completion of the course, the students will be able to:
1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:
7. Bacon, Francis: Power as Knowledge

HU5177  APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE  L T P C
        3 0 0 3

UNIT I  INTRODUCTION
Nature and fields.

UNIT II  PSYCHOLOGY IN INDUSTRIES AND ORGANIZATIONS
Job analysis; fatigue and accidents; consumer behavior.

UNIT III  PSYCHOLOGY AND MENTAL HEALTH
Abnormality, symptoms and causes psychological disorders

UNIT IV  PSYCHOLOGY AND COUNSELING
Need of Counseling, Counselor and the Counselee, Counseling Process, Areas of Counseling.

UNIT V  PSYCHOLOGY AND SOCIAL BEHAVIOUR
Group, group dynamics, teambuilding, Prejudice and stereotypes; Effective Communication, conflict and negotiation.

TOTAL: 45 PERIODS

TEXTBOOKS
COURSE DESCRIPTION
This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.

OBJECTIVES
✓ To familiarize students with the concepts of sex and gender through literary and media texts.
✓ To help students ask critical questions regarding gender roles in society.
✓ To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
✓ To help students think critically about gender based problems and solutions.

LEARNING OUTCOMES
➢ Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
➢ Students will be able to analyse current social events in the light of gender perspectives.
➢ Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I  INTRODUCTION TO GENDER
• Definition of Gender
• Basic Gender Concepts and Terminology
• Exploring Attitudes towards Gender
• Social Construction of Gender

Texts:
1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II  GENDER ROLES AND RELATIONS
• Types of Gender Roles
• Gender Roles and Relationships Matrix
• Gender-based Division and Valuation of Labour

Texts:
1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)

UNIT III  GENDER DEVELOPMENT ISSUES
• Identifying Gender Issues
• Gender Sensitive Language
• Gender, Governance and Sustainable Development
• Gender and Human Rights
• Gender and Mainstreaming
Texts:
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)

UNIT IV  GENDER-BASED VIOLENCE
- The concept of violence
- Types of Gender-based violence
- The relationship between gender, development and violence
- Gender-based violence from a human rights perspective

Texts:
1. Lights Out (Play, Manjula Padmanabhan)
2. Lights Out (Video of play enacted)

UNIT V  GENDER AND CULTURE
- Gender and Film
- Gender, Media and Advertisement

Texts:
1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:
Discussion & Classroom Participation: 20%
Project/Assignment: 30%
End Term Exam: 50%

HU5272  ETHICS AND HOLISTIC LIFE

OBJECTIVES:
- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

UNIT I  HUMAN LIFE, ITS AIM AND SIGNIFICANCE
The concept of a successful life, happy life and a meaningful life, Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

UNIT II  CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT
Intellectual, Emotional, Creative, Ethico - spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.
UNIT III  HARMONY IN PERSONAL AND SOCIAL LIFE:
Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all, Creating a value based work culture in hostel, classroom and other places in the campus and society.

UNIT IV  CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE
Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

UNIT V  DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

HU5273  LAW AND ENGINEERING  L T P C
UNIT I  THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE  9
Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT II  LAWS  9
Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.

UNIT III  BUSINESS ORGANISATIONS  9
Sole traders (Business has no separate identity from you, all business property belongs to you). Partnerships: Types of Partnerships - Limited Liability Partnership, General Partnership, Limited Partnerships. Companies: The nature of companies, Classification of companies, Formation of companies, Features of a public company, Carrying on business, Directors– Their Powers and Responsibilities/Liabilities.
COURSE DESCRIPTION
This is an intensive course designed to promote comprehensive understanding and insights into the nature of cinema and other related forms and practices. Movies, though at times are used more as escapism, they are also a true art form and expressive tool used by writers, directors and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling and various other elements of a film. It will also explore the impact of movies in our society and in our lives. It also encourages students to use films as a medium to analyse visual texts and read underlying messages.

OBJECTIVES:
- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.

UNIT I THE COMPONENTS OF FILMS
Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II EVOLUTION OF FILM

UNIT III FILMS ACROSS THE WORLD

UNIT IV INDIAN FILMS

UNIT V INTERPRETING FILMS
Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies – Television – New Media & Online Media – Films Beyond Entertainment.

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the students will be able to:
- Recognize types of films, their impact on society and their roles in our lives.
- Have an understanding of the concepts of storytelling, Mise en Scene, and other elements of film making.
- Interpret the underlying messages in the movies.

TEACHING METHODS
- Each unit consists of reading materials, learning activities videos, websites. Students are expected to watch movies sometimes in class and at times at home and discuss in class.
EVALUATION

- As this is course is critical appreciation course on films, there is no written end semester examination. The course is more on learning how to critically analyse a movie and appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)

- Assignment 1: Write a movie review with critical analysis (20 marks).
- Assignment 2: Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
- Group discussion: Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others’ posts. (10 marks)

REFERENCES

1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983

HU5275  FUNDAMENTALS OF LANGUAGE AND LINGUISTICS  L T P C  3 0 0 3

OBJECTIVES

- To broadly introduce students to the formal and theoretical aspects of linguistics.
- To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

CONTENTS :

UNIT I LANGUAGE AND LINGUISTICS: AN OVERVIEW  9

UNIT II MORPHOLOGY - WORDS OF LANGUAGE  9

UNIT III SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS-THE MEANING OF LANGUAGE  9

UNIT IV PHONETICS – THE SOUNDS OF LANGUAGE  9
UNIT V  APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE  9
Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

TOTAL : 45 PERIODS

TEACHING METHODS :
Lectures, discussion.

EVALUATION INTERNAL AND EXTERNAL :
Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)

REFERENCES :

HU5276  UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE  L T P C
3 0 0 3

OBJECTIVES
- To internalize the importance of language by understanding its role in the transformation of man.
- To look at language, literature and culture as locus of identity and change.
- To extract meaning from existing literatures and cultures.
- To identify meanings in modern life by reconnecting with lost cultures.

UNIT I  INTRODUCTION
Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions- Pictography. From visual to oral -Logography. Reading out literature to young children- Edmund J Farrell.

UNIT II  READING CULTURE
Reading culture through language, signs and consumables- Roland Barthes. Culture through poems- Nissim Ezekiel’s ‘The night of the Scorpion’ , ‘Nothing’s Changed’- Tatamkhulu Afrika- Apartheid. Ruskin Bond- ‘Night train at Deoli’- How real life is different from movies.

UNIT III  IDENTIFYING MEANING
Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar’s ‘Jagat Mithya’- the world as an illusion. The Indian version as ‘meaningless meaning’.

UNIT IV  POST MODERNISM
‘If on a winter’s night a traveler’- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.

UNIT V  RETURNING TO PICTURES

READING LIST
1. Bond, Ruskin: ‘Night train at Deoli’
2. Ezekiel, Nissim: ‘The Night of the Scorpion’
3. Afrika, Tatamkhulu: ‘Nothing’s Changed’
4. Barthes, Roland: *Mythologies*
5. Shankaracharya: *Viveka Chudamani*
6. Camus, Albert: *The Myth of Sisyphus*
7. Calvino, Italo: *If on a winter's night a traveler*

**OUTCOMES:**

- Can identify the connections among language, literature and culture.
- Is able to relate between seemingly different aspects of life.
- Understands the fractions in modern life and can assimilate meanings.