ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
B.E. MANUFACTURING ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :

Manufacturing Engineering Graduates are expected, within 5 years after graduation, to meet the following Program Educational Objectives (PEOs):

1. Be employed in jobs related to designing, modeling, analyzing, and managing modern complex systems, implementing and improving systems in manufacturing sectors at local, regional, national and global levels.
2. Have engaged in life-long learning, such as graduate studies and research, certification from professional organizations, Fundamentals of Engineering certification, or active participation in professional societies/activities.
3. Demonstrate professional success as evidenced by, among others, increased job responsibilities and leadership role at the place of employment and in greater society.

PROGRAMME OUTCOMES (POs):

a. Engineering/Foundational Knowledge in mathematics, engineering sciences, applied probability, computer science, humanities, and social science
b. Professional Skills to communicate in both oral and written forms and to be proficient in working in diverse teams of individuals
c. Manufacturing Engineering Knowledge/Skills in materials and manufacturing processes, process, assembly, and product engineering, manufacturing competitiveness, and manufacturing systems design,
d. Confidence in Engineering and professional skills.
e. Understanding of Professional and Ethical Behavior to be prepared for ethical decision making, service to the engineering profession, and have the means to continue in the acquisition of knowledge

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# ANNA UNIVERSITY, CHENNAI

## UNIVERSITY DEPARTMENTS

**B.E. MANUFACTURING ENGINEERING**

**REGULATIONS – 2015**

**CHOICE BASED CREDIT SYSTEM**

**CURRICULA AND SYLLABI I - VIII SEMESTERS**

## SEMESTER I

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*Attention*

*Signature*

Director

Centre For Academic Courses
Anna University, Chennai-600 025
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*4 weeks (Total duration can be flexibly covered in fifth and/or sixth semester holidays)

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*Course from the curriculum of other UG Programmes

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**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

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COURSE DESCRIPTION:
This course aims at developing the language skills necessary for the first year students of Engineering and Technology.

OBJECTIVES:
- To develop the four language skills – Listening, Speaking, Reading and Writing.
- To improve the students’ communicative competence in English.
- To teach students the various aspects of English language usage.

CONTENTS

UNIT I  GREETING AND INTRODUCING ONESELF  12
Listening – Types of listening – Listening to short talks, conversations; Speaking – Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family/ friend; Reading – Skimming a passage– Scanning for specific information; Writing – Guided writing - Free writing on any given topic (My favourite place/ Hobbies/ School life, writing about one’s leisure time activities, hometown, etc.); Grammar – Tenses (present and present continuous) -Question types - Regular and irregular verbs; Vocabulary – Synonyms and Antonyms.

UNIT II  GIVING INSTRUCTIONS AND DIRECTIONS  12
Listening – Listening and responding to instructions; Speaking – Telephone etiquette - Giving oral instructions/ Describing a process – Asking and answering questions; Reading – Reading and finding key information in a given text - Critical reading - Writing –Process description( non-technical); Grammar – Tense (simple past& past continuous) - Use of imperatives – Subject – verb agreement – Active and passive voice; Vocabulary – Compound words – Word formation – Word expansion ( root words).

UNIT III  READING AND UNDERSTANDING VISUAL MATERIAL  12
Listening- Listening to lectures/ talks and completing a task; Speaking –Role play/ Simulation – Group interaction; Reading – Reading and interpreting visual material; Writing- Jumbled sentences – Discourse markers and Cohesive devices – Essay writing (cause & effect/ narrative); Grammar – Tenses (perfect), Conditional clauses –Modal verbs; Vocabulary –Cause and effect words; Phrasal verbs in context.

UNIT IV  CRITICAL READING AND WRITING  12
Listening- Watching videos/ documentaries and responding to questions based on them; Speaking Informal and formal conversation; Reading –Critical reading (prediction & inference);Writing–Essay writing ( compare & contrast/ analytical) – Interpretation of visual materials; Grammar – Tenses (future time reference); Vocabulary – One word substitutes (with meanings) – Use of abbreviations & acronyms – Idioms in sentences.

UNIT V  LETTER WRITING AND SENDING E-MAILS  12
Listening- Listening to programmes/broadcast/ telecast/ podcast; Speaking – Giving impromptu talks, Making presentations on given topics- Discussion on the presentation; Reading –Extensive reading; Writing– Poster making – Letter writing (Formal and E-mail) ; Grammar – Direct and Indirect speech – Combining sentences using connectives; Vocabulary –Collocation;

TEACHING METHODS:
Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.
EVALUATION PATTERN:
Internals – 50%
End Semester – 50%
TOTAL: 60 PERIODS

OUTCOMES:
- Students will improve their reading and writing skills
- Students will become fluent and proficient in communicative English
- Students will be able to improve their interpersonal communication

TEXTBOOK:

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

MA7151 MATHEMATICS I
(Common to all branches of B.E./B.Tech. Programmes in I Semester)

L T P C
4 0 0 4

OBJECTIVES:
- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I DIFFERENTIAL CALCULUS
12

UNIT II FUNCTIONS OF SEVERAL VARIABLES
12
UNIT III INTEGRAL CALCULUS 12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

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

TOTAL: 60 PERIODS

OUTCOMES:
- Understanding of the ideas of limits and continuity and an ability to calculate with them and apply them.
- Improved facility in algebraic manipulation.
- Fluency in differentiation.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Understanding the ideas of differential equations and facility in solving simple standard examples.

TEXTBOOKS:

REFERENCES:
OBJECTIVE:
- To introduce the concept and different ways to determine moduli of elasticity and applications.
- To instill the concept of sound, reverberation, noise cancellation, and ultrasonic generation, detection and applications
- To inculcate an idea of thermal properties of materials, heat flow through materials and quantum physics
- To promote the basic understanding of interferometers, principles and applications of lasers, optical fibers and sensors
- To establish a sound grasp of knowledge on the basics, significance and growth of single crystals

UNIT I PROPERTIES OF MATTER

UNIT II ACOUSTICS AND ULTRASONICS

UNIT III THERMAL AND MODERN PHYSICS

UNIT IV APPLIED OPTICS

UNIT V CRYSTAL PHYSICS
Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditrections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS
OUTCOME:
- The students will understand different moduli of elasticity, their determination and applications.
- The students will gain knowledge on the properties of sound, noise cancellation, and production, detection and applications of ultrasonics.
- The students will acquire sound knowledge on thermal expansion and thermal conductivity of materials. Further they will gain an idea of quantum physics.
- The students will gain knowledge on interferometers, lasers and fiber optics.
- The students will secure knowledge on the basics of crystal structures and their significance. Further they gain basic ideas of growing single crystals.

TEXTBOOKS:

REFERENCES:

CY7151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVE
- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY
9
Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II SURFACE CHEMISTRY AND CATALYSIS
9

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY
9
UNIT IV CHEMICAL THERMODYNAMICS 9
Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van’t Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.

UNIT V NANO CHEMISTRY 9

TOTAL: 45 PERIODS

OUTCOME
- Will be familiar with polymer chemistry, surface chemistry and catalysis.
- Will know the photochemistry, spectroscopy and chemical thermodynamics.
- Will know the fundamentals of nano chemistry.

TEXTBOOKS

REFERENCES

GE7152 ENGINEERING GRAPHICS L T P C
3 2 0 4

OBJECTIVES
- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HANDSKETCHING 14
Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 14
Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and 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 14
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 14 SURFACES
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 15
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 packages and demonstration of their use.

L=45+T=30, TOTAL: 75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
- Perform free hand sketching of basic geometrical shapes and multiple views of objects.
- Draw orthographic projections of lines, planes and solids
- Obtain development of surfaces.
- Prepare isometric and perspective views of simple solids.

TEXT BOOK:

REFERENCES:
Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005

Publication of Bureau of Indian Standards:

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

BS7161 BASIC SCIENCES LABORATORY L T P C
(0 0 4 2)
PHYSICS LABORATORY: (Any Seven Experiments)

OBJECTIVE:
- 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, band gap determination and viscosity of liquids.

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. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow
OUTCOME:
- 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)

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

TOTAL: 60 PERIODS

TEXTBOOKS

GE7162 ENGINEERING PRACTICES LABORATORY

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

OBJECTIVES
- To provide exposure to the students with hands-on experience on various Basic Engineering Practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP – A (CIVIL & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICES

PLUMBING
Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
• Laying pipe connection to the suction side of a pump.
• Laying pipe connection to the delivery side of a pump.
• Practice in 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 and Tenon joint and Dovetail joint.
STUDY
• Study of joints in door panels and wooden furniture
• Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICES
• Basic household wiring using Switches, Fuse, Indicator and Lamp etc.,
• Stair case light wiring
• Tube – light wiring
• Preparation of wiring diagrams for a given situation.
• Study of Iron-Box, Fan Regulator and Emergency Lamp

GROUP – B (MECHANICAL AND ELECTRONICS)

3. MECHANICAL ENGINEERING PRACTICES
WELDING
• Arc welding of Butt Joints, Lap Joints, and Tee Joints
• Gas welding Practice.
• Basic Machining - Simple turning, drilling and tapping operations.
• Study and assembling of the following:
  a. Centrifugal pump
  b. Mixie
  c. Air Conditioner.

DEMONSTRATION ON FOUNDRY OPERATIONS.

4. ELECTRONIC ENGINEERING PRACTICES
• Soldering simple electronic circuits and checking continuity.
• Assembling electronic components on a small PCB and Testing.
• Study of Telephone, FM radio and Low Voltage Power supplies.

TOTAL: 60 PERIODS

OUTCOMES
• Ability to fabricate carpentry components and to lay pipe connections including plumbing works.
• Ability to use welding equipments to join the structures
• Ability to do wiring for electrical connections and to fabricate electronics circuits.

HS7251 TECHNICAL ENGLISH L T P C
4 0 0 4

OBJECTIVES
• To enable students acquire proficiency in technical communication.
• To enhance their reading and writing skills in a technical context.
• To teach various language learning strategies needed in a professional environment.

CONTENTS
UNIT I ANALYTICAL READING
Listening- Listening to informal and formal conversations; Speaking – Conversation Skills(opening, turn taking, closing )-explaining how something works-describing technical functions and applications; Reading –Analytical reading, Deductive and inductive reasoning; Writing- vision statement--structuring paragraphs.
UNIT II SUMMARISING 12
Listening - Listening to lectures/ talks on Science & Technology; Speaking –Summarizing/ Oral Reporting. Reading – Reading Scientific and Technical articles; Writing - Extended definition –Lab Reports – Summary writing.

UNIT III DESCRIBING VISUAL MATERIAL 12
Listening - Listening to a panel discussion; Speaking – Speaking at formal situations; Reading - Reading journal articles - Speed reading; Writing-data commentary-describing visual material-writing problem-process- solution-the structure of problem-solution texts- writing critiques

UNIT IV WRITING/ E-MAILING THE JOB APPLICATION 12
Listening- Listening to/ Viewing model interviews; Speaking –Speaking at different types of interviews – Role play practice ( mock interview); Reading – Reading job advertisements and profile of the company concerned; Writing- job application – cover letter –Résumé preparation.

UNIT V REPORT WRITING 12
Listening- Viewing a model group discussion; Speaking –Participating in a discussion - Presentation; Reading – Case study - analyse -evaluate – arrive at a solution; Writing– Recommendations- Types of reports (feasibility report)- designing and reporting surveys- – Report format.- writing discursive essays.

TEACHING METHODS:
Practice writing
Conduct model and mock interview and group discussion.
Use of audio – visual aids to facilitate understanding of various forms of technical communication.
Interactive sessions.

EVALUATION PATTERN:
Internals – 50%
End Semester – 50%

TOTAL:60 PERIODS

OUTCOMES
- Students will learn the structure and organization of various forms of technical communication.
- Students will be able to listen and respond to technical content.
- Students will be able to use different forms of communication in their respective fields.

TEXTBOOK:

REFERENCES:
OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of the electric current.
- To make the student 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  
MATRICES


UNIT II  
VECTOR CALCULUS

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

UNIT III  
ANALYTIC FUNCTION


UNIT IV  
COMPLEX INTEGRATION


UNIT V  
LAPLACE TRANSFORMS


TOTAL: 60 PERIODS

OUTCOMES:

- Upon successful completion of the course, students should be able to:
- Evaluate real and complex integrals using the Cauchy integral formula and the residue theorem
- Appreciate how complex methods can be used to prove some important theoretical results.
- Evaluate line, surface and volume integrals in simple coordinate systems
- Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities
- Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.
TEXTBOOKS:

REFERENCES:

PH7251 MATERIALS SCIENCE
(Common to Manufacturing, Industrial, Mining, Aeronautical, Automobile and Production Engineering)

OBJECTIVE:
- To impart knowledge on the basics of binary phase diagrams and their applications
- To learn the phase diagram, effect of alloying elements and various transformations in the Fe-C system, and also the heat treatment of steels.
- To introduce various strengthening methods of materials, and also various mechanical properties and their measurement
- To instill the types, properties and applications of magnetic, dielectric and superconducting materials.
- To introduce the preparation, properties and applications of various new materials.

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

UNIT II FERROUS ALLOYS AND HEAT TREATMENT
UNIT III  MECHANICAL PROPERTIES


UNIT IV  MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS


UNIT V  NEW MATERIALS


TOTAL: 45 PERIODS

OUTCOME:
Upon completion of this course, the students will
- gain knowledge on the basics of binary phase diagrams and the use of lever rule
- learn about the Fe-C phase diagram, effect of alloying elements, TTT in the Fe-C system, and also the heat treatment of steels.
- understand the significance of dislocations, strengthening mechanisms, and tensile, creep, hardness and fracture behavior of materials
- acquire knowledge on the types, properties and applications of magnetic, dielectric and superconducting materials.
- get adequate understanding on the preparation, properties and applications of ceramics, composites, metallic glasses, shape-memory alloys and nanomaterials.

TEXTBOOKS:

REFERENCES:
EE7151  BASIC ELECTRICAL AND ELECTRONICS  L T P C  3 0 0 3
ENGINEERING

OBJECTIVE:
- To impart the knowledge on basic concepts of electrical circuits and electrical machines.
- To impart the knowledge on basic concepts of electronic components, devices and circuits.

UNIT I  BASIC CONCEPTS AND DC CIRCUITS  9
Ohm's law - Electrical resistance - Series /Parallel resistive circuits - Star/Delta transformations - Kirchoff's law - Node and Mesh analysis - Thevenin's and Norton's theorem.

UNIT II  A.C. CIRCUITS  9
RMS and average value of periodic waves - Form factor - Phase and Phase difference - Simple RC.RL and RLC circuits - series and parallel resonance - power and power factor - introduction to three phase systems – power measurement in 3 phase system.

UNIT III  D.C. MACHINES  10

UNIT IV  ELECTRONIC COMPONENTS AND DEVICES  9
Operating principle and characteristics of Simple PN Junction Diodes, Zener diode, Bipolar Junction transistor - Field Effect Transistors – UJT – SCR.

UNIT V  ANALOG CIRCUITS  8
Rectifier and Power Supply Circuits, clipper, clamper using diodes, Operational Amplifiers (Ideal) - properties and typical circuits like differentiator, integrator, summer, comparator.

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to use the various electrical machines like AC/ DC, electronic components and applications of analog circuits

REFERENCES:

GE7151  COMPUTING TECHNIQUES  L T P C  3 0 0 3
(Common to all branches of Engineering and Technology)

OBJECTIVE
- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I  INTRODUCTION  9
Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code Flow Chart and Algorithms.
UNIT II  C PROGRAMMING BASICS  9

UNIT III  ARRAYS AND STRINGS  9

UNIT IV  POINTERS  9
Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems- Basic file operations

UNIT V  FUNCTIONS AND USER DEFINED DATA TYPES  9
TOTAL : 45 PERIODS

OUTCOME
At the end of the course, the student should be able to:
• Write C program for simple applications
• Formulate algorithm for simple problems
• Analyze different data types and arrays
• Perform simple search and sort.
• Use programming language to solve problems.

TEXTBOOKS:

REFERENCES:

GE7153  ENGINEERING MECHANICS  L T P C
4 0 0 4

OBJECTIVE:
• The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.
UNIT I  STATICS OF PARTICLES

UNIT II  EQUILIBRIUM OF RIGID BODIES

UNIT III  DISTRIBUTED FORCES
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center 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

UNIT V  DYNAMICS OF PARTICLES
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles.

L – 45 + T – 15 TOTAL: 60 PERIODS

OUTCOMES:
- Upon completion of this course, students will be able to construct meaningful mathematical models of physical problems and solve them.

TEXT BOOK

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

LIST OF EXPERIMENTS:
1. Load test on separately excited DC shunt generator
2. Load test on DC shunt moor
3. Load test on S Transformer
4. Load test on Induction motor
5. Regulation of 3 Alternator
6. Study of CRO
7. Logic gates
8. Operational amplifiers
9. Time constant of RC circuit
10. Characteristics of LVDT
11. Calibration of Rotometer
12. RTD and Thermistor
13. Flapper Nozzle system

TOTAL: 60 PERIODS

OUTCOMES:
- Ability to perform speed characteristic of different electrical machine
- Ability to use of diodes, transistors for rectifiers
- Ability to use of operational amplifiers

GE7161  COMPUTER PRACTICES LABORATORY  L T P C
0 0 4 2

OBJECTIVES
- To understand the basic programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.
- To articulate where computer programs fit in the provision of computer-based solutions to real world problems.
- To learn to use user defined data structures.

LIST OF EXPERIMENTS
1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function
10. Program using structures and unions.

TOTAL: 60 PERIODS

OUTCOMES
At the end of the course, the student should be able to:
- Write and compile programs using C programs.
- Write program with the concept of Structured Programming
- Identify suitable data structure for solving a problem
- Demonstrate the use of conditional statement.
LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS
30 Systems with C compiler

CE7251 STRENGTH OF MATERIALS

OBJECTIVE:
- To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

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

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

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame’s theory – Application of theories of failure.

TOTAL: 45 PERIODS

OUTCOMES:
- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
- Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- The applications of the conservation laws to flow through pipes and hydraulic machines are studied.
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

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

UNIT II FLOW THROUGH CIRCULAR CONDUITS

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

UNIT IV PUMPS
Impact of jets - Euler’s equation - Theory of rotodynamic machines - various efficiencies - velocity components at entry and exit of the rotor - velocity triangles - Centrifugal pumps - working principle - work done by the impeller - performance curves - Reciprocating pump - working principle - indicator diagram - work saved by fitting air vessels - Rotary pumps - classification - comparison of working principle with other pumps - advantages.

UNIT V TURBINES

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students will be able to:
- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Critically analyse the performance of pumps and turbines.

TEXTBOOKS:

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

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

UNIT II ENVIRONMENTAL POLLUTION 8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards– 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 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
From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

TOTAL: 45 PERIODS

OUTCOMES:
Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environment at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.

TEXTBOOKS:

REFERENCES:

MA7357 PROBABILITY AND STATISTICS

OBJECTIVES:
- To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
- The Students will have a fundamental knowledge of the concepts of probability.

UNIT I RANDOM VARIABLES
Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES
Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).
UNIT III  TESTS OF SIGNIFICANCE

UNIT IV  DESIGN OF EXPERIMENTS
Completely randomized design – Randomized block design – Latin square design - 2² factorial design - Taguchi’s robust parameter design.

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

OUTCOMES:
- Students will be able characterize probability models using probability mass (density) functions & cumulative distribution functions.
- The students can independently participate in the processes of analysis, planning, formulating strategies of development, decision-making, governing and management, and independent making of tactical and strategic decisions related to the statistics.

TEXTBOOKS:

REFERENCES:

ME 7351  DESIGN CONCEPTS IN ENGINEERING

OBJECTIVES:
- To impart the importance of design in today’s context of global competition, environmental awareness and customer oriented market.
- To impart the basic concepts and various aspects of design using simple examples and case studies.

UNIT I  DESIGN TERMINOLOGY
Definition- various methods and forms of design-importance of product design-static and dynamic products- various design projects- morphology of design- requirements of a good design-concurrent engineering-computer aided engineering-codes and standards-product and process cycles-bench marking.

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UNIT II DESIGN PROCESS
Basic modules in design process-scientific method and design method-Need identification, importance of problem definition-structured problem, real life problem- information gathering - customer requirements- Quality Function Deployment (QFD)- product design specifications-generation of alternative solutions- Analysis and selection-Detail design and drawings-Prototype, modeling, simulation, testing and evaluation.

UNIT III CREATIVITY IN DESIGN
Creativity and problem solving-vertical and lateral thinking-invention-psychological view, mental blocks-Creativity methods-brainstorming, synectics, force fitting methods, mind map, concept map- Theory of innovative problem solving (TRIZ) - conceptual decomposition creating design concepts.

UNIT IV HUMAN AND SOCIETAL ASPECTS
Human factors in design, ergonomics, user friendly design-Aesthetics and visual aspects environmental aspects-marketing aspects-team aspects-legal aspects-presentation aspects.

UNIT V MATERIAL AND PROCESSES IN DESIGN
Material selection for performance characteristics of materials-selection for new design substitution for existing design-economics of materials-selection methods-recycling and material selection-types of manufacturing process, process systems- Design for Manufacturability (DFM) - Design for Assembly (DFA).

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students will be able to:
- Understand the various design requirements and processes involved in product development.
- Be exposed to various creativity and problem solving techniques.

TEXTBOOK:

REFERENCES:

MF7301 MACHINE TOOLS AND PROCESSES

OBJECTIVE:
- To identify the necessity of “manufacturing” Define with examples the concept of manufacturing, Machine tools and machining. State with examples the main requirements for “machining” List the main classifications of the manufacturing processes with examples.

UNIT I FUNDAMENTALS OF METAL CUTTING
UNIT II  MACHINE TOOLS AND PROCESSES FOR PRODUCING ROUND SHAPES  
Turning parameters - Lathes and Lathe operations - Cutting screw threads - Drilling and drills - Drilling machines - Boring and boring machines - reaming and reamers - tapping and taps - Design considerations for drilling, reaming and tapping.

UNIT III  MACHINE TOOLS AND PROCESSES FOR PRODUCING VARIOUS SHAPES  
Milling operations - Milling machines - Planner and shaper: Machines and Operations - Broaching and broaching machines - Sawing - filing and finishing - gear manufactured by machining.

UNIT IV  ABRASIVE MACHINING AND FINISHING OPERATIONS  

UNIT V  MACHINE TOOL STRUCTURE AND AUTOMATION  

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course this domain knowledge will increase their employability skills
- Use this knowledge to develop innovative ideas in the areas of machine building, work holding and tool holding methods.
- Encourages to involve in research in the area of machining

TEXTBOOKS:

REFERENCES:

CE7261                      STRENGTH OF MATERIALS LABORATORY         L T P C
0 0 4 2

OBJECTIVES:
- To study the mechanical properties of materials subjected to different types of loading.

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

TOTAL: 60 PERIODS

OUTCOMES:
- The students will have the knowledge in the area of testing of materials

REFERENCES:
2. IS 432(Part I ) -1992 – Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement

CE7361   FLUID MECHANICS AND MACHINERY LABORATORY

OBJECTIVE:
- Students should be able to verify the principles studied in theory by performing the experiments in lab.

LIST OF EXPERIMENTS
1. Flow Measurement 32
   a. Calibration of Rotometer
   b. Flow through Venturimeter
   2. Flow through a circular Orifice
   3. Determination of mean velocity by Pitot tube
   4. Verification of Bernoulli’s Theorem
   5. a. Flow through a Triangular Notch
       b. Flow through a Rectangular Notch

2. Losses in Pipes 8
   a. Determination of friction coefficient in pipes
   b. Determination of losses due to bends, fittings and elbows

3. Pumps 16
   a. Characteristics of Centrifugal pumps
   b. Characteristics of Submersible pump
   c. Characteristics of Reciprocating pump

4. Determination of Metacentric height 4
   Demonstration Only

TOTAL: 60 PERIODS

OUTCOMES:
- The students will be able to measure flow in pipes and determine frictional losses.
- The students will be able to develop characteristics of pumps and turbines

REFERENCES:
ME7353 MECHANICS OF MACHINES L T P C
3 0 0 3

OBJECTIVES:
- To understand the principles in the formation of mechanisms and their kinematics.
- To understand the effect of friction in different machine elements.
- To analyze the forces and torque acting on simple mechanical systems.
- To understand the importance of balancing and vibration.

UNIT I KINEMATICS OF MECHANISMS 9

UNIT II GEARS AND GEAR TRAINS 9

UNIT III FRICTION IN MACHINE ELEMENTS 9
Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes– Friction in vehicle propulsion and braking.

UNIT IV FORCE ANALYSIS 9

UNIT V BALANCING AND VIBRATION 9

TOTAL: 45 PERIODS

OUTCOME:
- The course will enable the student to understand the forces and torque acting on simple mechanical systems and also the importance of balancing and vibration and the effect of friction in different machine parts of practical significance.

TEXT BOOK:

REFERENCES:
ME7451  MACHINE DESIGN  
(Use of P S G Design Data Book is permitted in the University examination)  

OBJECTIVE  
- To familiarize the various steps involved in the Design Process  
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.  
- To learn to use standard practices and standard data  
- To learn to use catalogues and standard machine components  

UNIT I  STEADY STRESSES IN MACHINE MEMBERS  
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 – Curved beams - theories of failure – Design for finite and infinite life under variable loading.  

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

UNIT III  ENERGY STORING ELEMENTS AND ENGINE COMPONENTS  
Types of springs, Design 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  
Design of Flat belts and pulleys - Selection of V belts and pulleys – Design of Transmission chains and Sprockets.  

UNIT V  SPUR GEARS, HELICAL GEARS AND GEAR BOXES  

OUTCOME  
- Upon completion of this course, the students can able to successfully design machine components
TEXTBOOKS

REFERENCES

ME7452 THERMODYNAMICS
L T P C
3 2 0 4

OBJECTIVES:
• To understand the basic laws of Thermodynamics and Heat transfer.
• To understand the principle of operation of thermal equipments like IC engine, boilers, turbine and refrigerator etc.

UNIT I BASIC CONCEPTS OF THERMODYNAMICS
12

UNIT II FIRST AND SECOND LAW OF THERMODYNAMICS
12

UNIT III HEAT ENGINES
12

UNIT IV GASES AND VAPOUR MIXTURES
12
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 V HEAT TRANSFER

OUTCOMES:
- Upon completion of this course, the students can able to understand different gas power cycles and use of them in IC and R&AC applications.

TEXTBOOKS:

REFERENCES:

OUTCOMES: L=45+T=30, TOTAL: 75 PERIODS

UNIT I INTRODUCTION OF CASTING
Patterns: Making - materials, types, allowances pattern making - Moulding: materials, equipment, sand preparation, testing and control - Cores and core making - Design considerations in casting, gating system - Melting furnaces - directional solidification in castings, Metallurgical aspects of Casting- Steps involved in casting.

UNIT II CASTING PROCESSES
Casting processes: Steps, Advantages, limitations and applications of Sand castings, permanent mould casting - pressure die casting, centrifugal casting - precision casting: investment casting, shell Moulding - CO₂ Moulding, continuous casting, squeeze casting, Fettling and finishing, casting defects and Inspection.

UNIT III INTRODUCTION TO WELDING

UNIT IV WELDING PROCESSES

UNIT V AUTOMATION OF WELDING AND CASTING
9

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course the students are expected

- To produce useful research output in welding and casting.
- Use this knowledge in advancing the welding and casting process.
- Application of design knowledge to understand and to overcome defects in welding and casting.

TEXTBOOKS:

REFERENCES:
UNIT III SHEET METAL FORMING PROCESSES

UNIT IV SPECIAL FORMING PROCESSES

UNIT V POWDER METALLURGY
Overview of powder metallurgy techniques, advantages and their applications - Powder forging, rolling, extrusion and drawing - Secondary and finishing operations - Design considerations for powder metallurgy - Economics of powder metallurgy processes.

TOTAL: 45 PERIODS

OUTCOME:
- At the end of the course the student will be able to apply and compare different metal forming concepts in bulk forming and sheet metal forming process.

TEXTBOOKS:

REFERENCES:

ML7451 ENGINEERING MATERIALS AND METALLURGY

OBJECTIVES:
- To impart knowledge on construction of phase diagrams and also the importance of iron-iron carbide phase diagram.
- To impart knowledge on different heat treatment processes used in industries and the basics behind the microstructure formation.
- To impart knowledge on the properties and applications of various engineering materials.
- To expose testing methods and procedures to find the mechanical properties of engineering materials.

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 and 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 superalloys – Properties and Applications

UNIT IV  NON-METALLIC MATERIALS

UNIT V  MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS

TOTAL: 45 PERIODS
OUTCOMES:
• Ability to understand the phase diagrams and relate to the heat treatment processes.
• Ability to tailor structure-property correlations to engineering materials.
• Ability to select proper engineering materials for various engineering applications.
• Ability to perform various testing’s to find the properties of engineering materials.

TEXT BOOKS:

REFERENCES:

ME7412  DYNAMICS LABORATORY

OBJECTIVES:
• To give an understanding of some of the basic measurements carried out in manufacturing industries and the importance of calibrating measuring instruments.
• To understand the principles of kinematics and Dynamics involved in various mechanisms.
DYNAMICS MEASUREMENTS

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

TOTAL: 60 PERIODS

OUTCOME:
- Students will be able to use and calibrate various measuring instruments.
- Students will be able to understand the measurement of various kinematic and vibration parameters.

ME7413 MANUFACTURING TECHNOLOGY LABORATORY

OBJECTIVE:
- To study and acquire knowledge on various basic machining operations and special purpose machines and their applications.

LIST OF EXPERIMENTS
1. Taper Turning and Eccentric Turning using lathe
2. External and Internal Thread cutting using lathe
3. Knurling
4. Shaping – Square and Hexagonal Heads
5. Drilling and Reaming
6. Contour milling - vertical milling machine
7. Spur and helical gear cutting using milling machine
8. Gear generation using gear hobber
9. Gear generation using gear shaper
10. Grinding – Cylindrical, Surface and Centerless grinding

TOTAL: 60 PERIODS

OUTCOME:
- Students will be able to use and calibrate various measuring instruments.
- Students will be able to understand the measurement of various kinematic and vibration parameters.

ME7413 MANUFACTURING TECHNOLOGY LABORATORY

OBJECTIVE:
- To study and acquire knowledge on various basic machining operations and special purpose machines and their applications.

LIST OF EXPERIMENTS
1. Taper Turning and Eccentric Turning using lathe
2. External and Internal Thread cutting using lathe
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4. Shaping – Square and Hexagonal Heads
5. Drilling and Reaming
6. Contour milling - vertical milling machine
7. Spur and helical gear cutting using milling machine
8. Gear generation using gear hobber
9. Gear generation using gear shaper
10. Grinding – Cylindrical, Surface and Centerless grinding

TOTAL: 60 PERIODS

OUTCOME:
- Students will be able to use and calibrate various measuring instruments.
- Students will be able to understand the measurement of various kinematic and vibration parameters.
OUTCOME:

- Upon completion of this course the students will be conversant with various machine tools and development of CNC part programs.

ME 7551  COMPUTER AIDED DESIGN

OBJECTIVES:

- To understand fundamental concepts of computer graphics and its tools in a generic framework.
- To provide clear understanding of CAD systems for 3D modeling and viewing.

UNIT I  FUNDAMENTALS OF COMPUTER GRAPHICS

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

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


UNIT IV  PART ASSEMBLY

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

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

TOTAL: 60 PERIODS

OUTCOME:

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

- Understand the various stages in the design process and the role of computer graphic communication process.
- Understand the mathematics behind the use of computer for modeling of mechanical components.
TEXT BOOK:

REFERENCES:

ME 7553 HYDRAULICS AND PNEUMATICS L T P C
3 0 0 3

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

UNIT I  FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS 9

UNIT II  HYDRAULIC ACTUATORS AND CONTROL COMPONENTS 9

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

UNIT IV  PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS 9
UNIT V TROUBLE SHOOTING AND APPLICATIONS


TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students will be able to:
- Identify hydraulic and pneumatic components and its symbol and usage.
- Ability to design hydraulic and pneumatic circuits.

TEXT BOOKS:

REFERENCES:

ME7554 INDUSTRIAL MANAGEMENT

OBJECTIVE
- To develop modern concepts of Industrial Management

UNIT I INTRODUCTION

UNIT II FUNCTIONS OF MANAGEMENT
UNIT III ORGANIZATIONAL BEHAVIOUR

UNIT IV GROUP DYNAMICS

UNIT V MODERN CONCEPTS

TOTAL: 45 PERIODS

OUTCOME
- The course will enable student preparedness to technology management and the forms of organisation in an industry. This course also enables the student to understand the functions of Management and also the organisational behaviour. It also gives some knowledge on the modern concepts such as Strategic management, SWOT analysis, Business Process Re-engineering (BPR) and supply chain management (SCM).

TEXTBOOKS

REFERENCES

MF7501 METROLOGY AND COMPUTER AIDED INSPECTION

OBJECTIVE:
- To teach the students basic concepts in various methods of engineering measurement techniques and applications, understand the importance of measurement and inspection in manufacturing industries. Expose the students to various modern metrological instruments, the procedure used to operate these instruments and applications of computers in metrology.
UNIT I BASIC CONCEPTS OF MEASUREMENTS
9
Important terminologies - Elements of Measurement, Need for measurement - Factors
influencing measurement - Precision and Accuracy - Methods of measurement - Errors in
Measurements - Causes - Types-Handling of measuring instruments - Dos and Don'ts -
Maintenance of Instruments - Clean room - Clean room procedures.

UNIT II LINEAR AND ANGULAR MEASUREMENTS
9
Measurement of Engineering Components - Comparators, Slip gauges, Rollers, Limit gauges -
Design - Types - Principle, Applications : Auto collimator - Angle dekkor - Alignment telescope -
Sine bar - Bevel protractors.

UNIT III FORM MEASUREMENTS
9
Measurement of various elements of Screw threads and gears - Radius measurement - Surface
finish measurement - Straightness, Flatness and roundness measurements - Principles -
Application – Computerized form measuring equipments.

UNIT IV LASER METROLOGY
9
Precision instrument based on Laser - Use of Lasers - Principle –Interferometers, Interference
microscope - Laser Interferometer - Application in Linear and Angular measurements - Testing
of machine tools using Laser Interferometer.

UNIT V COMPUTER AIDED INSPECTION AND ADVANCES IN METROLOGY
9
Co-ordinate Measuring Machines - Constructional features - Types - Applications of CMM - CNC
CMM applications - Fundamentals of Computer Aided Inspection - Machine Vision and
applications in Metrology - Introduction to Nanometrology.

TOTAL: 45 PERIODS

OUTCOME:
At the end of this course the student will be able to:
- Understand various technical terms and perform measurement tasks accurately.
- Choose the right instrument and method of measurement for a particular application.
- Follow the right procedure for measurement of various components depending upon the
applications.

TEXT BOOK:

REFERENCES:

ME 7561 COMPUTER AIDED MACHINE DRAWING
L T P C
0 0 4 2

OBJECTIVES:
- To make the students understand and interpret drawings of machine components
- To prepare assembly drawings both manually and using standard CAD packages
- To familiarize the students with Indian Standards on drawing practices and standard
components
- To gain practical experience in handling 2D drafting and 3D modeling software systems.
UNIT I  DRAWING STANDARDS & FITS AND TOLERANCES  12

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

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

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 / 3D CAD software.

OUTCOMES:
Upon completion of this course, the students will be able to:
- Appreciate the functions of various machine assemblies,
- Draw part drawings, sectional views and assembly drawings as per standards

TEXT BOOK:

REFERENCES:

MF7511  METROLOGY AND METALLURGY LABORATORY  L T P C
0 0 4 2
OBJECTIVES :
- To make the students understand the fundamental principles of measuring techniques by practicing exercises on various measuring instruments.
- Students should be able to perform metallographic study of the given samples and heat treatment study of steel.
LIST OF EXPERIMENTS - METROLOGY LAB:
1. Linear and Angular measurements using Autocollimator.
3. Calibration of optical comparator and measurement of dimensions.
5. Exercises in Microhite.
8. Study Exercises in Video measuring system, Rolling gear tester, Surface Roughness Tester and CMMs.

LIST OF EXPERIMENTS - METALLURGY LAB:
1. Micro structural examination of steel.
2. Micro structural examination of grey cast iron.
3. Micro structural examination of nodular cast iron.
4. Micro structural examination of non ferrous material (Aluminum, Copper).

TOTAL : 60 PERIODS

OUTCOMES:
At the end of this course the student will be able to:
- Understand various technical terms and perform measurement tasks accurately.
- Choose the right instrument and method of measurement for a particular application.
- Follow the right procedure for measurement of various components depending upon the applications.
- Understand the microstructure features of specimens and correlate with their macroscopic behavior.

ME 7603 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

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

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 9
Complete design and preparation of standard views of simple blanking, piercing, compound and progressive dies - fine Blanking dies.

UNIT V DESIGN OF BENDING, FORMING, DRAWING AND MISCELLANEOUS 9 DIES

TOTAL: 45 PERIODS

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

OUTCOMES:
Upon completion of this course, the students will be able to:
- Design jigs, fixtures and press tools and give the assembly drawing with dimensions and Parts list.
- Use the above knowledge to design various types of dies and give the standard dimensioned views

TEXT BOOKS:

REFERENCES:

MF7601 CNC TECHNOLOGY
L T P C 3 0 0 3

OBJECTIVES:
- To understand the evolution and principle of CNC machine tools
- To describe constructional features of CNC machine tools, drives and positional transducers used in CNC machine tools
- To generate CNC programs for popular CNC controllers
- To describe tooling and work holding devices for 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 - turning centre - machining centre - grinding machine - vertical turret lathe - turn-mill centre - EDM

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

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

UNIT V TOOLING AND WORK HOLDING DEVICES
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- economics of CNC - maintenance of CNC machines.

TOTAL: 45 PERIODS

OUTCOME:
At the end of this course
• This domain knowledge will increase their employability skills.
• Use this knowledge to program CNC machines.
• Use this knowledge to organize production using CNC machines.

TEXT BOOKS:

REFERENCES:

MF7602 OPERATIONS RESEARCH

OBJECTIVES:
• To provide knowledge and training using optimization techniques under limited resources for the engineering and business problems.
UNIT I  LINEAR MODELS  
The phase of an operation research study - Linear programming - Graphical method - Simplex algorithm - Duality formulation - Sensitivity analysis: - changes in - Objective function, RHS of Constraints and variables.

UNIT II  TRANSPORTATION MODELS AND NETWORK MODELS  

UNIT III  INVENTORY AND REPLACEMENT MODELS  
Inventory models - Economic order quantity models - Quantity discount models - Stochastic inventory models - Multi product models - Inventory control models - replacement models - service life - Economics.

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

UNIT V  DECISION MODELS  

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

TEXT BOOK:

REFERENCES:

MF7651  NON-TRADITIONAL MACHINING PROCESSES  
L T P C  
3 0 0 3

OBJECTIVE:
At the end of this course the students are expected to
• Understand the working principles of various non-traditional machining processes, their applications, advantages and limitations.
• The students can also able to learn advanced nano finishing processes, recent developments in the non-traditional machining processes and to compare them.
UNIT I  INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES  9
Introduction to non-traditional machining processes, need for non-traditional machining, classification of non-traditional machining processes, their applications, advantages, limitations. Abrasive jet machining, abrasive water jet machining, ultrasonic machining their working principles, equipments, effect of process parameters, applications, advantages and limitations.

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

UNIT III  THERMO-ELECTRIC ENERGY BASED PROCESSES  9
Electric discharge machining, wire electric discharge machining, laser beam machining, plasma arc machining, electron beam machining, ion beam machining their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT IV  ADVANCED NANO FINISHING PROCESSES  9
Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT V  RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES  9
Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course the students are expected to understand
- The working principles of various non-traditional machining processes, their applications, advantages and limitations.
- Advanced nano finishing processes.
- Recent developments in the non-traditional machining processes.
- Comparison of non-traditional machining processes.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To understand the concepts of CNC machine tools types, cutting tools and metal cutting process.
- Generate part programs using CNC programming and simulation s/w for CNC Lathe, CNC Milling Machine and CNC Wire EDM.
- To get hands on experience by machining the parts on actual machines.
- To understand the configuration of 4 & 5 axis Robot, comprehend Robot programming methods using robot language.
- Create work cell configuration and verify by simulation.

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. Dimensional and geometric measurement of machined features using VMS, Surface Roughness and CMM.
12. Robot programming for Material handling applications.
13. Understanding assembly, polishing, palletizing for different types of robots using software.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of this course

- Students will be able to use CNC machines for production.
- Use this knowledge to program CNC machines and Robots.
- Knowledge and skill development of the students in the area of advance manufacturing Technology-different metal machining process of complicated parts used in general engg.
- Robot workcell creation and handling.

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. Non contact type 2 axes Measuring System.
8. 3 D Coordinate Measuring Machine.
9. 3 D scanner with s/w.
10. Surface Roughness tester.
12. Robot workcell design, programming and simulation software for different manufacturers of robots.

MF7612 CREATIVE AND INNOVATIVE PROJECT L T P C 0 0 4 2

The goal of this course is to help students to identify innovative projects that promote creativity to explore the variables that affect creativity and innovation. By the end of the period, students should be familiar with current thinking in their field, and able to apply the concepts to relevant research problems or practical applications.

The goal of this course is to drive them to learn concepts, models, frameworks, and tools that engineering graduates need in a world where creativity and innovation is fast becoming a precondition for competitive advantage. Each student will choose a nagging workplace problem or socially relevant problems that have been difficult for them to solve. At the end of the semester, each or group of students have to submit a report for evaluation.

TOTAL: 60 PERIODS

ME7354 MECHATRONICS L T P C 3 0 0 3

OBJECTIVE:
- To impart knowledge about the elements and techniques involved in Mechatronics systems in understanding the concept of automation.

UNIT I INTRODUCTION

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

OUTCOME:
- Upon completion of this course, the students will be able to design Mechatronics systems with the help of Microprocessor, PLC and other Electrical and Electronics Circuits.
ME 7751

FINITE ELEMENT ANALYSIS

L T P C
3 0 0 3

OBJECTIVES:
- To introduce the concepts of Mathematical Modeling and numerical solution of engineering problems.
- To appreciate the use of Finite Element Method to a range of engineering problems.

UNIT I
INTRODUCTION
9

UNIT II
ONE-DIMENSIONAL PROBLEMS
9

UNIT III
TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS
9

UNIT IV
TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS
9

UNIT V
ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS
9
Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric...

TOTAL:45 PERIODS

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

- Understand the use of the FEM to solve problems in Mechanical Engineering.
- Use the Finite Element Method to solve Structural, thermal and Eigen value problems.

TEXT BOOKS:

REFERENCES:

MF7701 COMPUTER INTEGRATED PRODUCTION MANAGEMENT

OBJECTIVE:

- The course provides basic concepts of production planning and control, its bottlenecks, material requirement planning, shop floor control and different approaches to computer aided process planning in manufacturing sector.

UNIT I MANUFACTURING PLANNING AND CONTROL

Basic concepts - Types of production System - Functions of production planning and control – problems with Production Planning and Control – Computer Integrated Production Management System - Evolution of the MPC system-Demand management in MPC system and the MPC Environment: Make-to-stock, Assembly - to - order, Make - to –order, Engineer- to-order.

UNIT II FORECASTING


UNIT III MATERIAL REQUIREMENT PLANNING

UNIT IV  COMPUTER AIDED PROCESS PLANNING

UNIT V  SHOP FLOOR CONTROL

OUTCOMES:
At the end of this course the students are expected
- To familiarize the students with computer application in various activities of manufacturing, production and control system.
- To apply appropriate principles and strategies of planning and control, forecasting, material requirement planning, process planning concepts and shop floor control into computer integrated manufacturing system.

TEXT BOOKS:

REFERENCES:

ONLINE COURSE MATERIALS:
1. Course Material from NPTEL: http://nptel.ac.in/courses/112102101/
OBJECTIVES:
- To develop codes for the microprocessor, microcontroller and PLC.
- To gain knowledge about the various types of sensors and signal conditioning units.
- To interface the I/O devices with microprocessor, microcontroller and PLC.
- To understand the method of actuating and controlling the speed of electrical and mechanical drives.
- To understand image processing techniques and DAQ system.

LIST OF EXPERIMENTS:
1. Experimental study of basic Signal Conditioning Circuits.
3. Experiments on application of LDR, Optocoupler, Ultrasonic and Infrared sensors.
4. Modelling and Analysis of basic Hydraulic, Pneumatic and Electro-Pneumatic Circuits using Simulation Software.
5. Actuation of Hydraulic, Pneumatic and Electro-Pneumatic circuits.
6. Application of PLC with Timers and Counters.
7. Solving basic Arithmetic Problems using 8085 Microprocessor and 8051 Microcontroller.
9. Speed and Direction Control of DC drives by Microcontroller.
10. Speed Control of AC drives by Microcontroller.
11. Stepper Motor Actuation and Control.
13. Actuation of Double-Acting Cylinder by Microcontroller and PLC.
17. Control of Robotic Actuation by Microcontroller.

TOTAL: 60 PERIODS

OUTCOME:
Upon completion of this course, the students will be able to:
- Have hands-on experience with sensors, actuators and controllers which are commonly used in Mechatronics systems.

OBJECTIVE:
- The main objective of the Industrial Training is to experience and understand real life situations in industrial organizations and their related environments and accelerating the learning process of how student's knowledge could be used in a realistic way.

DURATION:
The students have to undergo practical industrial training for four weeks (During Sixth 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 Seventh Semester

OUTCOME:
At the end of the course the student will be able to understand the different forms of organization, functions of management, organizational behavior, group dynamics and modern concepts in industrial management.

MF7811 PROJECT WORK

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

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.

TOTAL: 300 PERIODS

OUTCOME:
On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

GE7071 DISASTER MANAGEMENT

OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity
UNIT I INTRODUCTION TO DISASTERS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies

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

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

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

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

TEXTBOOK:

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

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

UNIT I


UNIT II


UNIT III

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

UNIT IV

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V


OUTCOME:

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

REFERENCES:


AIM

- To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand 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

UNIT III TQM TOOLS & TECHNIQUES I

UNIT IV TQM TOOLS & TECHNIQUES II

UNIT V QUALITY MANAGEMENT SYSTEM

OUTCOMES:
- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

REFERENCE:
ME7072  COMPUTATIONAL TECHNIQUES FOR FLUID DYNAMICS  L  T  P  C
3  0  0  3

OBJECTIVES:

- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence in solving complex problems in the field of fluid flow and heat transfer by using high speed computers.

UNIT I  GOVERNING EQUATIONS AND BOUNDARY CONDITIONS  9

UNIT II  FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION  9

UNIT III  FINITE VOLUME METHOD FOR CONVECTION DIFFUSION  9
Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT IV  FLOW FIELD ANALYSIS  9

UNIT V  TURBULENCE MODELS AND MESH GENERATION  9

TOTAL:45 PERIODS

OUTCOMES:

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

- Create numerical models and their role in the field of fluid flow and heat transfer
- Use the various discretization methods, solution procedures and turbulence models to solve flow and heat transfer problems.

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To understand the design constraints in manufacturing and assembly operations.

UNIT I  INTRODUCTION AND CASTING  9
Introduction - Economics of process selection - General design principles for manufacturability; Design considerations for: Sand cast – Die cast – Permanent mold cast parts.

UNIT II  FORMING  9
Design considerations for: Metal extruded parts – Impact/Cold extruded parts – Stamped parts – Forged parts.

UNIT III  WELDING  9

UNIT IV  MACHINING  9
Design considerations for: Turned parts – Drilled parts – Milled, planed, shaped and slotted parts – Ground parts.

UNIT V  ASSEMBLY  9

OUTCOME:
Upon completion of this course, the students will be able to:
- Gain technical competency in design modification of components / products with respect to manufacturability.

TEXT BOOK:

REFERENCES:
UNIT II MOTIVATION

UNIT III BUSINESS

UNIT IV FINANCING AND ACCOUNTING

UNIT V SUPPORT TO ENTREPRENEURS

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

ME 7081 PROCESS PLANNING AND COST ESTIMATION

OBJECTIVE:
- To give an understanding of the fundamentals of Process Planning and estimation of appropriate costs of processes and products and applying these to manage competitive manufacturing systems and organisations.

UNIT I INTRODUCTION TO PROCESS PLANNING
Aims and Objectives, Place of process planning in Manufacturing cycle, Drawing interpretation, Dimensional tolerance vs Production processes.

UNIT II PROCESS PLANNING STEPS
Design of a process plan – Selection of production processes, tools and process parameters- Positioning and work holding devices, Selection of inspection devices and tools, Documenting the process plan, Simple Case studies.
UNIT III INTRODUCTION TO COST ESTIMATION
Importance, Types, Purpose, Components, Procedure, Classification of costs, Cost elements, Overhead expenses, Break-even analysis.

UNIT IV PRODUCTION COST ESTIMATION
Estimation of production cost for - Casting processes, Welding processes, and Forging processes.

UNIT V ESTIMATION OF MACHINING TIME AND COST
Estimation of Machining time – Lathe operations, Drilling, Milling, Shaping and Planing, and Grinding, Cost estimation for machining processes.

OUTCOME:
Upon completion of this course, the students will be able to:
- Make logical, rational and economical process plans and realistic cost estimates of Components and Products.

TEXT BOOKS:

REFERENCES:

ME 7082 PRODUCT DESIGN AND DEVELOPMENT

OBJECTIVES:
- To understand the basic concepts of Product Design and Process Development.
- To appreciate the importance, various stages, concepts, management and prototyping of products.

UNIT I INTRODUCTION

UNIT II PRODUCT PLANNING, IDENTIFYING CUSTOMER NEEDS, PRODUCT SPECIFICATION
Product Planning Process: Identification of opportunities; evaluation and prioritization of projects; allocation of resources & plan timing; completion of pre-project planning. Identification of Customer Needs: Collection of raw data from customers; interpretation of raw data of customer needs; organization of the needs into a hierarchy; establishment of relative importance of needs. Product Specifications: Establishment of Target Specifications, Setting-up of Final Specifications.
UNIT III CONCEPT GENERATION, SELECTION, TESTING
Concept Generation: clarification of the problem; searching externally; searching internally, systematic exploration. Concept Selection: concept screening steps; concept scoring steps. Concept Testing: Defining the purpose of concept test; choosing a survey population; format; communicating the concept; measuring the customer response; interpretation of results.

UNIT IV PRODUCT ARCHITECTURE, INDUSTRIAL DESIGN, DESIGN FOR MANUFACTURE

UNIT V PROTOTYPING AND MANAGING PRODUCTS

OUTCOME:
Upon completion of this course, the students will be able to:
- Launch own ideas and the ideas of others, which would enable them to manage to work with innovation and development in large companies
- Apply new theories on innovation and change, including emerging paradigms such as user-driven innovation, open innovation and market forecasting in practice.

TEXT BOOK:

REFERENCES:
UNIT II MECHANICS, SCALING AND DESIGN

UNIT III MICRO SYSTEM FABRICATION PROCESSES

UNIT IV TOOL BASED MICROMACHINING

UNIT V MICROSYSTEMS PACKAGING AND METROLOGY OF MICRO MACHINED COMPONENTS

OUTCOMES:
At the end of this course
• The student will be able to understand various MEMS techniques.
• Use this knowledge to design MEMS.
• Use this knowledge to measure MEMS components.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To understand the basics of Nanostructured coatings.
- To understand about different coating methods and characterization of nanocoatings.
- To understand the properties change due to coatings and also the applications.

UNIT I \ INTRODUCTION TO NANOSTRUCTURED COATING 9
Introduction of Nanotechnology - Production of Nanoparticles - Applications of Nanoparticles - Thin Films - Significance of Thin Films - Production of Thin Films - Applications of Thin films - Coating and Surface Engineering - Coating Issues and Applications.

UNIT II \ NANOSTRUCTURED COATINGS 9

UNIT III \ CHARACTERISATION OF NANOCOATINGS 9

UNIT IV \ PROPERTIES OF NANOSTRUCTURED COATINGS 9

UNIT V \ APPLICATIONS OF NANOCOATINGS 9
Surface Improvement for Making Fog and Vapor Resistant Layers - Self-Cleaning Glasses - Medical and Hygienic Applications - Food Packaging - Electrical and Electronic Applications - Lubricating Applications - Automobile industries - Defence applications.

TOTAL: 45 PERIODS

OUTCOMES:
- Will familiarize about the science of nanocoatings
- Will demonstrate the preparation of nanocoatings.
- Will develop knowledge in characteristic nanocoatings.

TEXT BOOKS:

REFERENCE:
OBJECTIVE:
• To make students to understand various Non Destructive testing methods including advanced techniques, with emphasis on basic principles, limitations and application areas.

UNIT I INTRODUCTION
Visual methods: Optical aids - In-situ metallography - Optical holographic methods - Dynamic inspection.

UNIT II LIQUID PENETRANT & MAGNETIC INSPECTION

UNIT III RADIOGRAPHIC METHODS

UNIT IV ULTRASONIC TESTING OF MATERIALS

UNIT V ELECTRICAL AND OTHER METHODS

OUTCOMES:
At the end of this course the student will be able to:
• Choose the right method of testing for detection of defects on various materials.
• Will understand to operate advanced NDT instruments and equipments easily.
• They will know the safety procedures of operating the NDT equipments and follow them.
• They will exploit the advantages of NDT in industrial applications for the benefit of the society.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- At the end of the course the student should be able to understand the theory of plasticity and the advances in metal forming.

UNIT I FUNDAMENTALS OF ELASTICITY 9
Brief review of elasticity- Octahedral normal and shear stresses-Spherical and deviatomic stress. Invariance in terms of the deviatoric stresses- Representative stress. Idealised stress-strain diagrams for different material models, Engineering and natural strains, Mathematical relationships between true stress and true strains, Cubical dilation, finite strains coefficients Octahedral strain, Strain rate and the strain rate tensor.

UNIT II YIELD CRITERIAS 9
Yield criteria for ductile metal, Von Mises, Tresca, Yield surface for Isotropic Plastic materials, Stress space, Experimental verification of Yield criteria, Yield criteria for an anisotropic material.

UNIT III STRESS STRAIN RELATIONS 9
Stress - Strain Relations, Plastic stress-strain relations, Prandtl Roeuss Saint Venant, Levy - Von Mises, Experimental verification of the Prandtl-Rouss equation, Yield locus, Symmetry convexity, Normality rule., Upper and lower bound theorems and corollaries.

UNIT IV APPLICATION TO PROBLEMS 9
Uniaxial tension and compression, bending of beams, Torsion of rods and tubes, Simple forms of indentation problems using upper bounds. Problems of metal forming - Extrusion, Drawing, Rolling and Forging.

UNIT V SLIP LINE THEORY 9
Introduction, Basic equations for incompressible two dimensional flows, continuity equations. Stresses in conditions of plain strain convention for slip-lines, Geometry of slip lines, Properties of slip lines.

OUTCOME:
- At the end of the course the student will be able to apply and compare and analysis different metal forming concepts in bulk forming and sheet metal forming process by applying theory of plasticity.

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- To provide and enhance the technical knowledge in precision engineering, its components and applications.

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.,

OUTCOMES:
On Completion of the course, Students will:
- Operate high precision machineries with ease.
- Research and explore new areas of cutting tools.

TEXT BOOKS:

REFERENCE:

OBJECTIVE:
The purpose of this subject is to equip the students with the knowledge of processes utilized in developing materials or making components using plastics and composite materials. This subject develops the competence of the students in major industrially practiced processing techniques.
UNIT I  INTRODUCTION TO PLASTICS AND COMPOSITE 9

UNIT II  PROCESSING OF PLASTICS 9

UNIT III  PROCESSING OF POLYMER MATRIX COMPOSITES 9
Open Mould Processes, Bag Moulding, Compression Moulding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting - Injection Moulding - Application of PMC’s.

UNIT IV  PROCESSING OF METAL MATRIX COMPOSITES 9

UNIT V  PROCESSING OF CERAMIC MATRIX COMPOSITES 9
Coldpressing and sintering - hot pressing-reaction bonding processes - Liquid infiltration - Lanxide process - In situ chemical reaction techniques: chemical vapour infiltration - chemical vapour deposition-Reactive consolidation - sol - gel techniques - pyrolysis - self propagating high temperature synthesis - Electropherotic deposition - Application of CMC’s.

TOTAL: 45 PERIODS

OUTCOMES:
- The students will be able to identify various processing methods used for different types of plastics used in our daily life.
- This subject induces the students to do project work in the area of composite materials.

TEXT BOOKS:

REFERENCES
OBJECTIVES:
• Teach the essentiality of SQC, sampling and reliability engineering. Study on various types of control charts, six sigma and process capability to help the students understand various quality control techniques.
• Reliability engineering focuses on the dependability, failure mode analysis, reliability prediction and management of a system.

UNIT I  STATISTICAL QUALITY CONTROL
Quality as a competitive priority - Methods and Philosophy of Statistical Process Control - Control Charts for Variables and Attributes - Cumulative sum and Exponentially weighted moving average control charts - Other SPC Techniques - Process - Capability Analysis - Six sigma concept.

UNIT II  ACCEPTANCE SAMPLING
Reasons for acceptance sampling - Acceptance Sampling Problem - Single sampling plans for attributes - double sampling - multiple sampling - sequential sampling - Military standards - The Dodge Roming sampling plans - Random sampling

UNIT III  RELIABILITY ENGINEERING
Definition of reliability - Performance and reliability - Reliability requirements - System life cycle - Mean time between failures - Mean time to failure - Mortality Curve - Availability - Maintainability.

UNIT IV  FAILURE DATA ANALYSIS

UNIT V  RELIABILITY PREDICTION AND MANAGEMENT

OUTCOMES:
At the end of this course the student will be able to:
• Know and apply various quality tools to tackle dynamic industrial situations.
• Give a quality index to an industrial situation following an engineering approach.
• Estimate process capability and take remedial actions at the right time to have the processes under control.
• Understand reliability, various modes of failures, maintenance, replacement of machineries and equipments at the right time and be instrumental in enriching the industrial culture with quality policy leading to higher productivity.

TEXT BOOKS:

REFERENCES:

MF7008 RENEWABLE ENERGY SOURCES

AIM:
- To instruct the importance of renewable energy and its utilization for the thermal and electrical energy needs and also the environmental aspects of these resources.

OBJECTIVE:
- At the end of the course, the student expected to understand and analyze the pattern of renewable energy resources Suggest methodologies / technologies for its utilization. Economics of the utilization and environmental merits

UNIT I SOLAR ENERGY

UNIT II WIND ENERGY

UNIT III BIO - ENERGY

UNIT IV OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY
Tidal energy - Wave energy - Data, Technology options - Open and closed OTEC Cycles - Small hydro, turbines - Geothermal energy sources, power plant and environmental issues.

UNIT V NEW ENERGY SOURCES
Hydrogen, generation, storage, transport and utilisation, Applications: power generation, transport - Fuel cells - technologies, types - economics and the power generation.

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVE:
- To impart knowledge on sustainable manufacturing, polices, best practices for sustainable manufacturing, lean manufacturing, green energy, sustainable machinery, energy consumption, hazardous management and recyclability.

UNIT I SUSTAINABLE MANUFACTURING AND POLICIES

UNIT II SUSTAINABILITY MANUFACTURING BEST PRACTICES
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

OUTCOMES:
At the end of this course the student will be able
- To impart best practices for sustainable manufacturing in industries, understand polices for sustainable manufacturing.
- Understand concepts in lean manufacturing, green energy, sustainable machinery, energy consumption, hazardous management and recyclability.

TEXT BOOKS:
REFERENCES:

MF7010 SYSTEM SIMULATION

OBJECTIVES:
• To understand the importance and advantages 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. Development of simulation models, verification, validation and analysis. Introduction to various simulation languages and comparison.

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 – development of models using higher level languages for systems like queuing, production, inventory and maintenance – output analysis and interpretation, validation.

UNIT IV DISCRETE SYSTEM SIMULATION LANGUAGES
Need for simulation language - Comparison of simulation languages: SIMSCRIPT, GASP, SIMULA, GPSS, PROMODEL, EXTEND, ARENA and FLEXSIM.

UNIT V QUEUING POLICIES, ALGORITHMS AND CASE STUDIES
Introduction to basic Single - pass heuristics, meta-heuristics and applications - Application of Genetic algorithms and Ant colony based algorithms in Discrete event simulation models with simple examples. Development of simulation models using the simulation language studies for

TOTAL : 45 PERIODS

OUTCOMES:
- The student will be able to understand industrial scenarios, involve in intelligent questioning sessions with experts to get clear insight about the problem and build an appropriate simulation model.
- The students can understand the type of model to be built suiting to the industrial situation and choose right measures of performances for evaluation and analysis.
- They can justify their findings with statistical analysis and successfully compromise the management in implementing their proposed ideas and produce results.
- Students can easily understand simulation models developed in other simulation software and involve in expert suggestions to improvise the same.
- They can teach simulation situations through their own models and show the effects of altering them.

TEXT BOOK:

REFERENCES:

WEB REFERENCE BOOKS:

MF7011 THEORY OF METAL CUTTING L T P C 3 0 0 3

OBJECTIVES:
- To learn tool nomenclature, mechanical of metal cutting and forces in metal cutting.
- To know the thermal aspects in machining, tool materials, tool life and wear mechanisms

UNIT I TOOL NOMENCLATURE
Single point tool-nomenclature significance of the various angles provided and nose radius-American, German CIRP and orthogonal system of tool nomenclature, nomenclature of drills, milling cutters and broaches-grinding wheels, Need for chip breakers.

UNIT II MECHANICS OF METAL CUTTING
Mechanisms of formation of chips-types of chips and the conditions conducive for the formation of each type built-up edge, its effects orthogonal Vs oblique cutting - Merchant’s circle diagram-Force and Velocity relationship, shear plane angle. Energy considerations in matching-Ernst Mechant's theory of shear angle relationship-original assumption and modifications made.

UNIT III FORCES IN MACHINING
Forces in turning, drilling, milling and grinding, conventional Vs climb milling-mean and maximum cross sectional areas of chip in milling-specific cutting pressure-specific horse power-requirements of tool dynamometers-construction and principle of operation of tool dynamometers for turning, drilling and milling.

UNIT IV THERMAL ASPECTS IN MACHINING
Sources of heat generation in machining-temperature measurement techniques in machining, Functions of cutting fluid-characteristics of cutting fluid-types, modes of applications, additives-application of cutting fluids- dry machining, Minimum Quantity Lubrication (MQL) machining.
UNIT V  TOOL MATERIALS, TOOL WEAR AND TOOL LIFE

Requirements of tool materials - advances in tool materials - HSS, coated HSS, carbides and coated carbides, ceramic, cold pressed, hot pressed, ceramic composites, CBN, PCD, properties, advantages and limitations - ISO specifications for inserts and tool holders, tool wear, type mechanisms, tool life, machinability, economics of machining, chatter in machining.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of this course
- The student will be able to understand various tool nomenclatures.
- Use this knowledge to calculate forces in machining.
- Use this knowledge for the selection of tools for various machining operations.

TEXTBOOKS:

REFERENCES:

MF7012  VALUE ENGINEERING AND RE ENGINEERING  L T P C
3 0 0 3

OBJECTIVES:
- To understand and analyze the theory and methodology of Value Engineering with the Guidelines, Performa and Checklist for a systematic, step by step application of the technique to the current industrial problems.
- To provide the knowledge about Reengineering Principles, the various models and implementation method, which are adopted in the industry.

UNIT I  FUNDAMENTALS OF VALUE ENGINEERING
Value Types - How to add value job plan - Technique employed - Selection of project and team members - Value Engineering Job Plan - Benefits - Audit.

UNIT II  VALUE ENGINEERING AND JOB PLAN

UNIT III  REENGINEERING PRINCIPLES
UNIT IV REENGINEERING PROCESS IMPROVEMENT MODELS 9

UNIT V IMPLEMENTATION OF REENGINEERING 9
Process analysis techniques - Work flow analysis - Value analysis approach - Nominal group technique - Fish bone diagram - Pareto analysis - team building - Force field analysis - Implementation.

TOTAL: 45 PERIODS

OUTCOMES:
• The student will be able to practice the principles of value manufacturing
• This domain knowledge will help them to systematically doing value analysis
• The students will understand Systematic starting over and reinventing the way a firm, or a business process

TEXT BOOKS:

REFERENCE:

MF7071 ADDITIVE MANUFACTURING TECHNOLOGY L T P C 3 0 0 3

OBJECTIVES:
• To know the principle, methods, possibilities and limitations as well as environmental effects of Additive Manufacturing technologies.
• To be familiar with the characteristics of the different materials those are used in Additive Manufacturing technologies.

UNIT I INTRODUCTION 9

UNIT II DESIGN FOR ADDITIVE MANUFACTURING 9

UNIT III PHOTOPOLYMERIZATION AND POWDER BED FUSION PROCESSES 9

UNIT IV EXTRUSION BASED AND SHEET LAMINATION PROCESSES 9
UNIT V	PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES


TOTAL: 45 PERIODS

OUTCOME:

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

TEXT BOOKS:


REFERENCES:


MF7072 ELECTRONIC MATERIALS AND PROCESSING

OBJECTIVES

- To describe the basic processes of materials that are used to fabricate semiconductor and MEMS devices.
- To learn the thermal considerations of electronic materials.

UNIT I INTRODUCTION

Overview of semiconductors and other basic materials - Plastics, Elastomers, and Composites - tables with material properties, terms and definitions, trade names, and material structure correlation, basic electronic components and its metallurgical structure. Carrier generation and recombination; junctions; photovoltaic materials and devices.

UNIT II ORGANIC MATERIALS AND PROCESSES

Types and properties of organic materials, manufacturing technique –Vacuum Metallization, Vapour phase deposition, Thermal Imaging, Digital Lithography, Application areas.

UNIT III MEMS MATERIALS AND PROCESS

MEMS design process- Methods, Selection of materials for process, Optimization techniques in design, Over view of additive process of Semiconductors, Dielectric materials, Metals, and Polymer Materials, Piezoelectric materials, Shape memory alloys , Micromachining techniques, packaging methods.
UNIT IV MATERIALS SYSTEMS

UNIT V THERMAL MANAGEMENT OF MATERIALS AND SYSTEMS
Temperature effects on circuit operation and physical construction. Laws of heat transfer mechanism and their considerations in the manufacturing process. Thermal management in packaging of electronic materials

OUTCOME:
• Students will be familiar about the electronics material characteristics, and preparation and production process.

TEXT BOOKS:

REFERENCES:

MF7073 ELECTRONICS MANUFACTURING TECHNOLOGY

OBJECTIVES:
• To understand wafer preparation and PCB fabrication, the types of Mounting Technologies and components for electronics assembly & SMT process in detail.
• To know various Defects, Inspection Equipments SMT assembly process and repair, rework and quality aspects of Electronics assemblies.

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

UNIT II COMPONENTS AND PACKAGING
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 PROCESS
Introduction to the 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, throughput, packaging of components for automated assembly, Cp and Cpk and process control. Soldering- reflow process, process parameters, profile generation and control, solder joint metallurgy, adhesive, underfill and encapsulation process - applications, materials, storage and handling, process and parameters.

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

UNIT V       REPAIR, REWORK, QUALITY AND RELIABILITY OF ELECTRONICS ASSEMBLIES
Repair tools, methods, rework criteria and process, thermo-mechanical effects and thermal management, Reliability fundamentals, reliability testing, failure analysis, design for manufacturability, assembly, rework ability, testing, reliability, and environment.

OUTCOMES:
• Perform fabrication of PCBs and use of mounting technology for electronic assemblies.
• Perform quality inspection on the PCBs

TEXTBOOKS:

REFERENCES:

MF7074       FLEXIBLE MANUFACTURING SYSTEMS
OBJECTIVES:
• To understand the Modern manufacturing systems
• To understand the concepts and applications of flexible manufacturing systems

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UNIT I PLANNING, SCHEDULING AND CONTROL OF FLEXIBLE MANUFACTURING SYSTEMS 9
Introduction to FMS - development of manufacturing systems - benefits - major elements of FMS - types of flexibility - FMS application and flexibility –single product, single batch, n - batch scheduling problem - knowledge based scheduling system.

UNIT II COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING SYSTEMS 9
Introduction - composition of FMS - hierarchy of computer control - computer control of work center and assembly lines - FMS supervisory computer control - types of software specification and selection - trends.

UNIT III FMS SIMULATION AND DATA BASE 9

UNIT IV GROUP TECHNOLOGY AND JUSTIFICATION OF FMS 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 APPLICATIONS OF FMS AND FACTORY OF THE FUTURE 9
FMS application in machining, sheet metal fabrication, prismatic component production - aerospace application - FMS development towards factories of the future - artificial intelligence and expert systems in FMS - design philosophy and characteristics for future.

TOTAL: 45 PERIODS

OUTCOME:
• Ability to perform Planning, Scheduling and control of Flexible Manufacturing systems
• Perform simulation on software's use of group technology to product classification.

TEXT BOOK:

REFERENCES:

MF7075 INDUSTRIAL ROBOTICS

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

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

UNIT III  SENSORS AND MACHINE VISION  

UNIT IV  ROBOT KINEMATICS  
Forward Kinematics and Inverse Kinematics, Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 & 3 Dimension), Co-ordinate reference frame, Velocity and Forces - Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design - Derivations and problems.

UNIT V  ROBOT PROGRAMMING AND ROBOT ECONOMICS  
Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effectors commands and simple Programs. RGV, AGV: Implementation of Robots in Industries - Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

OUTCOMES:
• Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
At the end of this course the students are expected to understand the general issues relating to nanotechnology and nanofabrication.
- Methods for production of Nanomaterials.
- Characteristic techniques of Nanomaterials.

UNIT I    INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY   9
History, background scope and interdisciplinary nature of nanoscience and nanotechnology, scientific revolutions. Definition of Nanometer, Nanomaterials, and Nanotechnology. Concepts of nanotechnology - size dependent phenomena, surface to volume ratio, atomic structure, molecules and phases, energy at the nanoscale molecular and atomic size.

UNIT II    SYNTHESIS NANOMATERIALS AND PROCESSING OF NANOMATERIALS BY PHYSICAL METHODS   9

UNIT III    PROCESSING OF NANOMATERIALS BY CHEMICAL METHODS  9
Chemical precipitation methods - co-precipitation, arrested precipitation, sol - gel method, chemical reduction, photochemical synthesis, electrochemical synthesis, Microemulsions or reverse micelles, Sonochemical synthesis, Hydrothermal, solvothermal, supercritical fluid process, solution combustion process, spray pyrolysis method, flame spray pyrolysis, gas phase synthesis, gas condensation process, chemical vapor condensation. Fundamental aspects of VLS (Vapor-Liquid-Solid) and SLS (Solution-Liquid-Solid) processes - VLS growth of Nanowires - Control of the size of the nanowires - Precursors and catalysts - SLS growth - Stress induced recrystallization.

UNIT IV   LITHOGRAPHY  9

UNIT V   CHARACTERISATION OF NANOMATERIALS  9

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course
- The student will be able to produce nanomaterials using various techniques.
- Use this knowledge to characterize nanomaterials.
- Use this knowledge to fabricate nano-scaled products.
TEXT BOOKS:

REFERENCES:
6. Processing & properties of structural Nanomaterials by Leon L. Shaw (editor).
7. Chemistry of Nanomaterials : Synthesis, properties and applications by CNR Rao et.al.

MF7077 TOTAL PRODUCTIVE MAINTENANCE L T P C
3 0 0 3

OBJECTIVE:
- To teach the students basic concepts of Total Productive Maintenance. Expose the students to the objectives, maintenance models, group activities, logistics, condition monitoring and implementation of Total Productive Maintenance.

UNIT I MAINTENANCE CONCEPTS
Introduction - 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
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
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
Human factors in maintenance - maintenance manuals - maintenance staffing methods - queuing applications - simulation - spare parts management - maintenance planning and scheduling.

UNIT V ONLINE MONITORING

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

TEXT BOOKS:

REFERENCES:

ML7751 SURFACE ENGINEERING

OBJECTIVE
- The subject provides knowledge on various types of corrosion, their kinetics, testing and methods of protection as well as introduction to tribology.

UNIT I INTRODUCTION
Introduction to tribology, surface degradation, wear and corrosion, types of wear, adhesive, abrasive, oxidative, corrosive, erosive and fretting wear, roles of friction and lubrication-, expressions for corrosion rate. emf and galvanic series - merits and demerits -Pourbaix diagram for iron, magnesium and aluminium. Forms of corrosion - Uniform, pitting, intergranular, stress corrosion, corrosion fatigue, dezincification. erosion corrosion, crevice corrosion - Cause and remedial measures - Pilling Bedworth ratio - High temperature oxidation-Hydrogen embrittlement-Remedial Measures.

UNIT II KINETICS OF CORROSION
Exchange current density, polarization - concentration, activation and resistance, Tafel quation; passivity, electrochemical behaviour of active/passive metals, Flade potential, theories of passivity, Effect of oxidising agents

UNIT III CORROSION OF INDUSTRIAL COMPONENTS
Corrosion in fossil fuel power plants, Automotive industry, Chemical processing industries, corrosion in petroleum production operations and refining, Corrosion of pipelines.
UNIT IV TESTING
Purpose of corrosion testing - Classification - Susceptibility tests for intergranular corrosion - Stress corrosion test. Salt spray test humidity and porosity tests, accelerated weathering tests. ASTM standards for corrosion testing and tests for assessment of wear.

UNIT V PROTECTION METHODS
Organic, Inorganic and Metallic coatings, Electroless plating and Anodising - Cathodic protection, corrosion inhibitors - principles and practice - inhibitors for acidic neutral and other media. Special surfacing processes - CVD and PVD processes, sputter coating. Laser and ion implantation, Arc spray, plasma spray, Flame spray, HVOF.

OUTCOME
- Ability to control the factors that affect the metal corrosion.
- Ability to measure the corrosion rate.
- Ability to prevent corrosion by coatings and inhibitors, etc.

TEXT BOOKS

REFERENCES

PR7021 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT

OBJECTIVE:
- To introduce the concepts of economics as applied to Engineering and Management of Finance in business.

UNIT I FINANCIAL ACCOUNTING

UNIT II PROFIT VOLUME ANALYSIS

UNIT III WORKING CAPITAL MANAGEMENT
Current assets and liability decisions – Estimation of working capital requirements – Management of accounts receivable – Inventory – Cash – Inventory valuation methods.

UNIT IV CAPITAL BUDGETING
Significance of capital budgeting – payback period – present value method – Accounting rate of return method.
UNIT V ENGINEERING ECONOMICS 9

TOTAL: 45 PERIODS

OUTCOME:
The student will be understand economics, financial issues and management of industry.

TEXT BOOKS:

REFERENCES:

PR7651 PRODUCTION OF AUTOMOTIVE COMPONENTS L T P C
3 0 0 3

OBJECTIVES:
• To impart knowledge in various manufacturing methods in developing automotive components.
• To study the principle of automobile engineering.

UNIT I ENGINE 9
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 PARTS 9
Working principle of crank shaft – Cam shaft – valve operating mechanisms – carburetors - spark plug Production of Connecting rod , Crankshaft , push rod and rocker arm ,valves, tappets , carburetors and spark plugs.

UNIT III FUEL AND TRANSMISSION SYSTEM 9

UNIT IV CHASSIS AND SUSPENSION SYSTEM 9
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 ADVANCES 9

TOTAL: 45 PERIODS
OUTCOME:
- The students shall have knowledge of production of various automotive components.

TEXT BOOKS:

REFERENCES:

GE7072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

OBJECTIVES:
- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT

UNIT II REQUIREMENTS AND SYSTEM DESIGN

UNIT III DESIGN AND TESTING

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

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9

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

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

REFERENCES: