B.E. MECHANICAL ENGINEERING

CURRICULUM

(2018 AND ONWARDS)

(REGULAR PROGRAMME)

Department of Mechanical Engineering
FACULTY OF ENGINEERING

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
Established Under Section 3 of UGC Act 1956
Pollachi Main Road, Eachanari Post, Coimbatore – 641 021.INDIA
## KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University Established Under Section 3 of UGC Act, 1956)
Eachanari Post, Coimbatore-641021. Tamilnadu, India.

**FACULTY OF ENGINEERING**

**B.E. (MECHANICAL ENGINEERING)**

### COURSE OF STUDY AND SCHEME OF EXAMINATION
(2018 Batch Onwards)

### SEMESTER I

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### PROFESSIONAL ELECTIVE IV

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### PROFESSIONAL ELECTIVE VI

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### SCIENCE & HUMANITIES

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### ELECTRICAL AND ELECTRONICS ENGINEERING

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### ELECTRONICS AND COMMUNICATION ENGINEERING

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### BIOTECHNOLOGY

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### AUTOMOBILE ENGINEERING

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**Total number of credits: 171**

PEO: Programme Educational Objectives  
PO: Programme Outcomes  
L: Lecture Hour  
T: Tutorial Hour  
CIA: Continuous Internal Assessment  
P: Practical Hour  
C: No. of Credits  
ESE: End Semester Examinations  

**Note:**  
1. The passing minimum for Mandatory course is 50 marks out of 100 marks. There will be two tests, of which one will be class test covering 50% of syllabus for 50 marks and other for 50 marks.  
2. Credits for mandatory courses are not counted for computation of CGPA.  
3. A student will be eligible to get Under Graduate degree with Honors or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs.

**Programme Educational Objectives (PEO’s)**

- 1: Graduates will more conscious about their profession with social awareness and responsibility.  
- 2: Graduates will be engineering experts, who would help solve industry’s technological problems.  
- 3: Graduates will be engineering professionals, consultants or entrepreneurs engaged in technology development.  
- 4: Graduates will interact with their peers in other disciplines in industry and society and contribute to the economic growth of the country.

**Programme Outcomes (PO’s)**

- 1: Ability to apply knowledge of mathematics and science in solving engineering problems.
• 2: In-depth knowledge on the fundamental principles, construction and auxiliary systems of mechanical sciences.
• 3: To understand the principles involved in evaluating the structural, functional and safety requirements of mechanical systems.
• 4: Hands on knowledge to develop analytical skills for designing and analyzing various mechanical components and processes.
• 5: To understand and apply appropriate techniques and IT tools for the design and analysis of mechanical systems.
• 6: Understanding the mechanism of pollutant formation and its control techniques.
• 7: Understanding of human and ethical responsibilities towards the profession and society.
• 8: Ability to understand the economics and cost analysis in order to take economically sound decisions.
• 9: Ability to apply modern techniques and tools necessary for engineering practice with appropriate considerations for public health, safety, cultural and environmental limitations.
• 10: Understand the impact of engineering solutions in a societal context and to be able to respond effectively to the needs for sustainable development.
• 11: Function effectively as an individual, and as a member or a leader in diverse teams, and in multi-disciplinary situations.
• 12: To recognize the need for, and have the ability to engage in independent and lifelong learning.

Programme Specific Outcomes (PSO’s)

• 13: Ability to design a mechanical system, component, or process to meet desired needs of the nation, industries, institutions within realistic constraints such as economic, environmental, social, political, ethical, health care, and safety, manufacturability, and sustainability.
• 14: Ability to develop and use of software tools and Information Technology for mechanical engineering domain.
• 15: Ability to perform effectively first level managerial responsibilities for large or medium engineering organizations.

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SEMESTER I

18BEME101 MATHEMATICS I (Calculus and Linear Algebra for Mechanical and Automobile Engineering) 4 H – 4 C

Instruction hours / week L : 3 T : 1 P:0 Marks: Internal : 40 External : 60 Total:100

End Semester Exam :3 Hours

COURSE OBJECTIVES
The objective of this course is
1. To familiarize the prospective engineers with techniques in calculus, and multivariate analysis.
2. To familiarize the prospective engineers with techniques in linear algebra.
3. To equip the students with standard concepts and tools at an intermediate to advanced level.
4. To equip the students will serve them to wards tackling more advanced level of mathematics.
5. To make the students will serve them to find the useful applications in their disciplines.
6. To make the students to solve the real time problems using standard concepts and tools.

COURSE OUTCOMES
The students will learn:
1. To apply differential and integral calculus to notions of curvature and to improper integrals.
2. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
4. To deal with functions of several variables that are essential in most branches of engineering.
5. The essential tool of matrices and linear algebra in a comprehensively manner.
6. Students can solve real time problems using standard concepts and tools.

UNIT I MATRICES
Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation. Simple problems using Scilab.

UNIT II CALCULUS
Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT III CALCULUS
Taylor’s and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

UNIT IV MULTIVARIABLE CALCULUS (DIFFERENTIATION)
Limit, continuity and partial derivatives, directional derivatives, total derivative; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

UNIT V SEQUENCES AND SERIES
Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

SUGGESTED READINGS
COURSE OBJECTIVES
1. To introduce the basic physics concepts relevant to different branches of Engineering and Technology.
2. To acquire the knowledge of Electromagnetic field theory.
3. To make the student to learn scientific, mathematical and engineering principles.
4. To make the students to understand the basics of vacuum science.
5. To make the students to understand the process of production and measurement.
6. To make the students to understand the working of Gauges like Pirani, McLeod and Penning.

COURSE OUTCOMES
1. Formulate potential problems within electrostatics, magneto statics.
2. Formulate stationary current distributions in linear, isotropic media.
3. Acquire knowledge on properties of matter, quantum physics.
4. Understand the basics of vacuum science.
5. Understand the process of production and measurement.
6. Understand the working of Gauges like Pirani, McLeod and Penning.

UNIT I ELECTROSTATICS IN VACUUM
Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace’s and Poisson’s equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction; Practical examples like Farady’s cage and coffee-ring effect. 

UNIT II MAGNETOSTATICS
Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes’ theorem. 

UNIT III PROPERTIES OF MATTER
Elasticity – Three types of modulus of elasticity – basic definitions, relation connecting the moduli (Derivation)-factors affecting elastic modulus and tensile strength– Poisson’s ratio- Torsional pendulum-bending of beams - bending moment – uniform and non-uniform bending - I-shaped girders - stress due to bending in beams.

UNIT IV QUANTUM MECHANICS
Introduction to quantum theory – Black body radiation - dual nature of matter and radiation – de Broglie wavelength, uncertainty principle – Schrödinger’s wave equation – time dependent and time independent equations – particle in one dimensional box- physical significance of wave function, scanning electron microscope.

UNIT V VACUUM SCIENCE
Introduction - Importance of vacuum in industries - Pumping speed and throughput - Types of pumps-Rotary vane type Vacuum pump(oil sealed), Diffusion Pump and Turbo Molecular Pump - Measurement of High Vacuum-McLeod Gauge-Pirani Gauge-Penning Gauge.

SUGGESTED READINGS
COURSE OBJECTIVES
1. To learn the basic concepts in physics relevant to different branches of Engineering and Technology.
2. To study the concept of semiconductor and conductivity.
3. To learn the properties of materials.
4. To learn the basic concept of Numerical Aperture and acceptance angle.
5. To make the students to determination of wavelength using grating.
6. To learn the basic concept about viscosity of liquids.

COURSE OUTCOMES
1. Understand the basic concepts in physics relevant to different branches of Engineering and Technology.
2. Understand the concept of semiconductor and conductivity.
3. Acquire knowledge on the properties of materials.
4. Understand the basic concept of Numerical Aperture and acceptance angle.
5. Understand the students to determination of wavelength using grating.
6. Acquire knowledge on the basic concept about viscosity of liquids.

LIST OF EXPERIMENTS – PHYSICS
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 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. Optical fibre - Determination of Numerical Aperture and acceptance angle
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Determination of Band gap of a semiconductor.
12. Viscosity of liquids-Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow
COURSE OBJECTIVES

1. To impart the basic knowledge about the Electric circuits.
2. To understand the working of Electrical Machines and Transformers.
3. To understand the working of Power Converters and components of low-voltage electrical installations.
4. To understand and analyze basic electric and magnetic circuits.
5. To study the working principles of electrical machines and power converters.
6. To introduce the components of low-voltage electrical installations.

COURSE OUTCOMES

1. Gain the basic knowledge about the Electric circuits.
2. Understand the working of Electrical Machines and Transformers.
3. Understand the working of Power Converters and components of low-voltage electrical installations.
4. Understand and analyze basic electric and magnetic circuits.
5. Acquire knowledge on the working principles of electrical machines and power converters.
6. Understand the components of low-voltage electrical installations.

UNIT I - DCCIRCUITS


UNIT II - ACCIRCUITS

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III - ELECTRICAL MACHINES


UNIT IV - TRANSFORMERS AND POWER CONVERTERS


UNIT V - ELECTRICAL INSTALLATIONS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, RCCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

SUGGESTED READINGS

B. E. Mechanical Engineering

(ii) Laboratory

COURSE OBJECTIVES

1. To impart the basic knowledge about the Electric circuits.
2. To understand the working of Electrical Machines and Transformers.
3. To understand the working of Power Converters and components of low-voltage electrical installations.
4. To understand and analyze basic electric and magnetic circuits.
5. To study the working principles of electrical machines and power converters.
6. To introduce the components of low-voltage electrical installations.

COURSE OUTCOMES

At the end of this course, students will demonstrate the ability
1. Gain the basic knowledge about the Electric circuits.
2. Understand the working of Electrical Machines and Transformers.
3. Understand the working of Power Converters and components of low-voltage electrical installations.
4. Understand and analyze basic electric and magnetic circuits.
5. Acquire knowledge on the working principles of electrical machines and power converters.
6. Understand the components of low-voltage electrical installations.

List of Experiments

3. Speed control of DC shunt motor.
4. Draw the equivalent circuit of single-phase Transformer by conducting OC & SCTest.

SUGGESTED READING

COURSE OBJECTIVES

1. To make the students to design a system, component, or process to meet desired needs.
2. To prepare the students to design the components with realistic constraints.
3. To make the students to consider economic, environmental, ethical, health and safety when they design.
4. To make the students to design the components with considering manufacturability, and sustainability
5. To prepare the students to communicate effectively using the techniques, skills, and modern engineering tools.
6. To make the students to understand to use necessary for engineering practice.

COURSE OUTCOMES

The student will also learn:

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design and engineering graphics standards
3. Exposure to engineering communication effectively.
4. Exposure to 3D free hand sketching.
5. Acquired the knowledge of projections of points, lines and plane surfaces.
6. Understand the basic concept of projection of solids.

UNIT I INTRODUCTION

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Bureau of Indian Standards (BIS), Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice--geometric constructions, principles of dimensioning--linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.

UNIT II SCALES AND PLANECURVES

SCALES: Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conic sections including the Ellipse, Parabola and Hyperbola (eccentricity method only); Cycloid, Epicycloid, Hypocycloid and Involute.

UNIT III FREE HANDSKETCHING

Representation of Three-Dimensional objects—General principles of orthographic projection—Need for importance of multiple views and their placement—First angle projection—Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT IV PROJECTION OF POINTS, LINES AND PLANESURFACES

Projection of points and straight lines located in the first quadrant inclined to both planes—Determination of true lengths and true inclinations—Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT V PROJECTION OF SOLIDS

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

SUGGESTED READINGS

COURSE OBJECTIVES
1. To familiarize the prospective engineers with techniques in Multivariate integration.
2. To familiarize the concept of ordinary and partial differential equations and complex variables.
3. To equip the students to deal with advanced level of mathematics and applications.
4. To make the students to formulate and solve problems involving random variables.
5. To equip the students to Understand the basic concepts of one- and two-dimensional random variables.
6. To understand the concept of testing of hypothesis for small and large samples in real life problems.

COURSE OUTCOMES
1. The mathematical tools needed in evaluating multiple integrals and their usage.
2. The effective mathematical tools for the solutions of differential equations that model physical processes.
3. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.
4. Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
5. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.
6. Apply the concept of testing of hypothesis for small and large samples in real life problems.

UNIT I Multivariable Calculus (Integration)
Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Applications: areas and volumes, Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, Simple applications involving cubes and rectangular parallelepipeds.

UNIT II First order ordinary differential equations
Exact, linear and Bernoulli’s equations, Euler’s equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut’s type.

UNIT III Ordinary differential equations of higher orders
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

UNIT IV Analytic Functions
Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations.

UNIT V Complex Integration
Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), zeros of analytic functions, singularities, Taylor’s series, Laurent’s series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.
SUGGESTED READINGS
4. W.E.BoyceandR.
   C.DiPrima,(2009),ElementaryDifferentialEquationsandBoundary,ValueProblems9thEdn., WileyIndia.
COURSEOBJECTIVES
1. To understand the terminologies of atomic and molecular structure
2. To study the basics of Periodic properties, Intermolecular forces
3. To study about spectroscopic technique
4. To understand the working of electromagnetic spectrum and spectroscopic techniques
5. To understand the thermodynamic functions
6. To comprehend the basic organic chemistry and to synthesis simple drug.

COURSEOUTCOMES
1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
3. Understand the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.
4. Understand the concept of various spectroscopic techniques.
5. Rationalise bulk properties and processes using thermodynamic considerations.
6. List major chemical reactions that are used in the synthesis of molecules.

UNIT I Atomic and molecular structure

UNIT II Periodic properties, Intermolecular forces and potential energy surfaces
Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers. Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H₂F and HCN and trajectories on these surfaces.

UNIT III Spectroscopic techniques and applications

UNIT IV Use of free energy in chemical equilibria

UNIT V Organic reactions and synthesis of a drug molecule
Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

SUGGESTED READINGS
1. B. H. Mahan, (2010), University chemistry, Pearson Education.
4. B. L. Tembe, Kamaluddin and M. S. Krishnan, Engineering Chemistry (NPTEL Web-book)
(i) Chemistry Laboratory

COURSE OBJECTIVES

1. To understand the terminologies of atomic and molecular structure
2. To study the basics of Periodic properties, Intermolecular forces
3. To study about spectrophotometric technique
4. To understand the working of electromagnetic spectrum and spectroscopic techniques
5. To understand the thermodynamic functions
6. To comprehend the basic organic chemistry and to synthesis simple drug.

COURSE OUTCOMES

1. Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
3. Understand the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.
4. Understand the concept of various spectroscopic techniques.
5. Rationalise bulk properties and processes using thermodynamic considerations.
6. List major chemical reactions that are used in the synthesis of molecules.

Choice of 10 experiments from the following:

1. Determination of surface tension and viscosity
2. Determination of Sodium Carbonate and Sodium Hydrogen Carbonate in a mixture using volumetric titration
3. Determination of Ca / Mg using complexometric titration
4. Thin layer chromatography
5. Determination of chloride content of water
6. Determination of the rate constant of a reaction
7. Conductometry - Determination of cell constant and conductance of solutions
8. pH Metry – Determination of Acid / Base
9. Potentiometry - determination of redox potentials and emfs
10. Saponification/acid value of an oil
11. Determination of the partition coefficient of a substance between two immiscible liquids
12. Adsorption of acetic acid by charcoal
13. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.
COURSE OBJECTIVES

1. To enable students to attain fluency and accuracy to inculcate proficiency in professional communication.
2. To make the students to meet the growing demand in the field of Global communication.
3. To help students acquire their ability to speak effectively in real life situations.
4. To inculcate the habit of reading and to develop their effective reading skills.
5. To ensure that students use dictionary to improve their active and passive vocabulary.
6. To enable students to improve their lexical, grammatical and communicative competence.

COURSE OUTCOMES

1. Use English language for communication: verbal & non-verbal.
2. Enrich comprehension and acquisition of speaking & writing ability.
3. Ensure students proficiency in professional communication.
4. Developed their active and passive vocabulary.
5. Gain confidence in using English language in real life situations.
6. Improve word power: lexical, grammatical and communication competence.

UNIT I  BASIC WRITING SKILLS
Sentence Structures - Use of phrases and clauses in sentences - Importance of proper punctuation - Creating coherence - Organizing principles of paragraphs in documents - Techniques for writing precisely

UNIT II  VOCABULARY BUILDING
The concept of Word Formation - Root words from foreign languages and their use in English - Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives - Synonyms, antonyms, and standard abbreviations.

UNIT III  GRAMMAR AND USAGE
Subject-verb agreement - Noun-pronoun agreement - Misplaced modifiers – Articles – Prepositions – Redundancies - Clichés

UNIT IV  LISTENING AND READING SKILLS
Note taking- viewing model interviews – listening to informal conversations – improving listening / reading comprehension – reading model prose / poems – reading exercise

UNIT V  WRITING PRACTICES
Comprehension - Précis Writing - Essay Writing Listening Comprehension - Common Everyday Situations: Conversations and Dialogues - Communication at Workplace – Interviews - Formal Presentations
Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

SUGGESTED READINGS
(i) Theory

COURSE OBJECTIVES
1. Identify and understand the working of key components of a computer program.
2. Identify and understand the various kinds of keywords and different data types of C programming.
3. Understand, analyze and implement software development tools like algorithm,
4. pseudo codes and programming structure.
5. Study, analyze and understand logical structure of a computer program, and different
   construct to develop a program in “C” language.
6. Programming to solve matrix addition and multiplication problems and searching and sorting
   problems.

COURSE OUTCOMES
1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and
   conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.

UNIT I
INTRODUCTION TO PROGRAMMING, ARITHMETIC EXPRESSIONS AND PRECEDENCE

Introduction to Programming: Flowchart / pseudocode, compilation, Variables including data types, Arithmetic expressions and precedence.

UNIT II
CONDITIONAL BRANCHING AND LOOPS

Conditional Branching – Loops Writing and evaluation of conditionals and consequent branching, Iteration and loops.

UNIT III
ARRAYS AND BASIC ALGORITHMS


UNIT IV
FUNCTION AND RECURSION

Functions (including using built in libraries), Recursion with example programs such as Quick sort, Ackerman function etc.

UNIT V
STRUCTURE, POINTERS AND FILE HANDLING

Pointers, Structures including self-referential structures e.g., linked list, notional introduction, File handling in C.

SUGGESTED READINGS
(ii) Laboratory

COURSE OBJECTIVES
1. To provide an awareness to Computing and CProgramming
2. To know the correct and efficient ways of solving problems
3. To learn to develop algorithm for simple problems solving.
4. To Study, analyze and understand logical structure of a computer program
5. To be able to declare pointers of different types and use the mind defining self-referential structures.
6. To be able to create, read and write to and from simple textfiles.

COURSE OUTCOMES
1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at runtime
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program

List of Experiments
Tutorial1 : Problem solving using computers:
Lab1 : Familiarization with programming environment

Tutorial2 : Variable types and type conversions:
Lab 2 : Simple computational problems using arithmetic expressions

Tutorial3 : Branching and logical expressions:
Lab 3 : Problems involving if-then-else structures

Tutorial4 : Loops, while and for loops:
Lab4 : Iterative problems e.g., sum of series

Tutorial5 : 1D Arrays: searching, sorting:
Lab 5 : 1D Array manipulation

Tutorial6 : 2D arrays and Strings, memory structure:
Lab6 : Matrix problems, String operations

Tutorial7 : Functions, call by value:
Lab 7 : Simple functions

Tutorial 8 & 9 : Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9 : Numerical methods problems

Tutorial 10 : Recursion, structure of recursive calls:
Lab 10 : Recursive functions

Tutorial 11 : Pointers, structures and dynamic memory allocation
Lab 11 : Pointers and structures

Tutorial 12 : File handling:
Lab 12 : File operations
COURSE OBJECTIVES

1. To know about Indian constitution.
2. To know about central government functionalities in India.
3. To know about state government functionalities in TN.
4. To know the relations between central and state government.
5. To know about Right of Women and Children.
6. To know about Indian society.

COURSE OUTCOMES

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

1. Understand the functions of the Indian government.
2. Understand the functions of the state government.
3. Understand the relations between central and state government.
4. Understand and abide the rules of the Indian constitution.
5. Understand and appreciate different culture among the people.
6. Understand the Rights of Women, Children and other Weaker Sections.

UNIT I INTRODUCTION


UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT


UNIT IV CONSTITUTION FUNCTIONS

Indian Federal System – Center – State Relations – President’s Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V INDIAN SOCIETY

Society: Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

SUGGESTED READINGS

1. Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India, New Delhi
2. R.C. Agarwal, (1997). Indian Political System, S. Chand and Company, New Delhi,
3. Maciver and Page, Society: An Introduction Analysis, Mac Milan India Ltd, New Delhi
4. K.L. Sharma (1997), Social Stratification in India: Issues and Themes, Jawaharlal Nehru University, New Delhi,
5. Sharma, Brij Kishore, (2011), Introduction to the Constitution of India, Prentice Hall of India, New Delhi,
COURSE OBJECTIVES

1. To prepare the students to design a system, component, or process.
2. To meet desired needs within realistic constraints such as economic, environmental, social, and ethical.
3. To make the component with health and safety, manufacturability, and sustainability.
4. To prepare the students to communicate effectively and to use the techniques, and skills.
5. To make the students to use modern engineering tools necessary for engineering practice.
6. To make the students to assemble different components.

COURSE OUTCOMES

Upon completion of this course,

1. The students will gain knowledge of the different manufacturing processes.
2. To fabricate components using different materials.
3. Students will be able to fabricate components with their own hands.
4. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances.
5. By assembling different components with different processes.
6. They will be able to produce small devices of their interest.

(i) Lectures & videos: (10 PERIODS)

Detailed contents

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical & Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

(ii) Workshop Practice: (60 PERIODS)

1. Machine shop (10 Periods)
2. Fitting shop (8 Periods)
3. Carpentry (6 Periods)
4. Electrical & Electronics (8 Periods)
5. Welding shop (8 hours (Arc welding 4 Periods + gas welding 4 Periods))
6. Casting (8 Periods)
7. Smithy (6 Periods)
8. Plastic moulding & Glass Cutting (3 Periods)
9. Plumbing Exercises (3 Periods)

SUGGESTED READINGS

COURSE OBJECTIVES
1. To prepare the students to make section of solids like Prism, Cylinder, and Pyramid.
2. To prepare true shape of section.
3. To gain the knowledge on lateral surfaces.
4. To acquire the knowledge about development of surfaces like Prisms, pyramids, cylinders and cones.
5. To gain the knowledge on 2D drawing using CAD software.
6. To acquire the knowledge on basics of 3D modeling packages.

COURSE OUTCOMES
1. The students to draw section of solids like Prism, Cylinder, and Pyramid.
2. Students can prepare true shape of section.
3. Students gain the knowledge on lateral surfaces.
4. Students acquire the knowledge about development of surfaces like Prisms, pyramids, cylinders and cones.
5. Students gain the knowledge on 2D drawing using CAD software.
6. Students acquire the knowledge on basics of 3D modeling packages.

UNIT I - SECTION OF SOLIDS
Sectioning of Prism, Cylinder, Pyramid, and Cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

UNIT II - DEVELOPMENT OF SURFACES
Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT III - ISOMETRIC PROJECTIONS
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple solids, truncated prisms, pyramids, cylinders and cones; Conversion of Isometric Views to Orthographic Views and Vice-versa

UNIT IV - COMPUTER GRAPHICS – 2D
Overview of Computer Graphics, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars, Drawing Area, Dialog boxes and windows, Shortcut menus ,The Command Line (where applicable), Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids; consisting of set up of the drawing page and the printer, including scale settings, Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Annotations, layering & other functions, Demonstration of a simple team design project, Introduction to Building Information Modeling

UNIT V - COMPUTER GRAPHICS – 3D
Introduction to 3D modeling packages. Drafting practices - modeling of simple engineering components, sections and extraction of 2D drawings.

SUGGESTED READINGS:
COURSE OBJECTIVES
1. To introduce the basic concepts of PDE for solving standard partial differential equations
2. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
3. To provide an overview of probability and statistics to engineers
4. To introduce the basic concepts of two-dimensional random variables
5. To acquaint the knowledge of testing of hypothesis for small and large samples.
6. To apply testing of hypothesis in important role in real life problems.

COURSE OUTCOMES
After successfully completing the course, the student will have a good understanding of the following topics and their applications
1. The fundamental concepts of partial differential equations and the various solution procedures for solving the first order non-linear partial differential equations.
2. Appreciate the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow problems and one-dimensional wave equations.
3. Understand the basic concepts of one knowledge of the concepts of probability and have knowledge of standard distribution which can describe real life phenomenon.
4. Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
5. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.
6. Apply the concept of testing of hypothesis for small and large samples in real life problems.

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

UNIT II APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

UNIT III PROBABILITY AND RANDOM VARIABLES

UNIT IV 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 V TESTING OF HYPOTHESIS
Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means. Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.
TEXTBOOKS/REFERENCES:
1. **COURSE OBJECTIVES**
   1. To understand the basics of biology
   2. To gain knowledge about different biomolecules
   3. To get familiarize with human diseases.
   4. To learn about DNA & RNA.
   5. To learn about different clinical investigations
   6. To know the recent advances in biology

2. **COURSE OUTCOMES**
   At the end of the course
   1. Summarize the cell structures and its functions
   2. Explain the Biomolecules functions
   3. Classify the communicable and non-communicable human diseases
   4. Illustrate the different organ function tests
   5. Tell the applications of biology in environmental applications
   6. Describe the concept of biomechanics

3. **UNIT I - BASICS OF BIOLOGY**
   Cell structure: Prokaryotic and eukaryotic cells, Animal and Plant Cell, Cell cycle – Mitosis - Meiosis,

4. **UNIT II - BIOMOLECULES**

5. **UNIT III – HUMAN DISEASES**
   Communicable diseases – Tuberculosis, Chikungunya, Dengue, Influenza, HIV/AIDS; Non-Communicable diseases – Diabetes, Cancer, Cardiovascular diseases.

6. **UNIT IV – ORGAN FUNCTION TESTS**
   Liver function tests – Functions of liver- Tests to assess liver function- Bilirubin related liver test; Renal function tests – Tests to assess renal function - Clearance test – Creatine and urea- Urine concentration test; Gastric function tests – Tests to assess gastric function - Fractional test meal, Alcohol test meal, Insulin test meal; Pancreatic Function Test – Secretin test, Lundh test.

7. **UNIT V – APPLICATIONS OF BIOLOGY**
   Environmental - waste water treatment, bioremediation; Biomaterials and biopolymers for environmental applications; Biosensors; Biofuel- Biogas, Biodiesel; Biomechanics – Biofluid mechanics, Biotribology.

8. **SUGGESTED READINGS:**
COURSE OBJECTIVES
1. To develop capacity to predict the effect of force and motion.
2. To understand the importance of free body diagram for complex machine structure.
3. To perform force analysis using law of mechanics.
4. To introduce the concepts of static equilibrium condition for particles and rigid bodies.
5. To understand the concepts of kinematics of particles and friction.
6. To make the students conversant to solve the problems using equation of motions.

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand the basic concepts of force and laws of mechanics.
2. Develop free body diagram for complex machine structure and to perform force analysis.
3. Apply static equilibrium condition for particles and rigid bodies.
4. Locate the center of gravity and moment of inertia for planes and solids.
5. Understand the concepts of kinematics of particles and friction.
6. Solve the problems using equation of motions.

UNIT I STATICS OF PARTICLES
Forces – system of forces – concurrent forces in plane and space– resultant – problems involving the equilibrium of a particle–free body diagram–equilibrium of particle in space.

UNIT II STATICS OF RIGID BODIES IN TWO DIMENSIONS

UNIT III CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA
Centroids of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia – radius of gyration – mass moment of inertia of simple solids.

UNIT IV KINEMATICS OF PARTICLES

UNIT V KINETICS OF PARTICLES AND FRICTION

SUGGESTED READINGS
B. E. Mechanical Engineering 2018-19

18BEME304 THERMODYNAMICS 4 H – 4 C

Instruction hours / week L : 3 T : 1 P:0 Marks: Internal : 40 External : 60 Total:100
End Semester Exam :3 Hours

COURSE OBJECTIVES
1. To understand the Model of physical systems into relevant thermodynamic system and apply energy balance equation for closed and open system.
2. To provide knowledge on entropy change in thermodynamic processes.
3. To Study and acquire knowledge on various thermodynamic properties of pure substances in real time problems.
4. To establish the basic thermodynamic relations and properties of ideal and real gases for physical systems.
5. To facilitate the understanding of properties of air using psychrometric chart.
6. To acquaint the student with the concepts and applications of the thermodynamics to the various real-life systems.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Model the physical systems into relevant thermodynamic system and apply energy balance equation for closed and open system.
2. Determine entropy change in thermodynamic processes.
3. Identify the various thermodynamic properties of pure substances in real time problems.
4. Establish the basic thermodynamic relations and properties of ideal and real gases for physical systems.
5. Calculate the properties of air using psychrometric chart.
6. Explain the basic principles and applications of the thermodynamics to the various real life systems.

UNIT I BASIC CONCEPTS AND FIRST LAW

UNIT II SECOND LAW AND ENTROPY
Physical description of the second law - Kelvin-Planck and Clausius statements –Equivalence - Reversible processes and cycles- Carnot cycle – Corollaries - Absolute temperature scale – Clausius Theorem, inequality - Entropy- Principle, transfer, generation, balance - Third law of thermodynamics

UNIT III THERMODYNAMIC AVAILABILITY AND RELATIONS

UNIT IV PROPERTIES OF PURE SUBSTANCE AND GAS MIXTURES

UNIT V PSYCHROMETRY
Psychrometry - Psychrometric charts - Property calculations of air vapour mixtures- Psychrometric process-Adiabatic mixing - Evaporative cooling.

(Permitted to use standard thermodynamic table, Mollier diagram, and Psychrometric chart in the examination)

SUGGESTED READINGS

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore – 641 021.
(i) Theory

COURSE OBJECTIVES
1. To provide an overview of various analog device
2. To provide an overview of Digital concepts
3. To learn working of amplifier and its application.
4. To understand the concept of RC-timing circuits.
5. To learn cellular concept and block diagram of GSM system.
6. To provide a review of communicationsystem

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand the principles of semiconductor devices and their applications.
2. Understand the concept of voltageregulators
3. Design an application using Operationalamplifier.
4. Understand the working of timing circuits and oscillators.
5. Understand logic gates, flip flop as a building block of digitalsystems.
6. Learn the basics of Electronic communicationsystem.

UNITI SEMICONDUCTOR DEVICES AND APPLICATIONS
Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

UNITII OPERATIONAL AMPLIFIER AND ITS APPLICATIONS
Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

UNITIII TIMING CIRCUITS AND OSCILLATORS
RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausens criteria for oscillation, R-C phase shift and Wein bridge oscillator.

UNITIV DIGITAL ELECTRONICS FUNDAMENTALS
Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using Kmap, Logic ICs, half and full adder/subtractor, multiplexers, de-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

UNITV ELECTRONIC COMMUNICATION SYSTEMS
The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

SUGGESTED READINGS

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore – 641 021.
(ii) Laboratory

COURSE OBJECTIVES
1. To learn the characteristics of basic electronic devices such as Diode, BJT
2. To understand the basic operation and configuration of linear integrated circuits.
3. To understand the basic operation of Integrator and Differentiator.
4. To learn characteristics of basic electronic devices with various configurations.
5. To understand the working of Multiplex and Demultiplexer using Logic gates.
6. To understand the basics of logic gates and other digital circuits.

COURSE OUTCOMES
On completion of this laboratory course, the student should be able to:
1. Design amplifiers, oscillators, D-A converters using operational amplifier
2. Analyze the characteristics of basic electronic devices with various configurations.
3. Design and Test the digital logic circuits.
4. Design and Test sequential circuits.
5. Construct multivibrators using 555.
6. Understand the concept of Flipflop using Logic gates.

List of Experiments
1. Characteristics of PN Junction Diode
2. Common Emitter input-output Characteristics
3. Inverting, Non inverting and differential amplifiers
4. Integrator and Differentiator.
6. Astable and Monostable multivibrators using NE555 Timer.
7. Realization of Logic gates using basic gates
8. Realization of Halfadder and Fulladder using Logic gates
9. Realization of Multiplex and Demultiplexer using Logic gates
10. Realization of Flipflop using Logic gates
COURSE OBJECTIVES
1. To explain the surfaces for sheet metal working applications.
2. To understand the representation of details in machine drawing.
3. To introduce tolerances and fits of machine elements.
4. To equip them with skills to construct an assembly drawing using part drawings of machine components.
5. To equip them with skills to construct an assembly drawing of machine components using 2D drafting.
6. To equip them with skills to develop employability.

COURSE OUTCOMES
Learners should be able to
1. Express the importance of machine drawing and GD&T.
2. Interpret drawings of machine components.
3. Create assembled machine drawings.
4. Make part drawings from an assembly drawing.
5. Interpret the details of complex parts in cross section views.
6. Sketch production drawing from assembly drawing.

INTRODUCTION

CONVENTIONS
Code of practice for engineering drawing-conventional representation of details- drilled and tapped holes, countersunk and counter bored holes, internal and external threads, undercuts, grooves, chamfers, fillet radii and keyways. Conventions to represent standard components-bolts, nuts, washers, screws, cotters, pins, circlips, bearings, gears, springs and flanges.

FITS AND TOLERANCES

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

ASSEMBLY AND BILL OF MATERIALS USING CAD SOFTWARE
Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing and Drill jigs and Milling fixture.

SUGGESTED READINGS
COURSE OBJECTIVES
1. To understand the basic concepts of QUANTITATIVE ABILITY
2. To understand the basic concepts of LOGICAL REASONING Skills
3. To acquire satisfactory competency in use of VERBAL REASONING
4. To solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
5. To solve off-campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
6. To compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

COURSE OUTCOMES
1. Understand the basic concepts of QUANTITATIVE ABILITY
2. Understand the basic concepts of LOGICAL REASONING Skills
3. Acquire satisfactory competency in use of VERBAL REASONING
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
5. Solve off-campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability.
6. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

- Introduction, Speed Math’s, Problems on Numbers, Averages, Ratios and Proportions, Problems on Ages
- Percentage, Data Interpretation, Profit and loss, Simple and Compound Interest
- Time Speed and Distance, Time and Work, Pipes and Cistern, Geometry, Probability, Permutation and Combination

SUGGESTED READINGS
B. E. Mechanical Engineering

18BEME352A WELDINGPROCESS

Instruction hours / week L : 2 T : 0 P:0 Marks: Internal : 100 External : -- Total:100

COURSE OBJECTIVES

1. To understand the fusion welding processes
2. To learn about the advanced metal joining processes.
3. To understand the fundamental principles of special arc welding process.
4. To work with various metal joining processes.
5. To understand the knowledge of plasma arc in metal joining and cutting process.
6. To understand the fundamental principles of Laser Beam Welding.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Know the methods of metal joining processes.
2. Understand the fundamental principles of special arc welding process.
3. Decide the type of metal joining processes for applications.
4. Work with various metal joining processes.
5. Understand the knowledge of plasma arc in metal joining and cutting process.
6. Understand the fundamental principles of Laser Beam Welding.

UNIT I

Classification of welding processes; Gas welding; Arc welding; arc physics, power source characteristics, Manual metal arc welding: Concepts, types of electrodes and their applications, Gas tungsten arc welding: Concepts, processes and applications; gas metal arc welding, Concepts, processes and applications, types of metal transfer, CO2 welding, pulsed and synergic MIG welding, FCAW. Submerged arc welding; advantages and limitations, process variables and their effects, significance of flux-metal combination and modern development.

UNIT II

Narrow gap submerged arc welding, applications; electro slag and electro gas welding Plasma welding; Concepts, processes and applications, keyhole and puddle-in mode of operation, low current and high current plasma arc welding and their applications; Magnetically impelled arc butt (MIAB) welding Resistance welding, Concepts, types and applications, Flash butt welding, Stud welding and under water welding. Friction welding: Concepts, types and applications. Friction stir welding: Metal flow phenomena, tools, process variables and applications and induction pressure welding: Process characteristics and applications Explosive, diffusion and ultrasonic welding, principles of operation, process characteristics and applications.

UNIT III

EBW: Concepts, types and applications. LBW: Physics of lasers, types of lasers, operation of laser welding setup, advantages and limitations, applications Soldering: Techniques of soldering, solders, phase diagram, composition, applications Brazing: Wetting and spreading characteristics, surface tension and contact angle concepts, brazing fillers, role of flux and characteristics, atmospheres for brazing, adhesive bonding Cladding, Surfacing and Cutting

SUGGESTED READINGS

COURSE OBJECTIVES

1. To understand the basic metallurgical process during welding.
2. To learn the phase diagrams, weldability of ferrous and nonferrous materials.
3. To understand weld defects and remedial measures.
4. To understand the development of the fusion and heat-affected zones during the welding.
5. To understand the how metals solidify, how phases nucleate and grow, and the mechanisms by which metal alloys are strengthened.
6. To understand the how weld variables such as pool shape, travel speed, cooling rate and other variables affect the subsequent weld microstructure.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Apply influence of heat input and temperature distribution across a welded structure.
2. Describe basic physical metallurgy starting at the atomic level, with bonding, defect structure, phase diagrams and diffusion and moves towards the development of metal microstructure.
3. Describe how metals solidify, how phases nucleate and grow, and the mechanisms by which metal alloys are strengthened.
4. Describe the development of the fusion and heat-affected zones during the welding of aluminum.
5. Describe how weld variables such as pool shape, travel speed, cooling rate and other variables affect the subsequent weld microstructure.
6. Determine how the weld variables and weld microstructure affect the mechanical properties of the weld will be able to identify the microstructure of acceptable welds.

UNIT I


UNIT II

Phase transformations- weld CCT diagrams - carbon equivalent-preheating and post heating-weldability of low alloy steels, welding of stainless steels use of Schaffler and Delong diagrams. Welding of cast irons Welding of Cu, Al, Ti and Ni alloys, - processes, difficulties, microstructures, Joining of Dissimilar Materials

UNIT III

Defects and remedial measures Origin - types - process induced defects, - significance remedial measures, Hot cracking - cold cracking -lamellar tearing - reheat cracking - weldability tests - effect of metallurgical parameters.

SUGGESTED READINGS

COURSE OBJECTIVES

1. To perform different destructivetesting
2. To learn the characteristic materials
3. To understand the stress and strain relationship.
4. To determine the shear force for various materials.
5. To determine the impact load for various materials.
6. To determine the hardness for various materials

COURSE OUTCOMES

1. Ability to perform different destructivetesting
2. Ability to characteristic materials
3. Understand the stress and strain relationship.
4. Determine the shear force for various materials.
5. Determine the impact load for various materials.
6. Determine the hardness for various materials

LIST OF EXPERIMENTS

1. Tensile test on welded joints–stress strain characteristics
2. Hardness test on welded metals–Brinell and Rockwell hardness tests.
3. Impact test on welded metals–Charpy, Izod impact tests.
4. Shear test on welded metals–direct shear strength, single shear, doubleshear.
COURSE OBJECTIVES
1. To provide a basic knowledge about measurement systems and their components
2. To learn about various measurements like displacement, temperature, pressure, level, flow, speed
3. To learn about control systems and its principles.
4. To learn how to measure the quantities like strain, humidity and force
5. To learn how to measure the quantities like torque and power
6. To classify the various control methods and its application.

COURSE OUTCOMES
Upon completion of this course, the Students will be able to
1. Understand the measurement systems, their accuracy & range.
2. Measure the quantities like displacement, temperature, pressure
3. Measure the quantities like level, flow and speed
4. Measure the quantities like strain, humidity and force
5. Measure the quantities like torque and power
6. Classify the various control methods and its application and do system models and perform response analysis

UNIT I INTRODUCTION

UNIT II MEASUREMENTS I

UNIT III MEASUREMENTS II

UNIT IV MEASUREMENTS III

UNIT V CONTROLSYSTEMS
SUGGESTED READINGS

COURSE OBJECTIVES
1. To create the awareness about environmental problems among people.
2. To develop an attitude of concern for the environment.
3. To motivate public to participate in environment protection and improvement.
4. To demonstrate proficiency in quantitative methods, qualitative analysis, and critical thinking.
5. To develop writing and oral communication needed to conduct high-level work as interdisciplinary scholars and/or practitioners.
6. To learn about the systems concepts and methodologies to analyze and understand interactions.

COURSE OUTCOMES
1. Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
2. Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
4. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
5. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
6. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

UNIT I INTRODUCTION - ENVIRONMENTAL STUDIES & ECOSYSTEMS
Environment Definition, Scope and importance; Ecosystem, Structure and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Classification of ecosystem. Forest ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II NATURAL RESOURCES - RENEWABLE AND NON-RENEWABLE RESOURCES
Natural resources - Renewable and Non-Renewable resources. Land resources and land use change, Land degradation, soil erosion and desertification. Forest resources - Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water resources - Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water. Use of alternate energy sources, growing energy needs, case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT III BIODIVERSITY AND ITS CONSERVATION

UNIT IV ENVIRONMENTAL POLLUTION
UNIT V SOCIAL ISSUES AND THE ENVIRONMENT

SUGGESTED READINGS
(i) Theory

COURSE OBJECTIVES
1. To impart knowledge on metallurgical aspects of metals.
2. To understand heat treatment processes on different grades of steel.
3. To familiarize on selection of ferrous and non-ferrous materials for various applications.
4. To impart knowledge on non-metallic materials.
5. To learn about the strengthening mechanisms for Non-ferrous alloys.
6. To comprehend the significance of Non-Destructive Testing (NDT) methods.

COURSE OUTCOMES
Learners should be able to
1. Identify the metallurgical aspects of metals.
2. Identify suitable heat treatment processes for various applications.
3. Select appropriate ferrous and non-ferrous materials for various applications.
4. Identify and select suitable non-metallic materials.
5. Identify suitable strengthening mechanisms for Non-ferrous alloys.
6. Work with non-destructive testing methods.

UNIT I  CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

UNIT II  HEAT TREATMENT

UNIT III  FERROUS AND NON-FERROUS METALS

UNIT IV  NON-METALLIC MATERIALS
Polymers – types of polymer, commodity and engineering polymers – Properties and Applications of thermoplastics (PP, PVC, ABS, and PMMA) and thermosetting plastics (PF, UF, MF) – Engineering Ceramics.

UNIT V TESTING OF MECHANICAL PROPERTIES AND INSPECTION

SUGGESTED READINGS
(ii) Laboratory

COURSE OBJECTIVES
1. To impart knowledge on metallurgical aspects of metals.
2. To understand heat treatment processes on different grades of steel.
3. To familiarize on selection of ferrous and non-ferrous materials for various applications.
4. To review physics and chemistry in the context of materials science & engineering.
5. To describe the different types of bonding in solids, and the physical ramifications of these differences.
6. To describe and demonstrate diffraction, including interpretation of basic x-ray data.

COURSE OUTCOMES
Learners should be able to
1. Identify the metallurgical aspects of metals.
2. Identify suitable heat treatment processes for various applications.
3. Select appropriate ferrous and non-ferrous materials for various applications.
4. Identify and select suitable non-metallic materials.
5. Able to perform corrosion test.
6. Able to describe a polymer's elastic behavior above and below the glass transition.

LIST OF EXPERIMENTS
1. Study and use of metallurgical microscope (Term Paper).
3. Microstructure of annealed pure metals—a-iron, copper, lead, zinc aluminium and use of specific etchants.
4. Macro etching and sulphur printing.
5. Electropolishing.
6. Comparative study of microstructure of annealed steel (Hypo eutectoid, Eutectoid, Hyper eutectoid) and variation of hardness.
10. Recovery, Recrystallisation and Grain growth of cold worked copper.
11. Galvanostatic polarization & determination of corrosion rate by Tafel’s Extrapolation
12. Potentiostatic Polarization, passivity & Passivity breakdown study
COURSE OBJECTIVES

1. To incorporate the concepts and laws in thermodynamic analysis of cyclic processes.
2. To impart the mechanisms of combustion of fuels.
3. To apply the thermodynamic concepts in steam turbines and nozzles.
4. To learn about the performance of compressors.
5. To understand the concept of cogeneration and waste heat recovery in engineering applications.
6. To introduce concepts of refrigeration and air conditioning in engineering applications.

COURSE OUTCOMES

Learners should be able to

1. Calculate the efficiency of various gas power cycles.
2. Calculate the performance characteristics of engines.
3. Analyze combustion mechanism in IC engines.
4. Evaluate the characteristic of steam turbines and nozzles.
5. Evaluate the performance characteristics of compressors.
6. Identify and utilize the concepts of refrigeration and air conditioning in engineering applications.

UNIT I  GAS POWER CYCLES AND IC ENGINES


UNIT II  BOILER AND STEAM POWER CYCLES


UNIT III  STEAM NOZZLES AND STEAM TURBINES

Steam nozzles – flow through steam nozzles, effect of friction, critical pressure ratio, super saturated flow – Steam turbines – impulse and reaction turbine, compounding, velocity diagram, condition for maximum efficiency.

UNIT IV  AIR COMPRESSORS


UNIT V  REFRIGERATION AND AIR CONDITIONING

(Permitted to use standard thermodynamic table, Mollier diagram, Psychometric chart and Refrigeration property table in the examination).

SUGGESTED READINGS

COURSES OBJECTIVES

1. Ability to conduct experiment on IC engine to study the characteristic and performance of IC design/ steamturbines.
2. To appreciate concepts learnt in fundamental laws of thermodynamics.
3. To learn ideas how to sustain in energy crisis and think beyond curriculum in the field of alternative and renewable sources of energy.
4. To communicate effectively the concepts of internal combustion engines.
5. To make the students to prepare them to carry out experimental investigation and analysis at later stages of graduation.
6. To make the students to think beyond curriculum in alternative sources of energy.

COURSE OUTCOMES

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

1. conduct experiment on IC engine to study the characteristic and performance of IC engine
2. conduct experiment to find the thermo physical properties of given fluid.
3. Understand the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon.
4. Can formulate power production based on the fundamental laws of thermal engineering.
5. Understand instil upon to envisage appropriate experiments related to heat engines.
6. Understand and investigate the effectiveness of energy conversion process in mechanical power generation for the benefit of mankind.

LIST OF EXPERIMENTS

IC ENGINES AND FUELS

2. Performance Test on 4–stroke CI Engine.
4. Load test on 4–stroke CI Engine.
5. Morse Test on multicylinder SI Engine.
6. Retardation Test to find Frictional Power of a CI Engine.
8. Determination of Flash Point and Fire Point.
9. Performance test on single/two stage reciprocating air compressor.
10. Determination of COP of a refrigeration system
11. Experiments on air–conditioning system
(i) Theory

COURSE OBJECTIVES
1. To understand the concepts of stress and strain on deformation of solids.
2. To introduce the Concepts of safe working stresses and load carrying capacity of beams.
3. To enrich the understanding of deflection in beams and columns in engineering applications.
4. To understand the importance of the effect of torsion on shafts and springs.
5. To provide knowledge on principal stresses and analyze thin cylinders and shells subjected to pressure forces.
6. To provide knowledge on components subjected to various loadings with the help of various theories of failures.

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Determine stress and strain on deformation of solids.
2. Compute safe working stresses and load carrying capacity of beams.
3. Estimate the deflection in beams and columns in engineering applications.
4. Analyze the effect of torsion on shafts and springs.
5. Determine principal stresses and analyze thin cylinders and shells subjected to pressure forces.
6. Design the components subjected to various loadings with the help of various theories of failures.

UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS
Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT II  BEAMS – LOADS AND STRESSES
Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Relationship between load, shear force and bending moment – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.

UNIT III  BEAM DEFORMATION

UNIT IV  TORSION
Analysis of torsion of circular bars – Torsional Shear stress – Bars of solid and hollow circular section – Stepped shaft – Torsional rigidity – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads.

UNIT V  ANALYSIS OF STRESSES IN TWO DIMENSIONS
Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr’s circle for biaxial stresses – Maximum shear stress – Strain energy in bending and torsion.

SUGGESTED READINGS
(ii) Laboratory

COURSE OBJECTIVES
1. To perform different destructive testing
2. To learn the characteristic materials.
3. To understand the stress and strain relationship.
4. To determine the shear force for various materials.
5. To determine the impact load for various materials.
6. To determine the hardness for various materials.

COURSE OUTCOMES
1. Ability to perform different destructive testing
2. Ability to characteristic materials
3. Understand the stress and strain relationship.
4. Determine the shear force for various materials.
5. Determine the impact load for various materials.
6. Determine the hardness for various materials.

LIST OF EXPERIMENTS
1. Tensile test on metals–stress strain characteristics
2. Cupping test on metal sheets–load deformation characteristics, cupping load, cupping number.
3. Hardness test on metals–Brinell and Rockwell Hardness tests.
4. Impact test on metals–Charpy, Izod impact tests.
5. Shear test on metals–direct shear strength, single shear, doubleshear.
7. Torsion test on beams–torque and angle of twist characteristics, shear stress, modulus of rigidity, energy.
COURSE OBJECTIVES
1. To enrich the understanding of fluid properties
2. To make the students conversant with types of flow and calculate Major and minor loses in pipes.
3. To acquaint the student with the concepts of Buckingham’s π theorem.
4. To explain the working of different pumps
5. To explain the working of different turbines.
6. To equip students with skills to produce analytical solutions to various simple problems

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Demonstrate basic knowledge of fluid properties
2. Find types of flow and calculate Major and minor loses in pipes.
3. Apply Buckingham’s π theorem for problem solving.
4. Understand the working of different pumps
5. Understand the working of different turbines.
6. produce analytical solutions to various simple problems

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS
Fluid properties: Mass density, weight density, specific gravity, viscosity, compressibility, surface tension and capillarity. Buoyancy and floatation – metacentre and metacentric height (definition only)
Flow characteristics: concepts of system and control volume, application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT II FLOW THROUGH CIRCULAR PIPES

UNIT III DIMENSIONAL ANALYSIS
Dimension and units, dimensional homogeneity, applications of Buckingham’s π theorem, model and similitude, similarity laws.

UNIT IV HYDRAULIC TURBINES

UNIT V HYDRAULIC PUMPS

SUGGESTED READINGS
(ii) Laboratory

COURSE OBJECTIVES
1. To supplement the theoretical knowledge gained in Fluid Mechanics and Machinery with practical testing
2. To understand the concepts of coefficient of discharge for Orifice meter and Venturi meter.
3. To explain the Calibration of Rotameter.
4. To understand the importance of friction factor for flow through pipes.
5. To impart knowledge on the performance of various pumps.
6. To impart knowledge on the performance of turbines.

COURSE OUTCOMES
1. Calculate the coefficient of discharge for Orifice meter and Venturimeter.
2. Calibrate the Rotameter
3. Estimate the friction factor for flow through pipes.
4. Asses the performance of centrifugal pump and submergible pump.
5. Asses the performance of reciprocating pump and gear pump.
6. Asses the performance of turbines.

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

1. To equip the students with effective technical presentation
2. To understand the barriers and bridges to communication
3. To improve the public speaking capabilities, body language and posture.
4. To improve the literature survey skill.
5. To develop presentation skill using power point presentation
6. To improve skill to face viva voce examination.

COURSE OUTCOMES

1. Develop the ability to fabrication skill.
2. Ability to make literature review till the successful solution.
3. Ability to identify specific problems.
4. Gain the knowledge about data collection and conducting experiments.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE DESCRIPTION

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also, Students are encouraged to use various teaching aids such as overhead projectors, power point presentation and demonstrative models to present their work done.
COURSE OBJECTIVES

1. To know the weld design, fitup, timestandards.
2. To learn the cost, mechanization.
3. To understand the welding and efficient operation.
4. To impart knowledge regarding various advanced welding practices in industries.
5. To understand the various parameters and requirements for welding processes.
6. To know the comparative merits and demerits of various welding processes.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Apply suitable welding methods for joining.
2. Know the cost involved during welding.
3. Enhance the efficiency of the metal joining processes.
4. Students are introduced to various advanced welding techniques which make them interested to choose a career in the field of welding.
5. Students will understand the advanced welding practices in Industries and their comparative merits and demerits.
6. Students will be able to choose the right kind of welding techniques for joining raw materials of various thicknesses.

UNIT I

Welding design, selection of electrodes, size, type and metal recovery, electrode efficiency, stub thrown away, over welding and joint, fit-up welding position operation factor, Jigs, fixtures, positioners, operator efficiency.

Need for time standards, definition of standard time, various methods of computing standard time, analytical calculation, computerization of time standards.

UNIT II

Definition of terms, composition of welding costs, cost of consumables, labour cost, cost overheads, formulae for total cost, cost curves for different processes like CO2, SAW, ESW, etc., Mechanization in welding, job shop operation Process vs product layout, construction, service consideration, employees, services, process services, etc., different work stations in shop floor and their arrangements.

UNIT III

Selection and installation of equipment, safe handling of equipment, production control, planning for welding processes and materials, inventory control; basic aspects of financial management and man power planning.

SUGGESTED READINGS

COURSE OBJECTIVES

1. To know the modeling and simulation of the process.
2. To apply analytical techniques to welding processes.
3. To solve finite element problems in 2D & 3D using FEM software.
4. To analyse liquid metal flow through CFD software.
5. To understand the concept of artificial intelligence (AI).
6. To understand the concept of robotics configuration for demonstrate the model.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Understand the welding phenomena
2. Apply suitable analytical process for various metal joining processes
3. Apply FEM to solve real time problems in 2D & 3D
4. Understand concept of CFD software to analysis the liquid metal flow.
5. Understand the concept of artificial intelligence (AI).
6. Understand the concept of robotics configuration for demonstrate the model.

UNIT I

Mathematical modeling, physical simulation, advantages and limitations; process control, instrumentation and data acquisition systems Review of transport phenomena, differential equations & numerical methods; concept of physical domain and computational domain, assumptions and limitations in numerical solutions

UNIT II

Introduction to FEM & FDM, examples Introduction to software packages– useful websites and generic information about different products - ANSYS, Thermocalc, CFD; usage of expert systems, artificial intelligence and robotics; demonstration of some software packages Physical modeling – cold and hot models; case studies of water models, use of computers for the construction of phase diagrams, alloy design, crystallography, phase transformations and thermo chemical calculations.

UNIT III

Case studies from literature – pertaining to modeling of solidification / heat transfer, fluid flow, casting, welding and liquid metal treatment

SUGGESTED READINGS:

COURSE OBJECTIVES
1. To expose students to problem definitions
2. To understand the Fabricate device/system/component (s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE OUTCOMES
1. Formulate problem definitions
2. Fabricate device/system/component (s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE DESCRIPTION
The students may be grouped into maximum of 4 students and work under the guidance of the supervisor. A project report to be submitted by the group and the course oriented project working model or demo model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Centralized Production and Service Facility.
COURSE OBJECTIVES

1. To understand the various types of stresses induced in different machine members.
2. To Study and acquire knowledge on design shaft and couplings for effective transmission of power.
3. To study the features of welded joints and fasteners required for various industrial applications.
4. To give exposure to design springs and flywheels for various engineering applications.
5. To understand the importance design bearings and levers for engineering applications.
6. To make the students conversant to implement design procedure for designing a machine.

COURSE OUTCOMES

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

1. Determine various types of stresses induced in different machine members.
2. Design shaft and couplings for effective transmission of power.
3. Select the type of welded joints and fasteners required for various industrial applications.
4. Design springs and flywheels for various engineering applications.
5. Design bearings and levers for engineering applications.
6. Implement design procedure for designing a machine.

UNIT I  STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS

Introduction to the design process – factors influencing machine design, selection of materials based on mechanical properties – Factor of safety. Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading.

UNIT II  DESIGN OF SHAFTS AND COUPLINGS

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways – Design of rigid and flexible couplings – Introduction to gear and shock absorbing couplings – design of knuckle joints.

UNIT III  DESIGN OF FASTENERS AND WELDED JOINTS


UNIT IV  DESIGN OF SPRINGS AND FLYWHEEL

Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs – Belleville springs – Design of flywheels involving stresses in rim and arm.

UNIT V  DESIGN OF BEARINGS AND LEVERS

Selection of bearings – sliding contact and rolling contact types – Cubic mean load – Selection of journal bearings – McKees equation – Lubrication in journal bearings – calculation of bearing dimensions – Design of Levers.

(Permitted to use design data book in the examination)

SUGGESTED READINGS

(i) Theory

COURSE OBJECTIVES
1. To Study and acquire knowledge on heat transfer for conduction.
2. To introduce the concepts of heat transfer coefficients for natural and forced convection for different fluid flows.
3. To understand the performance of heat exchanger.
4. To study the features of radiation heat transfer between the surfaces.
5. To give exposure to mass transfer.
6. To make the students conversant to solve complex problems where heat and mass transfer takes place.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Determine the rate of heat transfer for conduction.
2. Evaluate heat transfer coefficients for natural and forced convection for different fluid flows.
4. Estimate the radiation heat transfer between the surfaces.
5. Calculate the coefficient of mass transfer.
6. Solve complex problems where heat and mass transfer takes place.

UNIT I  CONDUCTION

UNIT II  CONVECTION

UNIT III  PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS

UNIT IV  RADIATION

UNIT V  MASS TRANSFER

(Permitted to use standard Heat and Mass Transfer Table in the examination)

SUGGESTED READINGS
COURSE OBJECTIVES
1. To ability to conduct experiment on IC engine to study the characteristic and performance of IC design/steamturbines.
2. To apply Fourier’s law to validate the theoretical over all heat transfer coefficient.
3. To apply Stefan-Boltzmann law of radiation and emissivity relation.
4. To determine thermal properties of material by applying 1-D steady state heat transfer equation.
5. To apply non-dimensional numbers to evaluate and validate heat transfer parameters.
6. To ability to understand and solve conduction, convection and radiation problems.

COURSE OUTCOMES
1. Ability to conduct experiment on IC engine to study the characteristic and performance of IC design/steamturbines.
2. Apply Fourier’s law to validate the theoretical over all heat transfer coefficient.
3. Apply Stefan-Boltzmann law of radiation and emissivity relation.
4. Determine thermal properties of material by applying 1-D steady state heat transfer equation.
5. Apply non-dimensional numbers to evaluate and validate heat transfer parameters.
6. Ability to understand and solve conduction, convection and radiation problems.

HEAT TRANSFER
1. Heat transfer through a compositewall
2. Thermal conductivity measurement by guarded platemethod
3. Natural convection heat transfer from a verticalcylinder
4. Heat transfer from pin–fin (natural and forced convectionmodes)
5. Effectiveness of Parallel/counter flow heat exchanger
6. Determination of Stefan–Boltzmannconstant
7. Determination of emissivity of a greysurface
(i) Theory

COURSE OBJECTIVES

1. To familiarize the students to apply suitable molding and casting methods for producing components.
2. To develop an understanding of types of metal joining processes.
3. To explain types of deformation processes.
4. To understand the concept of sheet metal operations and metal forming processes.
5. To provide an overview of various plastic component manufacturing processes for various applications.
6. To study and acquire knowledge of process variables to manufacture defect free products.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Apply suitable molding and casting methods for producing components.
2. Decide the type of metal joining processes.
3. Select the type of deformation processes.
4. Work with various sheet metal operations and metal forming processes.
5. Select the various plastic component manufacturing processes for various applications.
6. Identify the effect of process variables to manufacture defect free products.

UNIT I  CASTING PROCESSES


UNIT II  JOINING PROCESSES


UNIT III  METAL FORMING PROCESSES


UNIT IV  SHEET METAL OPERATIONS


UNIT V  POWDER METALLURGY PROCESS


SUGGESTED READINGS

COURSE OBJECTIVES
1. To teach the process-level dependence of manufacturing systems through tolerances
2. To select appropriate Manufacturing Processing to manufacture any component
3. To expose the students to a variety of manufacturing processes including their typical use and capabilities.
4. To teach the important effects that manufacturing processes may have on the material properties of the processed part with a focus on the most common processes.
5. To explain and relate the basics of hot and cold working process, their advantages, Limitations and Applications
6. To explain basic principles of working of machine tools viz. Lathe, Milling, Grinding, Drilling machines etc.

COURSE OUTCOMES
Upon completion of the course, the students will be able to
1. Understand the idea for selecting materials for patterns.
2. Types and allowances of patterns used in casting and analyze the components of moulds.
3. Design core, core print and gating system in metal casting processes
4. Understand the application of arc and gas welding in industries.
5. Understand the principle behind the sheet metal forming process
6. Understand the working of the powder metallurgy process

LIST OF EXCERCISES
METAL CASTING:
• Pattern Design and making – for one casting drawing.
• Sand properties testing – Exercise - for strengths, and permeability
• Moulding Melting and Casting

WELDING:
• Exercises in ARC Welding
• Exercises in GAS Welding

SHEET METAL FORMING
• Develop a flat blank layout from an assembly print, transfer the layout to the sheet metal, cut and form to the desired shape

POWDER METALLURGY
• Form parts from metallic powders, record and plot pressing data, perform destructives tests on sintered powder metal parts.
(i) Theory

COURSE OBJECTIVES

1. To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism and cam mechanisms for specified output motions.
2. To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.
3. To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
4. To understand the concept of inertia force and inertia torque.
5. To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
6. To understand the effect of dynamics of undesirable vibrations.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Identify the type and mechanism and will be able to perform velocity and acceleration analysis.
2. Classify the types of friction and understand the friction applications used in screw threads, clutches, brakes.
3. Specify the gear terminology and to select appropriate gear trains for engineering applications.
5. Describe the vibration phenomenon and its types along with the vibration terminologies.
6. Analyze the systems subjected to vibration.

UNIT I MECHANISMS


UNIT II FRICTION

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches – Belt and rope drives, Friction aspects in Brakes.

UNIT III GEARING AND CAMS

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicyclic gear trains - Determination of speed and torque - Cam– Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions.

UNIT IV FORCE ANALYSIS AND BALANCING


UNIT V VIBRATION

SUGGESTED READINGS

5. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers and Distributors, New Delhi, 2005

(ii) Laboratory

COURSEOBJECTIVES

1. To supplement the principles learnt in kinematics and Dynamics ofMachinery.
2. To gaining knowledge about designing components subjected to fluctuating loads like beam, shaft.
3. To competent enough to design gear and can design gear box system projects.
4. To understand the concept of lubrication and able to design the sliding contact bearings.
5. To understand the approach of statistic in designing and competent enough to design simple machine components by optimum design.
6. To understand the basic principles of aesthetic and ergonomic considerations in design of machine parts, concept of design for manufacture and able to design the flywheel.

COURSE OUTCOME

Upon completion of this course students will be able to
1. Determine the various parameters of governors, Cam & Gyroscopes
2. Determine the critical speed of a given shaft
3. Perform balancing of rotating and reciprocating parts
4. Determine the natural frequency of a given system
5. Determine the mass moment of inertia of a given component
6. Determine the damping coefficient of a single degree freedom system

LIST OF EXPERIMENTS

1. Governors – Determination of sensitivity, effort, etc. for Watt, Porter, Proell, and spring controlled Governors
2. Cam – Determination of jump speed and profile of the cam.
5. Balancing of rotating and reciprocating masses.
7. Vibrating system – spring mass system – Determination of damping coefficient of single degree of freedom system
8. Determination of torsional frequencies for compound pendulum and flywheel system with lumped moment of inertia.
Students will select the open elective course from the set of open electives offered by various departments which are listed in the table of curriculum.
COURSE OBJECTIVES

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledgesystem.
2. To know the need and importance of protecting traditionalknowledge.
3. To know the various government acts and rules for protection ofTK.
4. To know the various enactments related to the protection of traditionalknowledge.
5. To understand the concepts of Intellectual property to protect the traditionalknowledge.
6. To know the traditional knowledge in different sectors like engineering, medicineetc.

COURSE OUTCOMES

Upon completion of the course, the students are expected to:

1. Understand the concept of Traditional knowledge and itsimportance
2. Know the need and importance of protecting traditionalknowledge.
3. Know the various government acts and rules for protection ofTK
4. Know the various enactments related to the protection of traditionalknowledge.
5. Understand the concepts of Intellectual property to protect the traditionalknowledge.
6. Know the traditional knowledge in different sectors like engineering, medicineetc.

UNITI INTRODUCTION

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

UNITII PROTECTION OFTK

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNITIII GOVERNMENTACTS


UNITIV INTELLECTUAL PROPERTY RIGHTS

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

UNITV TK IN DIFFERENT SECTORS

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

SUGGESTED READINGS

2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin KumarSingh, Pratibha Prakashan2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers,2002
4. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2
COURSE OBJECTIVES
1. To understand the concepts of geometrical dimensioning and Tolerancing
2. To study the physical importance of them in industrial point of view
3. To know the various types of Tolerancing, its measurement and design.
4. To translate geometric callouts into plain English with one meaning.
5. To explain the major rules found in ASME Y14.5-2009
6. To understand the hierarchy of geometric tolerancing.

COURSE OUTCOMES
1. Ability to learn and apply geometric dimensioning and tolerance standards to communicate design intent
2. Ability to Learn how the knowledge of certain processes can affect part design and documentation
3. Gain added insight on working in a team design environment.
4. Translate geometric callouts into plain English with one meaning.
5. Explain the major rules found in ASME Y14.5-2009
6. Understand the hierarchy of geometric tolerancing.

INTRODUCTION

FORM AND ORIENTATION TOLERANCE
Design considerations – Flatness and Circularity measurement concepts – Orientation tolerance specification and application design.

POSITION AND RUNOUT TOLERANCE
Profile of surface and line tolerance design and application – Location tolerance, Position, applied and material condition consideration – Coaxial controls and design – Concentricity, Symmetry – Measurement and application – Design considerations – Position, Composite tolerance concept, design and Measurement – Runout, Total Runout tolerances – Measurement and considerations.

SUGGESTED READINGS
- Wade, O, Tolerance Control in design and manufacturing, Industrial Press, 1972
- STANDARDS - IS: 10714, 10715, 10716, 10717, 11669, 10719, 813, 919, 2709, 8000 pt 1 to 10721, 11158 and AWS/ISO
COURSE OBJECTIVES

1. To know the industrial welding applications
2. To be familiar with the materials processes industry applications.
3. To apply the knowledge of solid-state welding process for engineering applications.
4. To understand the principles of radiant energy metal joining process.
5. To understand the fundamental principles of special arc welding process.
6. To understand the knowledge of plasma arc in metal joining and cutting process.

COURSE OUTCOMES

Upon completion of this course, the students can able to
1. Apply suitable welding methods for process industries
2. Know the materials for process industries.
3. Apply the knowledge of solid-state welding process for engineering applications.
4. Understand the principles of radiant energy metal joining process.
5. Understand the fundamental principles of special arc welding process.
6. Understand the knowledge of plasma arc in metal joining and cutting process.

UNIT I

Heat exchanges, power cycle piping, super heaters, reheaters, economizer, auxiliary pipes, materials, processes and testing/inspection. Materials, processes, fabrication techniques and field welding for pressure vessel applications

UNIT II

Materials, processes, fabrication and construction, use of automatic welding and systems in automobile industry, automation, Oil and gas industry, materials, processes, fabrication, inspection and testing, case studies, recent trends and developments

UNIT III

Materials, processes, fabrication, inspection and testing, reasons for stringent quality control measures in nuclear industry

SUGGESTED READINGS:

COURSE OBJECTIVES

1. To know the repair procedures.
2. To learn metallurgical failures and servicing.
3. To understand NDT processes.
4. To acquire fundamental knowledge on principles of solid state welding processes.
5. To understand the effect of welding parameters on weld quality.
6. To study the importance of advanced welding processes.

COURSE OUTCOMES

Upon completion of this course, the students can able to:
1. Apply suitable welding techniques repairing.
2. Know the methods of welding against metallurgical failures.
3. Acquire practical knowledge on fusion and solid state welding processes.
4. Understand the effect of welding parameters on quality of welded joint.
5. Expertise on using welding software packages.
6. Analyse the experimental results using statistical tools.

UNIT I

Engineering aspects of repair, aspects to be considered for repair welding, techno-economics, repair welding procedures for components made of steel casting and cast iron. Half bead, temper bead techniques, usage of Ni base filler metals Damaged bends in gas transmission pipeline, heat exchanger repair technique-explosive expansion, plugging, etc.

UNIT II

Creep damaged high temperature components, repair of cracked petroleum pressure vessel/reactor. Types of wear, wear resistant materials, selection of materials for various wear applications; reclamation surfacing techniques, selection of welding process for reclamation. Integrating repair/maintenance into ongoing operations.

UNIT III

Radiation protection, steam generator repair, plugging. Various types of hardness tests, NDE of surface coatings, characterisation of coatings, photothermal imaging, case histories on selection application/materials combination.

Suggested Readings:

COURSE OBJECTIVES

1. To know the concepts of materials joining technology
2. To apply them for the advanced manufacturing processing for various structural engineering applications.
3. Understand the various codes and standards on welding applications.
4. Gain knowledge to apply a specific code for a given welding application
5. Understand the various manual and automated welding processes available.
6. Gain knowledge of the concepts, operating procedures, applications, advantages and limitations of various welding processes

COURSE OUTCOMES

1. Develop basic welding skills in manual arc welding processes
2. Understand the weldment microstructure
3. Analyze the various metallurgical factors affecting mechanical properties of different metals and alloys.
4. Gain knowledge to apply a specific code for a given welding application
5. Understand the various manual and automated welding processes available.
6. Gain knowledge of the concepts, operating procedures, applications, advantages and limitations of various welding processes

List of Experiments: Welding

1. Arc striking practice
2. Bead-on-plate welding
3. Effect of welding parameters on weld bead
4. Macrostructure

HAZ, Weldment, Bead Shape pool dimensions, Reinforcement

5. Microstructural observation of weldments
   - Carbonsteel
   - Stainless steel
   - Aluminium alloy
   - Titanium alloy
   - Dissimilar joints
COURSE OBJECTIVES
1. To expose students to problem definitions
2. To understand the Fabricate device/system/component (s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE OUTCOMES
1. Formulate problem definitions
2. Fabricate device/system/component (s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE DESCRIPTION
The students may be grouped into maximum of 4 students and work under the guidance of the supervisor. A project report to be submitted by the group and the course oriented project working model or demo model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department.
COURSE OBJECTIVES

1. To Study and acquire knowledge on design the power transmission components like belts, pulleys, ropes, chains and sprockets.
2. To Study and acquire knowledge on design spurs and parallel axis helical gears.
3. To give exposure to dimensions for bevel and worm gears.
4. To provide an overview of design procedures of gear boxes for industrial applications.
5. To provide an overview of clutches and brakes for engineering applications.
6. To make the student acquire sound knowledge of mechanical system

COURSE OUTCOMES

Upon completion of this course, the students will able to
1. Design the power transmission components like belts, pulleys, ropes, chains and sprockets.
2. Design spurs and parallel axis helical gears.
3. Estimate the dimensions for bevel and worm gears.
4. Practice the design procedures of gear boxes for industrial applications.
5. Design clutches and brakes for engineering applications.
6. Design a mechanical system

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS

UNIT II DESIGN OF SPUR AND HELICAL GEARS

UNIT III DESIGN OF BEVEL AND WORM GEARS
Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits – terminology – Thermal capacity, materials – forces and stresses, efficiency, estimating the size of the worm gear pair.

UNIT IV DESIGN OF GEAR BOXES

UNIT V DESIGN OF CLUTCHES AND BRAKES
Design of plate clutches – axial clutches – cone clutches – internal expanding rim clutches – internal and external shoe brakes. (Permitted to use PSG design data book in the examination)

SUGGESTED READINGS

COURSE OBJECTIVES
1. To Explain the mechanics of metal cutting, cutting tool materials, tool wear and cutting fluids.
2. To understand the concept of constructional features of different types of lathe and their operations.
3. To provide knowledge on construction & working of shaping, milling & drilling machines and gear cutting & finishing process.
4. To expose students to various types of grinding machines and broaching machines.
5. To Explain the construction features of different types of CNC machine and manual part programming for a given component.
6. To Perform part programming for CNC machines.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Explain the mechanics of metal cutting, cutting tool materials, tool wear and cutting fluids.
2. Discuss about the constructional feature of different types of lathe and their operations.
3. Describe the construction & working of shaping, milling & drilling machines and gear cutting & finishing process.
4. Illustrate the various types of grinding machines and broaching machines.
5. Explain the construction feature of different types of CNC machine and manual part programming for a given component.
6. Perform part programming for CNC machines.

UNIT I THEORY OF METAL CUTTING

UNIT II CONVENTIONAL MACHINETOOLS

UNIT III CNC MACHINING

UNIT IV ABRASIVE PROCESSES

UNIT V ELECTRICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES
SUGGESTED READINGS

(ii) Laboratory

COURSE OBJECTIVES

1. To Study and acquire knowledge on various basic machining operations in special purpose machines.
2. To learn applications in real life manufacture of components in the industry.
3. To learn the Step turning and taper turning and thread cutting Drilling and Tapping on the lathe machine.
4. To perform thread cutting and knurling on a circular C.S rod and using the lathe machine
5. To the operations of Shaping and Planing and milling.
6. To learn the measurement of the Angle and tapers by Bevel protractor, Sine bars, etc

COURSE OUTCOME

Upon completion of this course, the students will be able to
1. Perform shaping operation
2. Perform milling & slotting operation
3. Perform drilling, tapping and reaming operation
4. Perform grinding operations
5. Work with tool grinding machine
6. Work in a capstan and turret lathe

LIST OF EXERCISES

1. Exercises in shaping.
2. Exercises in Milling.
3. Exercises in slotting.
4. Exercises in Drilling / Tapping / Reaming.
5. Exercises in Surface grinding and cylindrical grinding process.
7. Exercises in Capstan and Turret Lathe.
(i) Theory

COURSE OBJECTIVES

1. To provide knowledge on various Metrological equipment available to measure the dimension of the components.
2. To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.
3. To enrich the understanding of principles of measuring instruments and gauges
4. To give exposure to inspection of spur gear and thread elements.
5. To equip them with skills to linear measurements using various measuring instruments
6. To give exposure to procedures involved in erecting machineries

COURSE OUTCOMES

Upon completion of this course, the students will able to
1. Understand the basics of measurements and quality standards.
2. Perform linear measurements using various measuring instruments
3. Perform the geometrical measurements of various components
4. Measure the various dimensions of a screw thread
5. Measure the dimensions of the simple spur gear.
6. Know the procedures involved in erecting machineries.

UNIT I  BASICS OF MEASUREMENT, DEVICES AND QUALITY STANDARDS


UNIT II  LINEAR MEASUREMENTS

Material length standards – line and end measurement – calibration of end bars, datum and reference surfaces, surface plates, gauges – feeler gauges, micrometers, dial test indicator, slip gauges, care of gauge blocks, Comparators - mechanical, electrical, optical and pneumatic, optical projector.

UNIT III  GEOMETRICAL MEASUREMENT

Angular measurement – plain vernier and optical protractors, sine bar, optical instruments, flatness, parallelism and roundness measurement, need for limit gauge, design of plug gague, Taylor’s principle, three basic types of limit gauges, surface texture, reasons for controlling surface texture, parameters used, specification of surface texture, drawing and symbols, Tomilson surface meter CMM.

UNIT IV METROLOGY OF MACHINE ELEMENTS

Types of screw threads, economics of measurement, proportions of ISO metric thread, measurement of major, minor and effective diameters. Gear terminology and standard proportions, spur gear measurement, checking of composite errors, base pitch measurement, clean room environment.

UNIT V  MACHINE INSTALLATION AND TESTING

Equipment erection, commissioning, testing procedure for lathe, milling, continuous process line. First aid, safety precautions in installation of equipment, protocol for repair and testing, inspection check list.

TEXT BOOKS

COURSE OBJECTIVES

1. Inspection of engineering parts with various precision instruments.
2. Design of part, tolerances and fits.
4. Evaluation and inspection of surface roughness.
5. Inspection of spur gear and thread elements.
6. Machine tool testing to evaluate machine tool quality

COURSE OUTCOMES

1. Students will be able to design tolerances and fits for selected product quality.
2. Students will be able to choose appropriate method
3. Students will be able to instruments for inspection of various gear elements and thread elements.
4. Students will be able to understand the standards of length, angles.
5. Students will be able to can understand the evaluation of surface finish and measure the parts with various comparators.
6. Students will be able to quality of the machine tool with alignment test can also be evaluated by them.

METROLOGY

1. Calibration of Vernier / Micrometer / Dialgauge
2. Checking dimensions of part using slipgauges
3. Measurement of gear tooth dimensions – addendum, dedendum, pitch circle diameter and tooth thickness
4. Measurement of taper angle using sine bar / tool makersmicroscope
5. Measurement of straightness and flatness
6. Measurement of thread parameters
7. Checking the limits of dimensional tolerances using comparators (Mechanical / Pneumatic / Electrical)
8. Surface finish measurement
### 18BEME6E PROFESSIONAL ELECTIVE–I

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### 18BEME6E PROFESSIONAL ELECTIVE–II

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### 18BE OPEN ELECTIVE– II

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</tbody>
</table>
COURSE OBJECTIVES
1. To gain practical experience in handling 2D drafting and 3D modeling softwaresystems.
2. To impart training on SOLID WORKS for modelling
3. To provide knowledge on assembly of components
4. To facilitate the understanding of manufacturing drawings from the models created
5. To understand the importance of MAT Lab for simulating different systems
6. To acquaint the student with the concepts of mat lab for performing various mathematical operations

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. use computer and CAD software's for modeling of mechanical components
2. use various options in SolidWorks for modeling of given components
3. create assembly of components
4. prepare manufacturing drawings from the models created
5. Use MAT Lab for simulating different systems like hydraulic and pneumatic circuits
6. Use mat lab for performing various mathematical operations

COMPUTER AIDED DESIGN
1. 3D modeling of various machine elements using various options like protrusion, cut, sweep, draft, loft, blend, rib.
2. Assembly – creating assembly from parts – assembly constraints
3. Conversion of 3D solid model to 2D drawing – different views, sections, isometric view and dimensioning.
4. Introduction to Surface Modeling.
5. Introduction to File Import, Export – DXF, IGES, STL, STEP

Note: Any one of the 3D MODELING software’s like SOLIDWORKS, CREO, CATIA, NX Software, AutoCAD etc.

COMPUTER AIDED SIMULATION
1. Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using Software
2. Simulation of Hydraulic / Pneumatic cylinder using Software
3. Simulation of cam and follower mechanism using Software
4. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
5. Use of MATLAB to solve simple problems invibration
COURSE OBJECTIVES
1. To develop the student’s knowledge in various robot structures and their workspace.
2. To develop student’s skills in performing spatial transformations associated with rigid body motions.
3. To develop student’s skills in perform kinematics analysis of robot systems.
4. To provide the student with knowledge of the singularity issues associated with the operation of robotic systems.
5. To provide the student with some knowledge and analysis skills associated with trajectory planning.
6. To provide the student with some knowledge and skills associated with robot control.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Understand the fundamentals of robots
2. Describe the robot cell design
3. Know the safety considerations in robotic applications.
4. The student with knowledge of the singularity issues associated with the operation of robotic systems.
5. The student with some knowledge and analysis skills associated with trajectory planning.
6. The student with some knowledge and skills associated with robot control.

FUNDAMENTALS OF ROBOT

ROBOT CELL DESIGN
Robot cell design – simulation software (Robo Wave). Robot cell layouts – Multiple robots and machine interference – robot cell planning – robot cycle time analysis for assembly, welding and painting shop.

SAFETY CONSIDERATIONS

SUGGESTED READINGS
COURSE OBJECTIVES

1. To establish the welding procedures.
2. To learn the codes and practices.
3. To identify welding procedure specifications. Develop welding procedures, and list alloy/phases of metal and the effect of heating and cooling.
4. To identify the welding symbol and weld symbols.
5. To identify both destructive and non-destructive weld test, and identify weld discontinuities.
6. To list responsibilities of inspectors, apply pre-weld, in process, and shop inspections standards.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Establish the welding procedures.
2. Learn the codes and practices.
3. Identify welding procedure specifications. Develop welding procedures, and list alloy/phases of metal and the effect of heating and cooling.
4. Identify the welding symbol and weld symbols.
5. Identify both destructive and non-destructive weld test, and identify weld discontinuities.
6. List responsibilities of inspectors, apply pre-weld, in process, and shop inspections standards.

UNIT I

Design requirements, allowable stress values, workmanship and inspection, introduction to welding codes and standards, AWS D1.1 Process and product standards for manufacturing of pipe - welding procedure and welder qualification, field welding and inspection.

UNIT II

API 1104 and API 5L Design requirements, fabrication methods, joint categories, welding and inspection, post weld heat treatment and hydro testing, ASME II, V, VIII and IX Welding procedure specification, procedure qualification records, performance qualification, variables.

UNIT III

Introduction to materials standards and testing of materials, consumables testing and qualification as per ASME/AWS requirements

SUGGESTED READINGS:

1. AWS D1.1 Structural Welding Code
2. API 5L
3. API 1104
4. ASME Section VIII - Division I
5. ASME Section IX
6. ASME Section II Part A
COURSE OBJECTIVES
1. To know the consumables in welding industry.
2. To know the standards and qualification for consumables.
3. To describe safety precautions when using trade-related hand and power tools and equipment.
4. To selecting appropriate trade-related equipment for the job.
5. To safely operating trade-related equipment to complete specified welding processes efficiently and correctly.
6. To employing math concepts to measure thickness and layout materials to complete task.

COURSE OUTCOMES
Upon completion of this course, the students can able to:
1. Know the consumables in welding industry.
2. Know the standards and qualification for consumables.
3. Describing safety precautions when using trade-related hand and power tools and equipment.
4. Selecting appropriate trade-related equipment for the job.
5. Safely operating trade-related equipment to complete specified welding processes efficiently and correctly.
6. Employing math concepts to measure thickness and layout materials to complete task.

UNIT I
FLUX COATED ELECTRODES: SMAW electrodes for carbon steels, low alloy steels, stainless steels, Al alloys, Cu alloys, Ni alloys – Classification as per AWS, Requirements of mechanical properties, chemical composition, testing requirements, intended use of important electrodes. Problems based on selection of flux coated electrodes based on flux characteristics, material to be welded, properties required / applications. Filler metal qualification as per Section IIC.

BARE WELDING ELECTRODES AND RODS: Bare welding electrodes and rods for carbon steels, low alloy steels, stainless steels, Al alloys, Ni alloys, Cu alloys, Ti alloys – Classification as per AWS, Requirements of mechanical properties, chemical composition, testing requirements, intended use of important electrodes. Problems based on selection of bare welding electrodes and rods based on material to be welded, properties required / applications. Filler metal qualification as per Section IIC.

UNIT II
ELECTRODES AND FLUXES FOR SAW AND FLUX CORED ELECTRODES: SAW electrodes for carbon steels, low alloy steels, Fluxes, manufacturing methods, chemical nature; FCAW electrodes for Carbon steels, Low alloy steels, Stainless steels, Ni alloys. Classification as per AWS, Requirements of mechanical properties, chemical composition, testing requirements, intended use of important electrodes. Problems based on selection of electrodes and fluxes based on flux characteristics, material to be welded, properties required / applications. Filler metal qualification as per Section IIC.

CAST IRON ELECTRODES AND RODS: Classification as per AWS, Requirements of mechanical properties, chemical composition, testing requirements, intended use of important electrodes. Problems based on selection of iron electrodes based on material to be welded, properties required / applications. Filler metal qualification as per Section IIC.

UNIT III
BRAZING METALS, BRAZING FLUXES, TUNGSTEN ELECTRODES, SHIELDING GASES: Classification as per AWS, intended use, testing requirements, Shielding gases - Types, characteristics, physical properties, shielding properties, applications. Problems based on brazing metals, brazing fluxes, tungsten electrodes, shielding gases based on material to be joined, properties required / applications. Filler metal qualification as per Section IIC.

SUGGESTED READINGS
COURSE OBJECTIVES

1. To develop the knowledge of heat treatment and associated procedure of various engineering materials
2. apply them to study how it influences the microstructure and results in different mechanical behavior.

Course Content

3. The student will identify six properties of metals; explain the processes by which Iron and Steel are made; and describe the effect of alloying elements on Steel.
4. The student will select the proper grade of tool steel for a workpiece; harden and temper a carbon-steel workpiece; and caseharden a piece of machine steel.
5. The student will explain the three methods of hardness testing; perform a Rockwell C hardness test on a workpiece; Perform Tensile strength and impact tests on a workpiece; Describe several nonferrous metals used in industry.
6. The student will define various terms that apply to metal cutting; explain the flow patterns of metal as it is cut; and recognize the three types of chips produced from various metals.

COURSE OUTCOMES

1. Develop the knowledge of heat treatment and associated procedure of various engineering materials
2. Apply them to study how it influences the microstructure and results in different mechanical behavior.

Course Content

3. The student will identify six properties of metals; explain the processes by which Iron and Steel are made; and describe the effect of alloying elements on Steel.
4. The student will select the proper grade of tool steel for a workpiece; harden and temper a carbon-steel workpiece; and caseharden a piece of machine steel.
5. The student will explain the three methods of hardness testing; perform a Rockwell C hardness test on a workpiece; Perform Tensile strength and impact tests on a workpiece; Describe several nonferrous metals used in industry.
6. The student will define various terms that apply to metal cutting; explain the flow patterns of metal as it is cut; and recognize the three types of chips produced from various metals.

List of Experiments

1. Determination of grain size of low carbon steels
2. Heat treatment of mild, medium carbon and alloy steels
3. Carburizing of steel
4. Heat treatment of tool steels
5. Heat treatment of stainless steels
6. Heat treatment of titanium alloys
7. Heat treatment of magnesium alloys
8. Heat treatment of aluminium alloys
9. Heat treatment of superalloys
10. Microstructural evaluation of nitrocarburised steels
**COURSE OBJECTIVES**

1. To expose students to problem definitions
2. To understand the fabricate device/system/component(s) for problem solving.
3. To equip them subject knowledge to solve real-world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

**COURSE OUTCOMES**

1. Formulate problem definitions
2. Fabricate device/system/component(s) for problem solving.
3. Apply subject knowledge to solve real-world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

**COURSE DESCRIPTION**

The students may be grouped into maximum of 4 students and work under a project supervisor. The device/system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department.
COURSE OBJECTIVES
1. To understand the importance of automation in the field of machine tool based manufacturing
2. To get the knowledge of various elements of manufacturing automation – CAD/CAM, sensors, pneumatics, hydraulics and CNC
3. To understand the basics of product design and the role of manufacturing automation
4. To provide an overview of the importance of group technology and FMS
5. To provide knowledge on various inspection technologies to enhance the quality of the system
6. To enrich the understanding of various manufacturing support systems

COURSE OUTCOMES
Upon completion of this course, the students will
1. Understand the basics and need for automation in manufacturing
2. Describe the essential requirement of the computers in design
3. Explain the importance of group technology and FMS
4. Understand the essentiality of quality control.
5. Apply various inspection technologies to enhance the quality of the system.
6. Explain various manufacturing support systems.

UNIT I MANUFACTURING OPERATIONS

UNIT II AUTOMATED MANUFACTURING SYSTEMS

UNIT III GROUP TECHNOLOGY & FLEXIBLE MANUFACTURING SYSTEMS

UNIT IV QUALITY CONTROL SYSTEMS AND INSPECTION TECHNOLOGIES

UNIT V MANUFACTURING SUPPORT SYSTEM

SUGGESTED READINGS:
COURSE OBJECTIVES

1. To study the features of CNC Machine Tool.
2. To expose students to modern control systems (Fanuc, Siemens, etc.)
3. To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre.
4. To create part programming involving different motions.
5. To understand the working of standard canned cycles.
6. To generate NC code using software's

COURSE OUTCOMES

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

1. Create manual part programming for various components using G and M codes
2. Expose students to modern control systems (Fanuc, Siemens, etc.)
3. Know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre
4. Create part programming involving different motions.
5. Understand the working of standard canned cycles.
6. Generate NC code using software's

LIST OF EXPERIMENTS

1. MANUAL PART PROGRAMMING (Using G and M Codes) in CNC Machine.
2. Part programming for Linear, Circular interpolation, and Contour motions.
3. Part programming using standard canned cycles for Thread cutting, Drilling, Peck drilling, and Boring.
4. NC code generation using software's like Edge CAM, CREO, etc.
5. CNC Controllers like FANUC, Siemens, and Hiedenhain etc.
(i) Theory

COURSE OBJECTIVES
1. To get the knowledge on CAD/CAM systems.
2. To introduce the students to various techniques in CAD and help them to gain proficiency in developing mathematical models and CNC programmes.
3. To understand the concept of finite element method for displacement and nodal forces.
4. To gain knowledge of numerical calculations and computer tools for validation.
5. To study the convergence of output results and validate through theoretical approach.
6. To introduce the concepts of coding behind working of finite element concepts

COURSE OUTCOMES
Upon completion of this course, the students will
1. Understand geometric transformation techniques in CAD.
2. Develop mathematical models to represent curves and surfaces and model engineering components using solid modeling techniques.
3. Develop CNC programs to manufacture industrial components.
4. Apply core mechanical concept to provide preliminary results of nodal force and displacement using FEM.
5. Explain the coding behind working of finite element concept for validation of static structural and thermal analysis.
6. Interpret the results of finite element analysis and make an assessment results in terms of modeling Discretization.

UNIT I INTRODUCTION TO CAD/CAM AND GEOMETRIC MODELING

UNIT II CAM AND CNC

UNIT III INTRODUCTION TO FEM

UNIT IV ONE AND TWO DIMENSIONAL PROBLEMS

UNIT V AXISYMMETRIC AND ISOPARAMETRIC CONTINUUM
SUGGESTED READINGS:


(ii) Laboratory

COURSE OBJECTIVES

1. To perform simple structural analysis and thermal analysis using simulation software’s.
2. To perform structural analysis of bars and trusses.
3. To perform structural analysis of beams and frames.
4. To perform 2D analysis of plate and shells.
5. To perform modal analysis of simple systems.
6. To perform thermal analysis of simple systems.

COURSE OUTCOMES

Upon completion of this course, the Students will be able to
1. Perform structural analysis of bars and trusses.
2. Perform structural analysis of beams and frames.
3. Perform 2D analysis of plate and shells.
4. Perform modal analysis of simple systems.
5. Perform thermal analysis of simple systems.
6. Perform fluid and failure analysis of simple systems.

LIST OF EXPERIMENTS

(Simple Analysis using ANSYS Tool)

1. Structural Analysis (Static)
   1d and 2d analysis of
   - Bar and truss,
   - Beams & frames,
   - Plate and shell structures
2. Structural vibration analysis (Dynamic)
   - Modal analysis
   - Frequency response analysis
   - Transient response analysis
3. Thermal analysis – simple problems
4. Fluid Analysis – simple problems
5. Failure analysis – simple problems
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COURSE OBJECTIVES
1. To understand the working principles of pumps
2. To understand the working principles and motors
3. To develop the system curve
4. To calculate the Net Positive Suction Head
5. To calculate the pump Total Head versus Rate of Flow characteristic
6. To match pumps to variable, parallel and series pumping systems

COURSE OUTCOMES
1. Understand the working principles of pumps.
2. Understand the working principles and motors.
3. Develop the system curve.
4. Calculate the Net Positive Suction Head.
5. Calculate the pump Total Head versus Rate of Flow characteristic.
6. Match pumps to variable, parallel and series pumping systems.

UNIT I SINGLE PHASE INDUCTION MOTOR

UNIT II THREE PHASE INDUCTION MOTOR

UNIT III PUMPS
Pumps: definition and classifications – Sewage, fire fighting and Pressure boosting pumps Classification, working principle, indicator diagram, work saved by air vessels and performance curves – cavitations in pumps – rotary pumps: working principles of gear and vane pumps

SUGGESTED READINGS
COURSE OBJECTIVES

1. To identify how basic requirements of welding are fulfilled in welding processes and connect with the physical features.
2. To illustrate behavior of welding arc and appraise effect of arc welding process variables on bead parameters and develop arc welding procedure for given job.
3. To choose a suitable welding process for a given welding application.
4. To choose an appropriate method to produce directional solidification in the casting.
5. To illustrate causes of casting defects and its remedies and illustrate casting design considerations.
6. To illustrate capabilities and applications of casting processes.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Identify how basic requirements of welding are fulfilled in welding processes and connect with the physical features.
2. Illustrate behavior of welding arc and appraise effect of arc welding process variables on bead parameters and develop arc welding procedure for given job.
3. Choose a suitable welding process for a given welding application.
4. Choose an appropriate method to produce directional solidification in the casting.
5. Illustrate causes of casting defects and its remedies and illustrate casting design considerations.
6. Illustrate capabilities and applications of casting processes.

UNIT I


UNIT II

Types of joints, joint efficiency, edge preparation, types of loads, design for static lading, design for cyclic loading, rigid structures, primary and secondary welds, treating a weld as a line, structural tubular connections, influence of specifications on design, symbols for welding and inspection, estimating and control of welding costs. Residual stresses, causes and effects, methods to measure residual stresses, weld distortion.

UNIT III

Boiler and pressure vessel codes, structural welding codes, pipelines codes. Welding procedure specifications, welding procedure qualifications, welder performance qualifications, welding variables, filler metal qualifications, qualification of welding inspectors, welding supervisors and welding engineers, qualification of NDT personnel.

SUGGESTED READINGS:

COURSE OBJECTIVES
1. To identify how basic requirements of welding are fulfilled in welding processes and connect with the physical features.
2. To illustrate behavior of welding arc and appraise effect of arc welding process variables on bead parameters and develop arc welding procedure for given job.
3. To choose a suitable welding process for a given welding application.
4. To choose an appropriate method to produce directional solidification in the casting.
5. To illustrate causes of casting defects and its remedies and illustrate casting design considerations.
6. To illustrate capabilities and applications of casting processes

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Identify how basic requirements of welding are fulfilled in welding processes and connect with the physical features.
2. Illustrate behavior of welding arc and appraise effect of arc welding process variables on bead parameters and develop arc welding procedure for given job.
3. Choose a suitable welding process for a given welding application.
4. Choose an appropriate method to produce directional solidification in the casting.
5. Illustrate causes of casting defects and its remedies and illustrate casting design considerations.
6. Illustrate capabilities and applications of casting processes.

UNIT I
Type of joints, joint efficiency, factor of safety, symbols, selection of edge preparation, design considerations. Types of loading Permissible stress, allowable defects, computation of stresses in welds, weld size calculation, code requirement for statically loaded structures

UNIT II

UNIT III
Types of distortion - factors affecting distortion - distortion control methods - prediction - correction, jigs, fixtures and positioners.

Suggested Readings:
COURSE OBJECTIVES
1. To know the consumables in welding industry.
2. To know the standards and qualification for consumables.
3. To encribing safety precautions when using trade-related hand and power tools and equipment
4. To selecting appropriate trade-related equipment for the job
5. To safely operating trade-related equipment to complete specified welding processes efficiently and correctly
6. To employing math concepts to measure thickness and layout materials to complete task

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Know the consumables in welding industry.
2. Know the standards and qualification for consumables.
3. Encribing safety precautions when using trade-related hand and power tools and equipment
4. Selecting appropriate trade-related equipment for the job
5. Safely operating trade-related equipment to complete specified welding processes efficiently and correctly
6. Employing math concepts to measure thickness and layout materials to complete task

Ex.No.1. Process physical simulation Mathematical Modeling –

Ex No: 2: Thermal cycle’s simulation studies on weldments using ANSYS

Ex.No: 3 usage of expert systems in welding processes

Ex.No: 4 Artificial intelligence and welding

Ex.No: 5 Solidification studies and microstructure formation

Ex.No: 6. Weld simulator and weld skill development
COURSE OBJECTIVES
1. To expose students to problem definitions
2. To understand the Fabricate device/system/component(s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE OUTCOMES
1. Formulate problem definitions
2. Fabricate device/system/component(s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE DESCRIPTION
The students in a group consisting of maximum of 4 students works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. The project work carried out in this semester may be a standalone project or part of the work of project work – V carried out in the eighth semester.
COURSE OBJECTIVES

1. To expose students to problem definitions
2. To understand the Fabricate device/system/component (s) for problem solving.
3. To equip them subject knowledge to solve real world problems.
4. To acquaint the student to newer techniques to improve the performance of a device/system.
5. To develop the skill to prepare the project reports
6. To develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE OUTCOMES

1. Formulate problem definitions
2. Fabricate device/system/component (s) for problem solving.
3. Apply subject knowledge to solve real world problems.
4. Implement newer techniques to improve the performance of a device/system.
5. Develop the skill to prepare the project reports
6. Develop the skill to prepare power point presentation and to face reviews and viva voce examination.

COURSE DESCRIPTION

The students in a group consisting of maximum of 4 student’s works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.
COURSE OBJECTIVES
1. To describe various processing techniques of different engineering materials.
2. To analyse the Phase diagram and Microstructure using Microscope for different type of Stainless-steel materials.
3. To describe the metallurgical aspects of aluminium, magnesium and titanium alloys.
4. To get basic knowledge on super alloys and its applications.
5. To get basic understanding of nano materials, shape memory alloys and biomaterials.
6. To select the material for Biological, Nuclear, Space and Cryogenic service applications.

COURSE OUTCOMES
Upon completion of this course, the students can
1. Describe various processing techniques of different engineering materials.
2. Analyse the Phase diagram and Microstructure using Microscope for different type of Stainless-steel materials.
3. Describe the metallurgical aspects of aluminium, magnesium and titanium alloys.
4. Get basic knowledge on super alloys and its applications.
5. Get basic understanding of nano materials, shape memory alloys and biomaterials.
6. Select the material for Biological, Nuclear, Space and Cryogenic service applications.

UNIT I  CRYSTALLINE ALLOYS
Techniques of rapid solidification. Production of metallic glasses, atomic arrangement, comparison with crystalline alloys - mechanical, electrical, magnetic, superconducting and chemical properties and applications.

UNIT II  STAINLESS STEEL
Phase diagrams of ferritic, martensitic and austenitic stainless steels, duplex stainless steels, precipitation hardenable stainless steels, mechanical and metallurgical properties of stainless steels, HSLA steels, micro-alloyed steels.

UNIT III  ALLOYS OF ALUMINIUM, MAGNESIUM & TITANIUM
Aluminium alloys, magnesium alloys and titanium alloys; metallurgical aspects, mechanical properties and applications.

UNIT IV  SUPER ALLOYS
Development of super alloys - iron base, nickel base and cobalt base - properties and their applications; materials for cryogenic service, materials in nuclear field, materials used in space.

UNIT V  ADVANCED MATERIALS
Carbonaceous materials - including nano tubes and fullerenes; shape memory alloys, functionally gradient materials, high temperature super conductors - bio materials.

SUGGESTED READINGS
COURSE OBJECTIVES

1. To explain importance of renewable energy resources.
2. To understand the importance of basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
3. To understand the importance of principles of energy conversion from alternate sources.
4. To understand the importance of wind, geothermal, ocean, biomass, biogas and hydrogen.
5. To study the features of design principles of biogas plants.
6. To understand the concepts and applications of fuel cells, thermoelectric converter and MHD generator.

To give exposure to power plants working with non-conventional energy.

COURSE OUTCOMES

Upon completion of this course, the students can able to

1. Understand the importance of renewable energy resources.
2. Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.
3. Understand principles of energy conversion from alternate sources.
4. Understand the importance of wind, geothermal, ocean, biomass, biogas and hydrogen.
5. Implement design principles of biogas plants.
6. Understand the concepts and applications of fuel cells, thermoelectric converter and MHD generator.

UNIT I ENERGY AND ENVIRONMENT

Primary energy sources – world energy resources – Indian energy scenario – energy cycle of the earth – environmental aspects of energy utilization, CO$_2$ emissions and Global warming – renewable energy resources and their importance. Potential impacts of harnessing the different renewable energy resources.

UNIT II SOLARENERGY


UNIT III WIND, TIDAL AND GEO THERMAL ENERGY

Energy from the wind – general theory of windmills – types of windmills – design aspects of horizontal axis windmills – applications. Energy from tides and waves – working principles of tidal plants and ocean thermal energy conversion plants – power from geothermal energy – principle of working of geothermal power plants.

UNIT IV BIOENERGY


UNIT V OTHER RENEWABLE ENERGYSOURCES

Direct energy conversion (Description, principle of working and basic design aspects only) – Magneto hydrodynamic systems (MHD) – thermoelectric generators – thermionic generators – fuel cells – solar cells – types, Emf generated, power output, losses and efficiency and applications. Hydrogen conversion and storage systems.
SUGGESTED READINGS

COURSE OBJECTIVES
1. To understand the anatomy, basic concepts and applications of robot.
2. To learn the drives and end effectors used in robot.
3. To study the various types of sensors used in robot.
4. To familiarize robot kinematics and robot programming
5. To provide knowledge on simple offline robot program
6. To impart knowledge on economic analysis of robots

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Identify the various types of robots.
2. Select appropriate drive systems and end effectors for industrial application.
3. Decide the types of sensors required according to the applications of robot.
4. To identify the different types of machine vision technologies
5. Develop simple offline robot program for different applications.
6. Calculate the economic analysis of robots.

UNIT I  FUNDAMENTALS OF ROBOT

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

UNIT III  SENSORS AND MACHINEVISION

UNIT IV  ROBOT KINEMATICS AND ROBOT PROGRAMMING
Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems.
Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs

UNIT V  IMPLEMENTATION AND ROBOT ECONOMICS

SUGGESTED READINGS
B. E. Mechanical Engineering 2018-19

18BEME6E04 ADVANCED I.C.ENGINES 3 H – 3 C

Instruction hours / week L : 3 T : 0 P:0  Marks: Internal : 40 External : 60 Total:100

End Semester Exam :3Hours

COURSE OBJECTIVES
1. To understand the underlying principles of operation of different IC Engines and components.
2. To provide knowledge on pollutant formation, control, alternate fuels etc.
3. To Study and acquire knowledge to Identify parts, terminology and fuel supply system of internal combustion engine
4. To introduce the concepts of cooling and lubrication systems of IC engines
5. To make the student acquire sound knowledge on combustion, knocking and super charging of internal combustion engines
6. To expose students to recent trends associated with IC engines

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Explain the construction and operation of internal combustion engine.
2. Identify parts, terminology and fuel supply system of internal combustion engine.
3. Recognize the component used in cooling and lubrication systems of IC engines.
4. Describe the function of combustion, knocking and super charging of internal combustion engines.
5. Implement strategies for pollution control.
6. Know about the recent trends associated with IC engines

UNITI SPARK IGNITION ENGINES

UNITII COMPRESSION IGNITION ENGINES

UNITIII POLLUTANT FORMATION AND CONTROL

UNITIV ALTERNATIVE FUELS
Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNITV RECENT TRENDS

SUGGESTED READINGS
COURSE OBJECTIVES
1. To recognize symbols and fundamentals in fluid power generation and distribution.
2. To identify power source for hydraulic systems.
3. To select appropriate components used in various hydraulic systems.
4. To design hydraulic circuits for given applications.
5. To distinguish the components used in pneumatic circuits.
6. To create the logic circuits for controlling electro-hydraulic/pneumatic systems.

COURSE OUTCOMES
At the end of the course, the students will be able to
1. Recognize symbols and fundamentals in fluid power generation and distribution.
2. Identify power source for hydraulic systems.
3. Select appropriate components used in various hydraulic systems.
4. Design hydraulic circuits for given applications.
5. Distinguish the components used in pneumatic circuits.
6. Create the logic circuits for controlling electro-hydraulic/pneumatic systems.

UNIT I  FLUID POWER SYSTEMS AND FUNDAMENTALS

UNIT II  HYDRAULIC SYSTEM AND COMPONENTS

UNIT III  DESIGN OF HYDRAULIC CIRCUITS

UNIT IV  PNEUMATIC SYSTEMS AND COMPONENTS

UNIT V  DESIGN OF PNEUMATIC CIRCUITS
Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

SUGGESTED READINGS
COURSE OBJECTIVES

1. To make the student acquire sound knowledge on the types of vehicle structures, cooling and lubrication systems required.
2. To acquaint the student with the concepts of type of engines to be used for modern automobiles.
3. To familiarize the students to Distinguish between the manual transmissions systems with automatic transmission systems.
4. To provide knowledge on appropriate transmission systems for the optimal power transmission.
5. To provide knowledge on steering, brakes and suspension systems for effective functioning.
6. To acquaint the student with advanced technologies in automotive Engineering.

COURSE OUTCOMES

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

1. Identify the types of vehicle structures, cooling and lubrication systems required.
2. Determine the type of engines to be used for modern automobiles.
3. Distinguish between the manual transmissions systems with automatic transmission systems.
4. Select appropriate transmission systems for the optimal power transmission.
5. Select steering, brakes and suspension systems for effective functioning.
6. Implement the advanced technologies in automotive.

UNIT I AUTOMOBILE ARCHITECTURE AND PERFORMACE

Automotive components, subsystems and their positions – Chassis, frame and body, front, rear and four wheel drives – Operation and performance – Traction force and traction resistance, Power required for automobile– Rolling, air and gradient resistance.

UNIT II TYPES OF ENGINES


UNIT III TRANSMISSION SYSTEMS

Clutch : Types – coil spring and diaphragm type clutch, single and multi plate clutch, centrifugal clutch, Gear box : Types – constant mesh, sliding mesh and synchromesh gear box, layout of gear box, gear selector and shifting mechanism, overdrive, automatic transmission, Propeller shaft, universal joint, slip joint, differential and real axle arrangement, hydraulic coupling.

UNIT IV WHEEL AND TYRES AND SUSPENSION SYSTEM

Types of wheels, construction, wired wheels, Tyres – construction, Radial, bias and belted bias, slip angle, Tread patterns, Tyre retreading - cold and hot, Tubeless tyres, Types–front and rear suspension, conventional and independent type suspension, leaf springs, coil springs, dampers, torsion bars, stabilizer bars, arms, air suspension systems – Balancing of Wheels.

UNIT V STEERING SYSTEM AND BRAKING SYSTEM

Types of steering systems, Ackermann principle, Davis steering gear, steering gear boxes, steering linkages, power steering, wheel geometry–caster, camber, toe–in, toe out etc., wheel Alignment. Braking System – Forces on vehicles, tyre grip, load transfer, braking distribution between axles, stopping distance, Types of brakes, Mechanical, Hydraulic, Air brakes, Disc and Drum brakes, Engine brakes and Anti lock braking system.

SUGGESTED READINGS

2. Dr. Kirpal Singh, Automobile Engineering Vol–I and II, 14th edition, Standard publishers, Delhi, 2019
COURSE OBJECTIVES
1. To impart knowledge on the principles of locating and clamping devices in machining process.
2. To familiarize the students to understand design of jigs for a given component.
3. To Study and acquire knowledge on design fixtures for a given component.
4. To make the student acquire sound knowledge on appropriate type of press tool for a given component.
5. To expose students to drawing die for a given component.
6. To give exposure to the use computer aids for sheet metal forming analysis

COURSE OUTCOMES
Upon the completion of this course the students will be able to
1. Summarize the principles of locating and clamping devices in machining process.
2. Design jigs for a given component.
3. Design fixtures for a given component.
4. Design an appropriate type of press tool for a given component.
5. Develop a drawing die for a given component.
6. Use computer aids for sheet metal forming analysis

UNIT I PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES

UNIT II JIGS

UNIT III FIXTURES
General principles of boring, lathe, milling and broaching fixtures– Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures– Modular fixtures, Quick change fixtures. Design and development of fixtures for given component.

UNIT IV PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAYOUT

UNIT V DESIGN AND DEVELOPMENT OF DIES

SUGGESTED READINGS
COURSE OBJECTIVES
1. To understand the underlying principles of operations in different Refrigeration & Air conditioning systems and components.
2. To provide knowledge on design aspects of Refrigeration & Air conditioning systems.
3. To introduce the concepts on use of unconventional refrigerant system for industrial application.
4. To expose students to properties of air using psychrometric chart.
5. To provide knowledge on cooling load for a given system.
6. To know the application of air conditioning system for industrial and domestic purpose.

COURSE OUTCOMES
Learners should be able to
1. Calculate COP of various refrigeration cycles.
2. Choose appropriate refrigerants for various applications.
3. Identify the use of unconventional refrigerant system for industrial application.
4. Calculate the properties of air using psychrometric chart.
5. Calculate cooling load for a given system.
6. Select the appropriate air conditioning system for industrial and domestic applications.

UNIT I REFRIGERATION CYCLE

UNIT II REFRIGERANTS, SYSTEM COMPONENTS AND BALANCING

UNIT III PSYCHROMETRY

UNIT IV COOLING LOAD CALCULATIONS

UNIT V AIR CONDITIONING

SUGGESTED READINGS
COURSE OBJECTIVES
1. To provide knowledge on different aspects of powder metallurgy parameters.
2. To understand the importance of principle of advanced welding processes and its application.
3. To understand the importance of advanced forming processes and its application.
4. To familiarize the students to advanced manufacturing process for processing of different materials.
5. To acquaint the student to apply the suitable rapid prototyping mechanism for industry need.
6. To provide knowledge on optimum parametric for advanced manufacturing process.

COURSE OUTCOMES
Upon the completion of this course, the students will be able to
1. Understand different aspects of powder metallurgy parameters.
2. Understand basic principle of advanced welding processes and its application.
3. Understand basic principle of advanced forming processes and its application.
4. Select the best suitable advanced manufacturing process for processing of different materials.
5. Apply the suitable rapid prototyping mechanism for industry need.
6. Select the optimum parametric for advanced manufacturing process.

UNIT I  POWDER METALLURGY PROCESS

UNIT II  ADVANCED WELDING PROCESSES

UNIT III  SHEET METAL AND FORMING PROCESS

UNIT IV  ADVANCED MACHINING PROCESS
Modern machining process: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, Electro chemical Machining, Electro chemical Grinding, Electro Discharge Machining, wire cut EDM, Electron Beam Machining, plasma arc machining, Laser Beam Machining. Ultrasonic Machining, High speed machining process – deep hole drilling process

UNIT V  RAPID PROTOTYPING

SUGGESTED READINGS
COURSE OBJECTIVES
1. To understand the Fundamentals of Vibration and its practical applications
2. To understand the working principle and operations of various vibrations Measuring instruments.
3. To understand the importance of vibration isolation
4. To understand the various Vibration control strategies
5. To equip them with skills to solve mathematically a multi-degree freedom system & continuous system
6. To give exposure to the various experimental methods used for vibration analysis

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Define the terms involved in vibration system.
2. Describe the importance of vibration isolation
3. Explain the working nature of two degree of freedom systems
4. Solve mathematically a multi-degree freedom system & continuous system
5. List the various techniques used in vibration control
6. Explain the various experimental methods used for vibration analysis.

UNIT I  FUNDAMENTALS OF VIBRATION

UNIT II  TWO DEGREE FREEDOM SYSTEM
Introduction - Free Vibration of Undamped And Damped - Forced Vibration With Harmonic Excitation System – Coordinate Couplings And Principal Coordinates.

UNIT III  MULTI-DEGREE FREEDOM SYSTEM AND CONTINUOUS SYSTEM

UNIT IV  VIBRATION CONTROL

UNIT V  EXPERIMENTAL METHODS IN VIBRATION ANALYSIS

SUGGESTED READINGS
COURSE OBJECTIVES

1. To provide foundations on design of experiments and statistical analysis of experimental data obtained from laboratory and/or industrial processes.
2. To understand the important concepts of single factorial designs
3. To Study and acquire knowledge on various methodologies involved in single factorial designs
4. To know the application of testing of factorial experiment
5. To enrich the understanding of special experimental designs
6. To impart knowledge on basic concepts of Taguchi method in parameter design

COURSE OUTCOMES

Upon successful completion of the course, students will be able to:
1. Understand the knowledge of various techniques for experimental planning
2. Understand the concepts of single factorial designs
3. List the various methodologies involved in single factorial designs
4. Apply the concept of testing of factorial experiment
5. Solve the partial and ordinary differential equations special experimental designs
6. Apply the basic concepts of Taguchi method in parameter design

UNIT I INTRODUCTION

UNIT II SINGLE FACTOR EXPERIMENTS
ANOVA rationale - Sum of squares – Completely randomized design, Randomized block design, effect of coding, Comparison of treatment means – Newman Kuel’s test, Duncan’s Multiple Range test, Latin Square Design, Graeco-Latin Square Design, Balanced incomplete design.

UNIT III FACTORIAL EXPERIMENTS
Main and interaction effects –Two and three Factor full factorial Designs, 2 k designs with Two and Three factors-Unreplicated design- Yate’s Algorithm

UNIT IV SPECIAL EXPERIMENTALDESIGNS
Blocking in factorial design, Confounding of 2k design, nested design-Response Surface Methods.

UNIT V TAGUCHI TECHNIQUES
Fundamentals of Taguchi methods, Quality Loss function, orthogonal designs, application to Process and Parameter design.

SUGGESTED READINGS
1. This course introduces the fundamental concepts, principles, analysis and design of hybrid, electric and fuel cell vehicles.
2. To understand working of different configurations of electric vehicles, and its components, hybrid vehicle configuration and performance analysis.
3. To impart knowledge on various energy sources.
4. To provide knowledge on concepts of electric propulsion systems.
5. To expose students to various drive trains for hybrid electric vehicles.
6. To facilitate the understanding of the concepts of electronic converters.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to
1. Understand the concepts of electric and hybrid electric vehicles.
2. Describe about the various energy source available for the hybrid electric vehicles.
3. Explain the concepts of electric propulsion systems.
4. Design series drive train for hybrid electric vehicles.
5. Design parallel drive train for hybrid electric vehicles.
6. Understand the concepts of electronic converters for battery charging of electric hybrid vehicles.

**UNIT I ELECTRIC AND HYBRID ELECTRIC VEHICLES**


**UNIT II ENERGY STORAGE FOR EV AND HEV**

Energy storage requirements, Battery parameters, Types of Batteries, Modeling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modeling of PEMFC, Super Capacitors.

**UNIT III ELECTRIC PROPULSION**

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives.

**UNIT IV DESIGN OF ELECTRIC AND HYBRID ELECTRIC VEHICLES**

Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.

**UNIT V POWER ELECTRONIC CONVERTER FOR BATTERY CHARGING**

Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z-converter for battery charging, High frequency transformer based isolated charger topology, Transformer less topology.

**SUGGESTED READINGS**

COURSE OBJECTIVES

1. To understand the importance of the DFM approach and guidelines
2. To enrich the understanding of the selective assembly and Datum systems
3. To introduce the concepts of demonstrate true Position tolerancing theory.
4. To develop an understanding of the standard techniques and redesigning cast members using weldments and plastic component manufacturing.
5. To equip them with skills on Tolerance Charting Technique.
6. To Study and acquire knowledge of the various factors influencing the manufacturability of components and the use of tolerances in manufacturing

COURSE OUTCOMES

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

1. Understand the DFM approach and guidelines
2. Understand the selective assembly and Datum systems
3. Demonstrate true Position tolerancing theory.
4. Understand redesigning cast members using weldments and plastic component manufacturing.
5. Demonstrate the Tolerance Charting Technique.
6. Know the various factors influencing the manufacturability of components and the use of tolerances in manufacturing

UNIT I

DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS IN INDUSTRY

DFM approach, DFM guidelines, standardisation, group technology, value engineering, comparison of materials on cost basis, design for assembly, DFA index, Poka – Yoke principle; 6σ concept; Tolerance Analysis: Process capability, process capability metrics, Cp, Cpk, cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law.

UNIT II

SELECTIVE ASSEMBLY

Interchangeable and selective assembly, deciding the number of groups, Model–I: group tolerances of mating parts equal; Model–II: total and group tolerances of shaft, control of axial play.

Datum Systems: Grouped datum systems–different types, two and three mutually perpendicular grouped datum planes, grouped datum system with spigot and recess, pin and hole, and tongue–slot pair, computation of translational and rotational accuracy.

UNIT III

TRUE POSITION TOLERANCING THEORY

Comparison between co–ordinate and convention method of feature location tolerancing and true position tolerancing, zero true position tolerance, virtual size concept, floating and fixed fasteners, projected tolerance zone, functional gauges, paper layout gauging, compound assembly, examples.

UNIT IV

FORM DESIGN OF CASTINGS AND WELDMENTS

Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols – design considerations for plastic component manufacturing.

UNIT V

TOLERANCE CHARTING

Tolerance Charting Technique: Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples, design features to facilitate machining. Datum features – functional and manufacturing, component design–machining considerations, redesign for manufacture, examples.
SUGGESTED READINGS
COURSE OBJECTIVES
1. To introduce Governing Equations of viscous fluid flows
2. To introduce numerical modeling and its role in the field of fluid flow and heat transfer
3. To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
4. To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.
5. To equip them with skills to solve convection and diffusion problems
6. To understand the importance continuity and momentum equations for different types of fluid flow

COURSE OUTCOMES
Upon completion of this course, the students can able
1. Identify, solve engineering problems by computational fluid dynamics.
2. Understand the importance of governing equations involved in CFD
3. Formulate and solve problems in the field of fluid flow and heat transfer.
4. Solve the heat conduction problems using finite differencemethod.
5. Analyze and provide solutions for convection and diffusion problems.
6. Develop continuity and momentum equations for different types of fluid flow.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS

UNIT II DISCRETIZATION AND SOLUTION METHODOLOGIES
Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

UNIT III HEAT CONDUCTION
Finite difference and finite volume formulation of steady/transient one–dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems

UNIT IV CONVECTION AND DIFFUSION
Finite volume formulation of steady one–dimensional convection and Diffusion problems, Central, upwind, hybrid and power–law schemes – Discretization equations for two dimensional convection and diffusion.

UNIT V CALCULATION OF FLOWFIELD

SUGGESTED READINGS
COURSE OBJECTIVES
1. To give exposure to accessories and layout required for a steam power plant depending upon the requirements.
2. To study performance of steam turbine power plant.
3. To make the student acquire sound knowledge of working of nuclear and hydel power plant.
4. To study the features of gas turbine power plant.
5. To make the student acquire sound knowledge of economics of the power plant.
6. To make the student acquire sound knowledge on renewable energy technologies and availability.

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Select the accessories and layout required for a steam power plant depending upon the requirements.
2. Compute performance of steam power plant.
3. Explain the working of nuclear and hydel power plant.
5. Calculate the economics of the power plant.
6. Apply appropriate type of renewable energy technologies depending upon the application and availability.

UNIT I INTRODUCTION TO POWER PLANTS AND BOILERS

UNIT II STEAM POWERPLANT
Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, Draught – different types, Surface Condenser Types, Cooling Towers.

UNIT III NUCLEAR AND HYDEL POWERPLANTS

UNIT IV DIESEL AND GAS TURBINE POWERPLANT

UNIT V OTHER POWER PLANTS AND ECONOMICS OF POWERPLANTS

SUGGESTED READINGS
4. Morse Frederick T, Power Plant Engineering, 3rd edition, Prentice Hall of India, New Delhi, 2007(Digital)
COURSE OBJECTIVES
1. To understand and analyze the energy data of industries
2. To carryout energy accounting and balancing
3. To conduct energy audit and suggest methodologies for energy savings
4. To utilize the available resources in optimal ways
5. To make the students conversant with concepts of industrial furnaces
6. To equip them with skills to perform Energy audit

COURSE OUTCOMES
At the end of the course, student will be able to
1. Understand the Environmental aspects of energy utilization
2. Perform combustion analysis
3. Explain the concepts of industrial boiler
4. Understand how to work with the steam generated from the boilers in the industrial point of view
5. Explain the concepts of industrial furnaces
6. Perform Energy audit

UNIT I  ENERGY SCENARIO
Present status, rate of growth, energy utilization (sector wise), concept of energy conservation, energy economics.
COMBUSTION: Fuel analysis, combustion calculations, air requirements, theoretical and excess air requirements, excess air control, flue gas analysis and measurement, types of draught, draught calculations, chimney size calculations. F.D and I.D fan draught requirements and power requirements, furnace pressure requirements.

UNIT II  INDUSTRIAL BOILERS
Types and characteristics of industrial boilers, heat balance in boilers, efficiency trials in boilers, energy conservation opportunities in boilers operation and maintenance, water treatment requirements, soot blowing requirements, super heaters and superheat controls, waste heat recovery systems.
STEAM: Distribution requirements of steam and steamlines, efficient utilization of steam, steam trapping and air venting, flash steam recovery, condensate recovery, thermal insulation for systems including HVAC, steam balance calculations.

UNIT III  INDUSTRIAL FURNACES
Furnace types and characteristics, heat balance in furnaces, furnace efficiency calculations, energy conservation opportunities in furnaces, refractories types and properties, waste heat recovery system, insulating refractories, ceramic fibers, heat loss reduction calculations, wall and stored heat loss reduction.

UNIT IV  DRYING
Principle of drying and types of driers, mass and heat balance in driers, energy conservation opportunities in drying operations.
EVAPORATION: Principle of evaporation and types of evaporation, mass and heat balance, single and multiple effect evaporation, capacity and steam economy calculations, vapour recompression system.

UNIT V  ENERGY AUDIT AND APPLICATIONS
Types, methodology, questionnaire development, specific energy consumption (unitwise/section wise), identification of energy conservation measures/ technologies, economic and cost benefit analysis, case studies, Energy rating for thermal equipment, Energy saving measurement – Star status – National awards.

SUGGESTED READINGS
ADDITIVE MANUFACTURING

Instruction hours / week L : 3 T : 0 P:0
Marks: Internal : 40 External : 60 Total:100
End Semester Exam :3 Hours

COURSE OBJECTIVES
1. To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies.
2. To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.
3. To introduce process involved in Additive manufacturing technology.
4. To understand the importance of knowledge on software’s used in additive manufacturing technology.
5. To enrich the understanding of the working of SLS and other techniques.
6. To provide an overview of additive manufacturing technology in medical field and biostream.

COURSE OUTCOMES
On completion of this course, students will be able to:
1. Understand the need for additive manufacturing technology
2. Explain the process involved in Additive manufacturing technology
3. Get knowledge on software’s used in additive manufacturing technology
4. Describe the working of SLS and other techniques
5. Apply the additive manufacturing technology in medical field
6. Applications of additive manufacturing technology in biostream.

UNIT I
INTRODUCTION

UNIT II
CAD & REVERSE ENGINEERING

UNIT III
LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS
Classification – Liquid based system – Stereo lithography Apparatus (SLA)- Principle, process, advantages and applications - Solid based system – Fused Deposition Modeling - Principle, process, advantages and applications, Laminated Object Manufacturing

UNIT IV
POWDER BASED ADDITIVE MANUFACTURING SYSTEMS

UNIT V
MEDICAL AND BIO-ADDITIVE MANUFACTURING
Customized implants and prosthesis: Design and production. Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE) – Case studies

SUGGESTED READINGS
B. E. Mechanical Engineering

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

18BEME7E06

Instruction hours / week L : 3 T : 0 P:0

Marks: Internal : 40 External : 60 Total:100

End Semester Exam : 3 Hours

COURSE OBJECTIVES

1. To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies.
2. To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.
3. To explain basics of SCM and logistics.
4. To impart knowledge need for inventory management.
5. To expose students to value of information in SCM.
6. To understand the concept of information technology involved in SCM.

COURSE OUTCOMES

On completion of this course, students will learn about:

2. Understand the need for inventory management.
3. Apply the need for value of information in SCM.
4. Describe about the various strategic alliances.
5. Explain about the various issues in the international SCM.
6. Get knowledge in information technology involved in SCM.

UNIT I INTRODUCTION TO SUPPLY CHAIN MANAGEMENT

Definition, global optimization, Objectives of SCM. Logistics networks– data collection, model and data elevation, solution techniques.

UNIT II INVENTORY MANAGEMENT

Introduction, single warehouse, Inventory examples, economic lot size model, effect of demand uncertainty. Risk pooling, centralized and decentralized system, managing inventory in the supply chain, forecasting.

UNIT III VALUE OF INFORMATION


UNIT IV STRATEGIC ALLIANCES

Framework for strategic alliance, third party logistics, retailer, supplies partnership, distributor–integration, procurement and out servicing strategies.

UNIT V INTERNATIONAL ISSUES IN SCM

Introduction, risks and advantages– design for logistics, supplies integration into to new product development, mass customization. Issues in customer value.

Information technology for SCM: Goals, standardization, infrastructure, DSS for supply chain management.
SUGGESTED READINGS

COURSE OBJECTIVES
1. To understand the basic difference between incompressible and compressible flow.
2. To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.
3. To introduce the concepts of various conditions of compressible fluid flows.
4. To Study and acquire knowledge on performance analysis of subsonic and supersonic inlets, combustors, afterburners and exhaust nozzles.
5. To understand the concept of working of various types of rocket engines.
6. To study the features of thrust equation for rocket propulsion system.

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Analyze various conditions of compressible fluid flows.
2. Calculate mass flow rate in flow through variable area ducts.
4. Perform performance analysis of combustors, afterburners and exhaust nozzles.
5. Understand the working of various types of rocket engines.
6. Use thrust equation for rocket propulsion system.

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS

UNIT II FLOW THROUGHDUCTS
Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – Variation of flow properties – Isothermal flow with friction in constant area ducts – Use of tables and charts – Generalised gas dynamics.

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

UNIT IV JET PROPULSION

UNIT V ROCKET PROPULSION

(Permitted to use standard Gas Tables in the examination)
SUGGESTED READINGS

COURSE OBJECTIVES

1. To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.
2. To understand the concepts of sensors and transducers.
3. To provide an overview of actuation systems.
4. To expose students to controller model for electrical, mechanical and thermal systems.
5. To provide knowledge about various types of controllers.
6. To facilitate the understanding of PLC program using ladder logic.

COURSE OUTCOMES

Upon completion of this course, the students can able to
1. Implement the concepts of sensors and transducers.
2. Design the actuation systems.
3. Develop the controller model for electrical, mechanical and thermal systems.
4. Explain about various types of controllers.
5. Create the PLC program using ladder logic.
6. Design Mechatronics system.

UNIT I MECHATRONICS SENSORS AND TRANSDUCERS


UNIT II ACTUATORS AND SYSTEM MODELS


Introduction to system models – Building block of Mechanical, Electrical, Fluid and Thermal Systems.

UNIT III MICROPROCESSORS IN MECHATRONICS


UNIT IV CONTROLLERS


UNIT V DESIGN OF MECHATRONIC SYSTEMS

SUGGESTED READINGS

COURSE OBJECTIVE

1. To gain knowledge in design and material selection of various machinetools.
2. To provide an overview of regulation of speeds and feeds
3. To study the features of machine toolstructures
4. To understand the importance of constructional features of machine toolstructures
5. To expose students to design in machine tool structures, guide ways, power screws andspindles
6. To expose students to design spindles and spindlesupports

COURSE OUTCOMES:
Upon the completion of this course the students will be able to
1. Discuss the basics machine tool drives andmechanisms
2. Get knowledge on regulation of speeds and feeds
3. Understand the importance of machine toolstructures
4. Explain the constructional features of machine toolstructures
5. Design in machine tool structures, guide ways, power screws andspindles
6. Design spindles and spindlesupports

UNITI    INTRODUCTION TO MACHINE TOOL DRIVES ANDMECHANISMS
Introduction to the course, Working and Auxiliary Motions in Machine Tools, Kinematics of Machine Tools, Motion Transmission

UNITII  REGULATION OF SPEEDS ANDFEEDS
Aim of Speed and Feed Regulation, Stepped Regulation of Spe
cds, Multiple Speed Motors, Ray Diagrams and Design Considerations, Design of Speed Gear Boxes, Feed Drives, Feed Box Design

UNITIII  DESIGN OF MACHINE TOOLSTRUCTURES

UNITIV    DESIGN OF GUIDEWAYS, POWER SCREWS ANDSPINDLES

UNITYV   DESIGN OF SPINDLES AND SPINDLESUPPORTS

SUGGESTED READINGS
COURSE OBJECTIVES

1. To understand the application of computers in various aspects of Manufacturing viz., Design, proper planning, Manufacturing cost, Layout & Material Handling system.
2. To know the application of principles of group technology in computer aided process planning.
3. To impart knowledge on working of the shop floor control.
4. To Study and acquire knowledge on data collection system in FMS.
5. To familiarize the students to understand CIM architecture for practical application.
6. To expose students to generate database for computer integrated manufacturing processes.

COURSE OUTCOMES

Upon completion of this course, the student can able to
1. Implement computer integrated manufacturing concepts in industries.
2. Apply the principles of group technology in computer aided process planning.
3. Understand the working of the shop floor control.
4. Implement automated data collection system in FMS.
5. Develop CIM architecture for practical application.

UNIT I INTRODUCTION
The meaning and origin of CIM -- the changing manufacturing and management scene -- External communication -- islands of automation and software -- dedicated and open systems -- manufacturing automation protocol -- product related activities of a company -- marketing engineering -- production planning -- plant operations -- physical distribution -- business and financial management.

UNIT II GROUP TECHNOLOGY
Group technology -- part families -- Classification and coding -- Approaches to computer aided process planning -- variant approach and generative approaches

UNIT III SHOP FLOOR CONTROL AND INTRODUCTION OF FMS
Shop floor control -- phases -- factory data collection system -- automatic identification methods -- Bar code technology -- automated data collection system. FMS -- components of FMS -- types -- FMS workstation -- material handling and storage systems -- FMS layout -- computer control systems -- application and benefits.

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION
CIM and company strategy -- system modeling tools -- IDEF models -- activity cycle diagram -- CIM open system architecture (CIMOSA) -- manufacturing enterprise wheel -- CIM architecture -- Product data management -- CIM implementation software. Communication fundamentals -- local area networks -- topology -- LAN implementations -- network management and installations -- MRP, ERP concepts

UNIT V OPEN SYSTEM AND DATABASE FOR CIM
Open systems -- open system inter connection -- manufacturing automations protocol and technical office protocol (MAP /TOP). Development of databases -- database terminology -- architecture of database systems -- data modeling and data associations -- relational data bases -- database operators -- advantages of data base and relational database.

SUGGESTED READINGS
1. Mikell P. Groover, Automation, Production Systems and computer integrated manufacturing, 4e, Pearson Education, Delhi, 2016
COURSE OBJECTIVES
1. To enable the students to gain competence in various Welding Technologies and to have in depth understanding of the weldability of metals.
2. To expose students to identify suitable reinforcement and matrix materials for preparation of composites using friction stir processing.
3. To understand the basic principle of electron beam and laser beam processes and its application.
4. To understand the weldability of cast iron and high carbon steel.
5. To provide knowledge on welding powersources.
6. To facilitate the understanding of grain growth mechanism and related properties.

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Understand solid state welding processes and applications.
2. Identify suitable reinforcement and matrix materials for preparation of composites using friction stir processing.
3. Understand basic principle of electron beam and laser beam processes and its application.
4. Understand weldability of cast iron and high carbon steel.
5. Select welding powersources.
6. Understand the importance of grain growth mechanism and related properties.

UNIT I SOLID STATE WELDING
Solid state welding: classification of solid state welding processes, Adhesive bonding, advantages and applications.

UNIT II FRICTION AND FRICTION STIR WELDING
Friction welding: Friction welding process variables, welding of similar and dissimilar materials, Defective analysis of friction welded components, Friction welding of materials with inter layer.
Friction stir welding: Processes parameters, tool geometry, welding of Aluminium alloys, Friction stir welding of Aluminium alloys and Magnesium alloys.

UNIT III ELECTRON BEAM WELDING

UNIT IV LASER BEAM WELDING
Laser Beam welding (LBW): Laser Beam welding process parameters, atmospheric affect and Laser Beam welding of steels.

UNIT V SELECTION POWER SOURCE AND WELDABILITY
Selection power source: Constant voltage and constant current power sources. Weldability of cast iron and steel: weldability studies of cast iron and steel

SUGGESTED READINGS
COURSE OBJECTIVES
- To Formulate and solve engineering and managerial situations as LPP.
- To understand the Engineering and Managerial situations in Transportation.
- To Study and acquire knowledge on engineering and Managerial solutions in Assignment and scheduling problems.
- To give exposure to inventory in industry.
- To make the student acquire sound knowledge on sequences to perform operation among various alternatives.
- To provide an overview of various tools in various sections of industries like marketing, material handling etc.

COURSE OUTCOMES
At the end of the course, student will be able to understand the
- Formulate and solve engineering and managerial situations as LPP.
- Solve Engineering and Managerial situations in Transportation.
- Give Engineering and Managerial solutions in Assignment and scheduling problems.
- Manage inventory in industry.
- Select better sequence to perform operation among various alternatives.
- Apply the various tools in various sections of industries like marketing, material handling etc.

UNIT I INTRODUCTION TO OPERATIONSRESEARCH

UNIT II TRANSPORTATION PROBLEMS
Least cost method, North west corner rule, Vogel’s approximation method, modified distribution method, optimization models, unbalance and degeneracy in transportation model.

UNIT III ASSIGNMENT MODELS AND SCHEDULING
Assignment models - Hungarian algorithm, unbalanced assignment problems - maximization case in assignment problems, traveling salesman problem. Scheduling – processing n jobs through two machines, processing n jobs through three machines, processing two jobs through ‘m’ machines, processing n jobs through m machines.

UNIT IV INVENTORY CONTROL AND QUEUING THEORY
Variables in inventory problems, inventory models with penalty, shortage and quantity discount, safety stock, multi item deterministic model.
Queuing Models: Queues – Notation of queues, performance measures, The M/M/1 queue, The M/M/m queue, batch arrival queuing system, queues with breakdowns.

UNIT V PROJECT MANAGEMENT, GAME THEORY, REPLACEMENT MODELS
Basic terminologies, constructing a project network, network computations in CPM and PERT, cost crashing – Replacement Models: Replacement of Items due to deterioration with and without time value of Money, Group replacement policy, Staff replacement

SUGGESTED READINGS
PROFESSIONAL ELECTIVE V

MANUFACTURING AND INSPECTION OF GEARS

Instruction hours / week L : 3 T : 0 P:0
Marks: Internal : 40 External : 60 Total:100
End Semester Exam :3 Hours

COURSE OBJECTIVES

1. To gain knowledge in production, gear material selection
2. To introduce the concepts of gear manufacturing
3. To Study and acquire knowledge on mechanism involve in conical gears
4. To Study and acquire knowledge on the procedures that involves in gear material selection
5. To expose students to detailed view of gear finishing methods
6. To impart knowledge modern gear production methods

COURSE OUTCOMES

Upon the completion of this course the students will be able to
1. Understand the overview on classification of gears and its terminology
2. Explain the various methods of gear manufacturing
3. Understands the concepts and mechanism involve in conical gears
4. Understand the procedures that involves in gear material selection
5. Attain a detailed view of gear finishing methods
6. Understanding the modern gear production methods

UNIT I
INTRODUCTION TO GEARS

UNIT II
PRODUCTION OF CONICAL GEARS
Production of straight bevel gears by bevel gear generator, duplex rotary cutter method, Gleason Reva cycle method, spiral and hybrid bevel gear generation. Description of machine, cutter and machine setting.

UNIT III
GEAR MATERIAL SELECTION AND HARDENING METHODS
Properties of gear materials—non-metallic, non-ferrous and plastic gears, selection of material for power transmission, high speed application. Selection of material for worm and wheel. Hardening by through hardening, case hardening, induction hardening, flame hardening, nitriding and tuftriding, hardening defects.

UNIT IV
GEAR FINISHING METHODS
Gear finishing advantages, finishing of gears by grinding, shaving, lapping and honing methods, cold rolling of gears—description of process, machine, cutters and process parameters setting. Gear Inspection: Type of gear errors-gear quality standards and allowable limits-tooth thickness, base tangent length measurement, pitch error, radial run out, involute profile error measurements methods and analysis, composite error measurement, computerized gear inspection, gear failure reasons andremedies.

UNIT V
MODERN GEAR PRODUCTION METHODS
Gear production by stamping, die casting, powder metal process, injection and compression moulding of plastic gears, cold and hot rolling. Mass production methods, shear speed shaping, gear broaching, Gleason G-TRAC – gear generation methods. Economical and Quality Production of Gears: Gear production systems – batch production, gear production cells, lean and agile production practices, automobile gear and gear boxes, heavy engineering gear production, gear for instruments and appliances, process and cutter selection for quantity, cost and quality criteria.

SUGGESTED READINGS
COURSE OBJECTIVES
1. To understand the fundamentals of composite material strength and its mechanical behavior
2. Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
3. Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
4. Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronicchips.
5. To introduce the concepts of carbon-carbon composite for different industrial application
6. To impart knowledge on various advances in composites

COURSE OUTCOMES
Learners should be able to
1. Select the various types of composite matrix required for an application.
2. Choose appropriate manufacturing process for polymer matrix composite.
4. Use the concepts of ceramic composites and its production techniques.
5. Identify the type of carbon-carbon composite for different industrial application.
6. Explain the various advances in composites

UNIT I INTRODUCTION TO COMPOSITES
Fundamentals of composites - need for composites – Enhancement of properties - classification of composites
– Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC)
– Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

UNIT II POLYMER MATRIX COMPOSITES

UNIT III METAL MATRIX COMPOSITES

UNIT IV CERAMIC MATRIX COMPOSITES
Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC

UNIT V ADVANCES IN COMPOSITES

SUGGESTED READINGS
COURSE OBJECTIVES
1. To enable the students to have better understanding about the concepts of Heat, Ventilation and Air conditioning and also equip them with the ability to solve problems relating to HVAC systems.
2. To impart knowledge on heating and cooling load calculations for different ambient conditions.
3. To understand the importance Psychrometry processes.
4. To facilitate the understanding of functions of refrigerating components.
5. To know the application of refrigerant with less GWP and ODP.
6. To expose students to different types of fan and its characteristics.

COURSE OUTCOMES
At the end of the course, student will be able to
1. Understand the basic concepts of heat, ventilation, and air conditioning.
2. Solve heating and cooling load calculations for different ambient conditions.
3. Understand the importance Psychrometry processes.
4. Equip themselves familiar with functions of refrigerating components.
5. Select refrigerant with less GWP and ODP.
6. Know the different types of fan and its characteristics.

UNIT I AIR CONDITIONING FUNDAMENTALS

UNIT II PSYCHROMETRY
Properties of Moist Air, Psychrometric Properties - Use of Psychrometric Chart - Psychrometric Processes In Air Conditioning Equipment - Summer Air Conditioning - Winter Air Conditioning.

UNIT III LOAD CALCULATION
Solar Radiation – Internal Heat Gains, Humidity And Air Flow- Heating Load Estimate And Cooling Load - Psychrometric Calculations For Cooling - Selection Of Air Conditioning Apparatus For Cooling And Dehumidification, Evaporative Cooling.

UNIT IV REFRIERGANTS

UNIT V FANS AND AIR DISTRIBUTION

SUGGESTED READINGS:
COURSE OBJECTIVES
1. To provide in-depth knowledge on various techniques of non-destructive testing
2. To provide an overview of destructive and non-destructive tests and state their applications
3. To study the features of NDT techniques for various products.
4. To expose students to skills needed for selection of appropriate NDT technique(s) for new inspection jobs
5. To understand the established NDE techniques and basic familiarity of emerging NDE techniques.
6. To facilitate the understanding of standard application area of NDET

COURSE OUTCOMES
Student will be able to
1. Understand the codes, standards and specifications related to NDT
2. Classify the destructive and non-destructive tests and state their applications
3. Develop NDT techniques for various products.
4. Acquire skills needed for selection of appropriate NDT technique(s) for new inspection jobs
5. Acquire sound knowledge of established NDE techniques and basic familiarity of emerging NDE techniques.
6. Make use of standards application area of NDET

UNIT I INTRODUCTION
Properties of Materials – Characteristics of Ferrous, Non-ferrous and Alloys. Destructive testing and Non-destructive testing – Classification – Uses and applications. Codes, Standards and Specifications (ASME, ASTM, AWS etc.).

UNIT II PENETRANT TESTING AND MAGNETIC PARTICLE INSPECTION
Introduction to Penetrant Testing – Liquid Penetrants and Dye Penetrants - An Illustration of Penetrant Testing, Advantages of Penetrants Testing, Disadvantages of Penetrant Testing. Introduction to Magnetic Particle Inspection - An Illustration of Magnetic Particle Inspection, Advantages of Magnetic Particle Crack Detection, Disadvantages of Magnetic Particle Crack Detection

UNIT III ULTRASONIC FLAW DETECTION AND RADIOGRAPHY INSPECTION

UNIT IV EDDY CURRENT AND ELECTRO-MAGNETIC METHODS

UNIT V NON-DESTRUCTIVE INSPECTION (NDI) AND ITS APPLICATIONS
Inspection of Raw Products, Inspection For In-Service Damage, Power Plant Inspection, Storage Tank Inspection, Aircraft Inspection, Jet Engine Inspection, Pressure Vessel Inspection, Bridge Inspection, Pipeline Inspection.

SUGGESTED READINGS
INDUSTRIAL SAFETY ENGINEERING

**COURSE OBJECTIVES**

1. To provide in-depth knowledge on various techniques of non-destructive testing
2. To acquaint the student with the need and awareness of the safety concepts
3. To understand the importance of various safety techniques involved in the industrial sector
4. To introduce the concepts of accident zone and prepare reports related to it.
5. To equip them with skills to conduct basic safety inspections using strategies that they have developed
6. To develop an understanding of safety monitoring

**COURSE OUTCOMES**

At the end of the course, student will be able to
1. Understand the need and awareness of the safety concepts
2. Understand the various safety techniques involved in the industrial sector
3. Record and investigate the accident zone and prepare reports related to it.
4. Conduct basic safety inspections using strategies that they have developed
5. Identify and demonstrate working of safety monitoring
6. Train about the education and training based on safety

**UNIT I CONCEPTS**

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety.

**UNIT II TECHNIQUES**

Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

**UNIT III ACCIDENT INVESTIGATION AND REPORTING**

Concept of an accident, reportable and non reportable accidents, unsafe act and condition – principles of accident prevention, Supervisory role- Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports

**UNIT IV SAFETY PERFORMANCE MONITORING**

Reactive and proactive monitoring techniques - Permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety “t” score, safety activity rate – problems.

**UNIT V SAFETY EDUCATION AND TRAINING**


**SUGGESTED READINGS**

COURSE OBJECTIVES
1. To study the surface preparation techniques
2. To import knowledge on thermal spraying process and electrodeposited coating
3. To study the process of Hot dip and diffusion coating
4. To induce the testing procedure for surface coating
5. To introduce the methods of non metallic coating
6. To impart knowledge on testing procedure for quality assurance

COURSE OUTCOMES
Upon completion of this course, students will be able to
1. Explain the important of surface engineering to industries
2. Use of thermal spray for coating
3. Explain the working principle of hot dip coating
4. Explain the process and mechanism of different diffusion coating processes
5. Explain the methods of non metallic coating
6. Explain the testing procedure for quality assurance.

UNIT I METAL CLEANING AND PREVIEW ON SURFACE ENGINEERING

UNIT II THERMAL SPRAYING PROCESSES AND ELECTRODEPOSITED COATINGS

UNIT III HOT DIP COATING AND DIFFUSION COATINGS

UNIT IV NON-METALLIC COATING OXIDE AND COVENSION COATINGS

UNIT V QUALITY ASSURANCE, TESTING AND SELECTION OF COATINGS

SUGGESTED READINGS
B. E. Mechanical Engineering

PROFESSIONAL ELECTIVE VI

18BEME8E01 QUALITY CONTROL AND RELIABILITY ENGINEERING  3 H – 3 C

Instruction hours / week L : 3 T : 0 P:0  Marks: Internal : 40 External : 60 Total:100
End Semester Exam : 3 Hours

COURSE OBJECTIVES

- To Understand the concept of SQC.
- To enrich the understanding of control charts to analyze for improving the process quality.
- To familiarize the students to understand different sampling plans
- To Understand the importance of need and types of life testing.
- To introduce the reliability of a system.
- To introduce the concepts of quality control and reliability techniques in industries.

COURSE OUTCOMES

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

- Understand the concept of SQC.
- Use control charts to analyze for improving the process quality.
- Describe different sampling plans
- Understand the need and types of life testing.
- Improve the reliability of a system.
- Implement quality control and reliability techniques in industries.

UNIT I  INTRODUCTION AND PROCESS CONTROL FOR VARIABLES

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost–Variation in process– factors – process capability – process capability studies and simple problems – Theory of control chart– uses of control chart – Control chart for variables – X chart, R chart and σ chart.

UNIT II  PROCESS CONTROL FOR ATTRIBUTES

Control chart for attributes –control chart for proportion or fraction defectives – P chart and NP chart – control chart for defects – C and U charts, State of control and process out of control identification in charts.

UNIT III  ACCEPTANCE SAMPLING


UNIT IV  LIFE TESTING – RELIABILITY


UNIT V  QUALITY AND RELIABILITY


Note: Permitted to use approved statistical table in the examination.

SUGGESTED READINGS

COURSE OBJECTIVES

- To impart knowledge of need for planning and control in various aspects.
- To develop an understanding of the standard techniques in various work study methodologies.
- To familiarize the students to understand the product and process plan.
- To introduce the concepts of a production schedule based on different facets.
- To enrich the understanding of the level of inventory
- To understand the importance the recent advancements in production planning and control.

COURSE OUTCOMES

Student will be able to

- Indicate the need for planning and control in various aspects.
- Understand various work study methodologies.
- Construct product and process plan.
- Prepare a production schedule based on different facets.
- Estimate the level of inventory
- Understand the recent advancements in production planning and control.

UNIT I INTRODUCTION


UNIT II WORKSTUDY


UNIT III PRODUCT PLANNING AND PROCESS PLANNING


UNIT IV PRODUCTIONSCHEDULING


UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC


SUGGESTED READINGS

1. Martand Telsang, Industrial Engineering and Production Management, 3rd edition, S.Chand and Company, New Delhi,2018
COURSE OBJECTIVES

1. To study the significance of waste heat recovery systems and carry out its economic analysis.
2. To know the concepts of cogeneration, its types and probable areas of applications.
3. To enrich the understanding of thermodynamics, heat transfer, and fluid Mechanics principles to design and analysis of this emerging technology.
4. To impart knowledge on operational issues and challenges cogeneration technologies.
5. To understand the impact of this technology in waste heat recovery systems.
6. To introduce the concepts of various systems involved in waste heat recovery process.

COURSE OUTCOMES

The student will be able to:

1. Understand the various methods of cogeneration.
2. Apply knowledge of thermodynamics, heat transfer, and fluid Mechanics principles to design and analysis of this emerging technology.
3. Have thorough understanding, operational issues and challenges cogeneration technologies.
4. Understand the impact of this technology in waste heat recovery systems.
5. Get the knowledge over various systems involved in waste heat recovery process.
6. Begin a career as an engineer in an organization economic analysis.

UNIT I  INTRODUCTION


UNIT II  COGENERATION TECHNOLOGIES


UNIT III  ISSUES AND APPLICATIONS OF COGENERATION TECHNOLOGIES


UNIT IV  WASTE HEAT RECOVERY SYSTEMS

Selection criteria for waste heat recovery technologies - recuperators - Regenerators - Economizers - plate heat exchangers - thermic fluid heaters - Waste heat boilers classification, location, service conditions, design Considerations - fluidized bed heat exchangers - heat pipe exchangers - heat pumps – sorption systems.

UNIT V  ECONOMIC ANALYSIS


SUGGESTED READINGS

COURSE OBJECTIVES
1. To Understand and apply the principles of science, technology, engineering, and math to solve industry-related problems.
2. To Understand the concepts and terminologies in industries
3. To Study and acquire knowledge in creating an industrial design layout
4. To introduce the methods involved in material handling
5. To understand the knowledge in analysis of work processing happening in industries
6. To equip them with skills to perform work measurement in an industry

COURSE OUTCOMES
Upon completion of this course, the student can able to
1. Understand the concepts and terminologies in industries
2. apply their knowledge in creating an industrial design layout
3. understand the methods involved in material handling
4. apply their knowledge in analysis of work processing happening in industries
5. perform work measurement in an industry
6. understand the role of human involvement in industrial work system design

UNIT I  INTRODUCTION TO INDUSTRIAL ENGINEERING
for layout study – types of layout. Plant location analysis – factors, costs, location decisions – simple problems in single facility location models, network location problems.

UNIT II  LAYOUT DESIGN
Design cycle – SLP procedure manpower, machinery requirements – computer algorithms – ALDEP, CORELAP, CRAFT

UNIT III  QUANTITATIVE METHODS AND MATERIAL HANDLING
Group technology – Production Flow analysis (PFA), ROC (Rank Order Clustering) – Line balancing. Principles, unit load concept, material handling system design, handling equipment types, selection and specification, containers and packaging. Material Handling—Automatic Storage and Retrieval System (ASRS)

UNIT IV  OPERATIONS ANALYSIS AND WORK MEASUREMENT
Productivity and living standards, Productivity measurement, work design and Productivity – process planning – types. Total time for a job or operation, total work content and ineffective time, methods and motions, graphic tools. Stop watch time study – time study through videography, Standard data, methods time measurement (MTM), Development of Production Standards, learning effect.

UNIT V  HUMAN FACTORS IN WORK SYSTEM DESIGN
Human factors Engineering/Ergonomics, human performance in physical work, anthropometry, design of work station, design of displays and controls.

SUGGESTED READINGSS
2. Martand Telsang, Industrial Engineering and Production Management, 3rd edition, S.Chand and Company, New Delhi, 2018
B. E. Mechanical Engineering

18BEME8E05 COMPUTER AIDED DRAFTING AND COST ESTIMATION 3 H – 3 C

Instruction hours / week L : 3 T : 0 P:0 Marks: Internal : 40 External : 60 Total:100

End Semester Exam :3 Hours

COURSE OBJECTIVES
1. To gain knowledge in sequence of process planning and cost estimation of various products.
2. To introduce the concepts of dimensional and tolerance analysis
3. To expose students to manufacturing drawings
4. To equip them with skills to apply their knowledge in re-dimensioning and tolerance charting
5. To understand the process chart for a given component
6. To estimate the cost of a given component

COURSE OUTCOMES
Upon completion of this course, the student can able to
1. Apply the various standards and conventions used in a drawingsheet
2. Perform dimensional and tolerance analysis
3. Understand the manufacturing drawings
4. Apply their knowledge in re-dimensioning and tolerance charting
5. Prepare process chart for a given component
6. Estimate the cost of a given component

UNITI STANDARDS AND CONVENTIONS
Current international standards (ISO) and Indian Standards (IS)- types of lines - principles of presentation - dimensioning - conventional representation of threaded parts, springs, and gears.

UNITII DIMENSIONAL AND FORM TOLERANCES
Limits and fits IT system of tolerances, deviation of fit - geometric tolerance-tolerancing of form, orientation, location and runout - datums and Datum systems-Dimensioning and tolerancing of profiles

UNITIII MANUFACTURING DRAWINGS
Surface texture indication on drawing - welds symbolic representation of drawings. Given a sub-assembly/assembly to prepare manufacturing drawings of components, Sample exercises on CAD- preparation of manufacturing Drawings.

UNITIV RE-DIMENSIONING AND TOLERANCE CHARTING
Introduction to re-dimensioning to suit manufacturing requirements-manufacturing datum-functional datum. Introduction to tolerance charting

UNITV COST ESTIMATION
Preparation of Process chart for a given component-estimation of setting time and machining time-estimation of material cost, labour cost and overhead cost based on supplied data.

SUGGESTED READINGS
COURSE OBJECTIVES
1. To introduce the concepts of essentiality of quality.
2. To understand the importance of various TQM principles.
3. To introduce the concepts of the various TQM principles.
4. To understand the techniques for quality management.
5. To introduce the standard quality systems in industries.
6. To familiarize the students to understand the various techniques to improve the quality in industries.

COURSE OUTCOMES
At the end of the course the student would be able to
1. Understand the essentiality of quality.
2. Summarize various TQM principles.
3. Understand the various TQM principles.
4. Understand the techniques for quality management.
5. Implement standard quality systems in industries.
6. Apply various techniques to improve the quality in industries.

UNIT I ESSENTIALS OF TQM
Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES

UNIT III TQM TOOLS
The new seven management tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma – APQP.

UNIT IV TQM TECHNIQUES

UNIT V QUALITY AND ENVIRONMENT SYSTEMS

SUGGESTED READINGS
OPEN ELECTIVES
COURSES OFFERED BY OTHER DEPARTMENTS

18BESHOE01 PROBABILITY AND RANDOM PROCESS 3 H – 3 C
Instruction hours / week L : 3 T : 0 P:0 Marks: Internal : 40 External : 60 Total:100 End Semester Exam :3Hours

COURSE OBJECTIVES
1. To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
2. To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
3. To understand the basic concepts of random processes which are widely used in IT fields.
4. To understand the concept of correlation and spectral densities.
5. To understand the significance of linear systems with random inputs.
6. To analyze the response of random inputs to linear time invariant systems.

COURSE OUTCOMES
Upon successful completion of the course, students should be able:
1. To understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
2. To understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
3. To apply the concept random processes in engineering disciplines.
4. To understand and apply the concept of correlation and spectral densities.
5. The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable.
6. To analyze the response of random inputs to linear time invariant systems.

UNIT I MEASURES OF CENTRAL TENDENCY AND PROBABILITY
Measures of central tendency – Mean, Median, Mode - Standard Deviation Probability - Random variable - Axioms of probability - Conditional probability - Total probability – Baye’s theorem.

UNIT II STANDARD DISTRIBUTIONS
Functions of a random variable - Binomial, Poisson, Uniform, Exponential, Gamma(one Parameter only) and Normal distributions - Moment generating functions, Characteristic function and their properties – Chebyshev's inequality.

UNIT III TWO DIMENSIONAL RANDOM VARIABLES
Joint distributions - Marginal and conditional distributions - Probability mass function - Probability density functions – Covariance - Correlation and regression

UNIT IV CLASSIFICATION OF RANDOM PROCESS
Definition and examples - first order, second order, strictly stationary, wide – sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process.

UNIT V CORRELATION AND SPECTRAL DENSITIES

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore – 641 021.
SUGGESTED READINGS

2. Ross, S, A first Course in Probability, Pearson Education, New Delhi (Chap 2 to 8), 2012
COURSE OBJECTIVES
1. Be able to understand basic knowledge of fuzzy sets and fuzzy logic
2. Be able to apply basic knowledge of fuzzy operations.
3. To know the basic definitions of fuzzy relations
4. Be able to apply basic fuzzy inference and approximate reasoning
5. To know the applications of fuzzy Technology.
6. Enable students to solve problems that are appropriately solved by neural networks, fuzzy logic.

COURSE OUTCOMES
1. To gain the main subject of fuzzy sets.
2. To understand the concept of fuzziness involved in various systems and fuzzy set theory.
3. To gain the methods of fuzzy logic.
4. To comprehend the concepts of fuzzy relations.
5. To analyze the application of fuzzy logic control to real time systems.
6. The Engineers will have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology.

UNIT I FUZZYSETS

UNIT II OPERATIONS ON FUZZYSETS
Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, tconorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

UNIT III FUZZYRELATIONS
Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

UNIT IV FUZZYMEASURES

UNIT V FUZZYINFERENCE
Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

SUGGESTED READINGS
COURSE OBJECTIVES
1. To introduce the basic concepts of vector space
2. To know the fundamentals of Linear Algebra
3. To solve system of linear equations
4. To study about the linear transformations
5. To introduce the concepts of inner product spaces
6. To apply linear algebra in other branches of sciences, engineering, and economics.

COURSE OUTCOMES
The student will be able to
1. To explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
2. To describe the fundamental concepts of Eigen values and Eigen vectors by using Power method.
3. To apply the fundamental concepts in their respective engineering fields
4. To visualize linear transformations as matrix form
5. To recognize the underlying theory of vector spaces over a field and inner product spaces over real or complex numbers
6. To articulate the importance of Linear Algebra and its applications in branches of Mathematics

UNIT I VECTOR SPACES
General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space

UNIT II EIGEN VALUES AND EIGENVECTORS
Eigen values and Eigen vectors - diagonalization - Power method - QR decomposition

UNIT III SYSTEM OF LINEAR EQUATIONS

UNIT IV LINEAR TRANSFORMATIONS
Linear Transformations – The Null Space and Range - Isomorphisms - Matrix Representation of Linear Transformations – Similarity - Eigenvalues and Eigenvectors Eigen values and Eigen vectors - Diagonalization

UNIT V INNER PRODUCT SPACES
The Dot Product on R^n and Inner Product Spaces - Orthonormal Bases - Orthogonal Complements - Application : Least Squares Approximation - Diagonalization of Symmetric M - Application: Quadratic Forms

SUGGESTED READINGS
COURSE OBJECTIVES
1. To disseminate the fundamentals of acoustic waves.
2. To inculcate the characteristics of radiation and reception of acoustic waves.
3. To divulge knowledge on the basics of pipe resonators and filters.
4. To introduce the features of architectural acoustics.
5. To impart the basic knowledge of transducers and receivers.
6. Recommend a safe healthy environment for the community and occupational welfare.

COURSE OUTCOMES
1. Develop the idea of the fundamentals of acoustic waves.
2. Apply the concepts of radiation and reception of acoustic waves.
3. Explain the basic ideas of pipe resonators and filters.
4. Illustrate the basics of architectural acoustics.
5. Illustrate the transducers and receivers and its applications in various electronic devices.
6. Apply the knowledge inputs of the course for engineering applications.

UNIT I  INTRODUCTION

UNIT II  RADIATION AND RECEPTION OF ACOUSTIC WAVES
Radiation from a pulsating sphere – Acoustic reciprocity – continuous line source radiation impedance - Fundamental properties of transducers. Absorption and attenuation of sound. Absorption from viscosity – complex sound speed and absorption – classical absorption coefficient

UNIT III  PIPES RESONATORS AND FILTERS

UNIT IV  ARCHITECTURAL ACOUSTICS

UNIT V  TRANSDUCTION

SUGGESTED READINGS
COURSE OBJECTIVES
1. To make the students conversant with basics of Solid waste and its classification.
2. To make the student acquire sound knowledge of different treatments of solid wastes.
3. To acquaint the student with concepts of waste disposals.
4. To develop an understanding of the basic concepts of Hazardous waste managements.
5. To acquaint the students with the basics of energy generation from waste materials.
6. To make the student understand about the disposal and treatment of waste scientifically.

COURSE OUTCOMES
1. Outline the basic principles of Solid waste and separation of wastes.
2. Identify the concepts of treatment of solid wastes.
3. Identify the methods of wastes disposals.
4. Examine the level of Hazardousness and its management.
5. Examine the possible of the energy production using waste materials.
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I  SOLID WASTE

UNIT II  WASTE TREATMENT
Size Reduction – Aerobic Composting – Incineration – batch type and continuous flow type, Medical/Pharmaceutical Waste Incineration – Environmental Impacts – Measures of Mitigate Environmental Effects due to Incineration

UNIT III  WASTE DISPOSAL

UNIT IV  HAZARDOUS WASTE MANAGEMENT

UNIT V  ENERGY GENERATION FROM WASTE

SUGGESTED READINGS
COURSE OBJECTIVES
1. To make the students conversant about the green chemistry
2. To make the student acquire sound knowledge of the atom efficient process and synthesis elaborately.
3. To acquaint the student with concepts of green technology.
4. To develop an understanding of the basic concepts of renewable energy resources.
5. To acquaint the students with the basics information on catalysis.
6. To acquaint the students about the green alternate solutions.

COURSE OUTCOMES
1. Outline the basic principles of green chemistry
2. Examine the different atom efficient process and synthesis elaborately
3. Apply the concepts combustion of green technology
4. Identify and apply the concepts of renewable energy
5. Apply the concepts of green catalysts in the synthesis
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I INTRODUCTION TO GREEN CHEMICAL PRINCIPLES
Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

UNIT II ATOM EFFICIENT PROCESSES
Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis

UNIT III BIOTECHNOLOGY AND GREEN CHEMISTRY
Bio technology and its applications in environmental protection-Bio informatics-Bio remediation, biological purification of contaminated air. Green chemistry for clean technology-Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

UNIT IV RENEWABLE RESOURCES
Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomass conversion

UNIT V CATALYSIS IN GREENCHEMISTRY
Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

SUGGESTED READINGS
COURSE OBJECTIVES
1. To make the students conversant with the information on electrochemical material.
2. To make the student acquire sound knowledge of conducting polymers.
3. To acquaint the student with concepts of Energy storage devices.
4. To develop energy storage devices.
5. To impart knowledge on basic principles of solar cells and its applications
6. To study about Electro organic chemicals

COURSE OUTCOMES
1. Outline the basic principles of chemistry in electrochemical material (K)
2. Examine the properties of conducting polymers(S)
3. Apply the concepts of electrochemistry in storage devices.(S)
4. Identify the concepts of storage devices and its applications. (S)
5. Apply the suitable materials for the manufacturing of storage devices. (S)
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology (A)

UNIT I METALFINISHING

UNIT II CONDUCTING POLYMERS AND ELECTROCHEMICALS
Electropolymerisation- anodic and cathodic polymerization-effect of reaction parameters on the course of the reaction- Electrochemical preparation of conducting polymers-poly acetylene- Electrolytic production of perchlorates and manganese dioxide- Electro organic chemicals- constant current electrolysis.

UNIT III BATTERIES AND POWERSOURCES-I
Principles of energy conservation- electrochemical energy conservation- thermodynamic reversibility, Gibbs equation. EMF- battery terminology, energy and power density- Properties of anodes, cathodes, electrolytes and separators- Types of electrolytes.

UNIT IV BATTERIES AND POWERSOURCES-II
Primary batteries- Dry Leclanche cells, alkaline primary batteries, Lithium batteries- construction, characteristics, problems associated with system- Secondary batteries- Lead acid, nickel cadmium- Fuel cells- Introduction, types of fuel cells, advantages.

UNIT V ELECTROCHEMICAL MATERIALSCIENCE
Solar cells- Preparation of CdS/Cu2S solar cells by screen printing techniques and their characteristics - Amorphous silicon solar cells - Photo electrochemical cells(PEC) for conversion of light energy to electrical energy - PEC cells based on Cd/Se and Ga/As characteristics.

SUGGESTED READINGS
COURSE OBJECTIVES
1. To make the students conversant with cement and lime and its uses.
2. To make the student acquire sound knowledge of abrasives and refractories.
3. To acquaint the student with concepts of inorganic chemicals.
4. To develop an understanding of the basic concepts explosives.
5. To acquaint the students with the basics of agriculture chemicals.
6. To acquaint the students about the use of industrial chemical as per government law.

COURSE OUTCOMES
1. Outline the basic chemistry of cement and lime
2. Examine the uses of abrasives and refractories
3. Identify the usage of the inorganic chemicals.
4. Identify the concepts of explosives and smoke screens
5. Identify the usage of the agriculture chemicals
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I CEMENT AND LIME

UNIT II ABRASIVES AND REFRactories

UNIT III INORGANIC CHEMICALS

UNIT IV EXPLOSIVES

UNIT V AGRICULTURE CHEMICALS

SUGGESTED READINGS
PURPOSE
It provides techniques of writing and also trains the students to write without their influence of mother tongue. In addition to honing their skills as professional writers, students will develop technical vocabularies that will aid writing research articles and discussing articles produced by their peers.

COURSE OBJECTIVES
1. Develop abilities to write technically and expressively,
2. Recognize writing as a constructive, meaningful process,
4. Design effective technical documents for both print and digital media
5. Identify the qualities of good technical writing
6. To lean avoiding similarity index.

COURSE OUTCOMES
1. Construct simple sentences, correct common grammatical errors in written English.
2. Develop confidence in English language by imbibing lexical and syntax rules.
3. Enrich their reading ability for effective writing.
4. Elevate them to minimize word, sentence, and paragraph length without sacrificing clarity or substance
5. Familiarize with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.
6. Demonstrate the basic components of definitions, descriptions, process explanations, and other common forms of technical writing.

UNIT I BASIC OF WRITING
Introduction to Technical Writing – Importance of Writing – Characteristics of Writing – Audience Recognition/ Analysis – Appropriateness of language — Conciseness and Flow – Bias free and plain writing – Impersonal and Formal Language -Techniques of Technical Writing – Overcoming writer’s block – Prioritizing for effective writing – Avoiding plagiarism.

UNIT II PARAGRAPHS AND ESSAYS

UNIT III LETTERS, MEMOS AND EMAIL

UNIT IV THE ART OF CONDENSATION AND TECHNICAL PROPOSALS

UNIT V REPORTS AND RESEARCH ARTICLES

SUGGESTED READINGS
3. Graham King, Collins Improve Your Writing, Collins; First edition,2009
COURSE OBJECTIVES
1. To study concepts of Internet, IP addresses and protocols
2. To explain the concept of web page development through HTML
3. To introduce the PERL and explore its current strengths and Weaknesses
4. To write working Java code to demonstrate the use of applets for client side programming
5. To study Internet telephony and various multimedia applications
6. To Elaborate on the principles of web page development

COURSE OUTCOMES
Upon completion of this course, the student will be able to:
1. Learn the advanced concepts & techniques of Internet and Java.
2. Analyze the requirements for and create and implement the principles of web page development
3. Understand the concepts of PERL
4. Implement client side programming using java applets
5. Generate internet telephony based upon advanced concepts
6. Develop applications on internet programming based on java applets and scripts

UNIT I INTRODUCTION

UNIT II HTML

UNIT III PERL

UNIT IV CLIENT-SERVER PROGRAMMING

UNIT V INTERNET TELEPHONY
SUGGESTED READINGS

1. Paul Deitel, Harvey Deitel & Abby Deitel, Internet and World Wide Web-How to Program, PHI Learning, Delhi, 2011
B. E. Mechanical Engineering

MULTIMEDIA AND ANIMATION

18BECSOE02

Instruction hours / week L : 3 T : 0 P:0

Marks: Internal : 40 External : 60 Total:100

End Semester Exam : 3 Hours

COURSE OBJECTIVES
1. To impart the fundamental concepts of Computer Animation and Multimedia
2. To study the graphic techniques and algorithms using flash
3. Explain various concepts available in 3D animation
4. Explain various devices available for animation
5. To study the multimedia concepts and various I/O technologies for concept development
6. To understand the three-dimensional graphics and their transformations

COURSE OUTCOMES
1. Develop their creativity using animation and multimedia
2. Understand the concepts of Flash and able to develop animation using it
3. Understand about various latest interactive 3D animation concepts
4. Know the various devices and software available in motion capture
5. Understand the concept development process
6. Develop an interactive multimedia presentation by using multimedia devices and identify theoretical and practical aspects in designing multimedia applications surrounding the emergence of multimedia technology.

UNIT I  INTRODUCTION

UNIT II  CREATING ANIMATION IN FLASH

UNIT III  3D ANIMATION & ITS CONCEPTS
Types of 3D Animation – Skeleton & Kinetic 3D Animation – Texturing & Lighting of 3D Animation – 3D Camera Tracking – Applications & Software of 3D Animation

UNIT IV  MOTION CAPTION

UNIT V  CONCEPT DEVELOPMENT
Story Developing – Audio & Video – Color Model – Device Independent Color Model – Gamma and Gamma Correction - Production Budgets- 3D Animated Movies.

SUGGESTED READINGS
2. Ranjan Parekh, Principles of Multimedia, TMH, 2007
COURSE OBJECTIVES
1. To study the basic parts of computer in detail
2. Introduce various peripheral devices available for computer and its detailed working concepts
3. Overview of various interfaces and other hardware overview
4. Assemble/setup and upgrade personal computer systems and discuss about power supplies and the skills to
trouble-shoot various power-related problems.
5. To study basic concepts and methods in troubleshooting
6. To study the installation/connection and maintenance of computer and its associated peripherals.

COURSE OUTCOMES
1. Identify the main components for the PC, familiarize themselves with PC memories such as RAM and ROM
deVICES and so on.
2. Identify various peripheral devices available and its working
3. Understand various concepts of hardware and its interface and control
4. Perform basic installation of PC. Importance of maintenance is understood
5. Understand Various faults and failures are identified and troubleshooting in detail
6. Understand overall PC hardware, interfacing, maintenance and troubleshooting

UNIT I INTRODUCTION
Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction
Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

UNIT II PERIPHERAL DEVICES
Special Types of Disk Drives – Mouse and Trackball – Modem – Fax-Modem – CD ROM Drive – Scanner –
Digital Camera – DVD – Special Peripherals.

UNIT III PC HARDWARE OVERVIEW
Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box –
Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT
Display interface – FDC – HDC.

UNIT IV INSTALLATION AND PREVENTIVE MAINTENANCE
Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive
maintenance – DOS – Virus – DataRecovery.

UNIT V TROUBLESHOOTING
Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools –
Microprocessor and Firmware – Programmable LSI’s – Bus Faults – Faults Elimination process –
Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification –
Troubleshooting levels – FDD, HDD, CD-ROM Problems.

SUGGESTED READINGS
1. B. Govindarajalu, IBM PC Clones Hardware, Troubleshooting and Maintenance, TMH, 2002
3. Scott Mueller, Repairing PC's, PHI, 1992
B. E. Mechanical Engineering

JAVAPROGRAMMING

Instruction hours / week L : 3 T : 0 P:0

Marks: Internal : 40 External : 60 Total:100

End Semester Exam :3Hours

COURSE OBJECTIVES
1. To understand Object Oriented Programming concepts and basic characteristics of Java
2. To know the principles of packages, inheritance and interfaces
3. To define exceptions and use I/O streams
4. To develop a java application with threads, generics classes and swings
5. To explain the need for generic programming
6. To design and build simple Graphical User Interfaces

COURSE OUTCOMES
1. Develop Java programs using OOP principles
2. Develop Java programs with the concepts inheritance and interfaces
3. Build Java applications using exceptions and I/O streams
4. Develop Java applications with threads and generics classes and swings
5. Understand various aspects for motivation of generic programming
6. Develop various interactive Java programs using OOP concepts of Java

UNIT I INTRODUCTION TO JAVA

UNIT II PACKAGES

UNIT III I/OSTREAMS

UNIT IV EXCEPTIONHANDLING
Exceptions – Syntax of exception handling code – Multiple catch statements – Using finally statements – Throwing our own exceptions – Using exceptions for debugging

UNIT V THREADS
Introduction, Creating Threads, The Life Cycle of a Thread, Thread Methods, Using Threads, Synchronization of Threads, Summary

SUGGESTED READINGS
COURSE OBJECTIVES
1. To understand the basic concepts of electric hybrid vehicle.
2. To gain the knowledge about electric propulsion unit.
3. To gain the concept of Hybrid Electric Drive-Trains.
4. To gain the different Energy Management Strategies.
5. To study about the efficiency manipulation in drives
6. To understand and gain the knowledge about various energy storage devices

COURSE OUTCOMES
1. Summarize the basic concepts in bioprocess Engineering.
2. Explain the concept of Hybrid Electric Vehicles.
3. Understand the concept of Hybrid Electric Drive-Trains.
4. Identify the different Energy Management Strategies.
5. Understand the concept of different Energy Storage devices.
6. Analyze the different motor drives used in Hybrid Electric Vehicles.

UNITI INTRODUCTION
History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNITII HYBRID ELECTRIC DRIVE-TRAINS
Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNITIII ELECTRIC PROPULSION UNIT
Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNITIV ENERGY STORAGE
Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNITV ENERGY MANAGEMENT STRATEGIES
Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

SUGGESTED READINGS
1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press,2010
COURSE OBJECTIVES
1. To gain the knowledge about energy management.
2. To understand the basic concepts in economic analysis in energy management.
3. To understand the basic principles of energy audit.
4. To gain the knowledge about the basic concept of types of Energy Audit
5. To gain and Evaluate the different energy efficient motors
6. Understand the concept of Energy conservation.

COURSE OUTCOMES
At the end of this course, students will demonstrate the ability to
1. Understand the concept of Energy Management.
2. Analyze the different methods for economic analysis
3. Knowledge about the basic concept of Energy Audit and types.
4. Evaluate the different energy efficient motors
5. Understand the concept of Energy conservation.
6. Investigate the different methods to improve power factor.

UNITI ENERGY MANAGEMENT
Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting – Energy Auditor and Energy Manager – Eligibility, Qualification and functions - Questionnaire and check list for top management.

UNITII ECONOMIC ASPECTS AND ANALYSIS
Economics analysis – Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis - Calculation of simple payback method, net present worth method.

UNITIII BASIC PRINCIPLES OF ENERGY AUDIT
Energy audit – definition, concept, type of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes – Energy audit of industries – energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNITIV ENERGY EFFICIENT MOTORS
Electric Motors: Factors affecting efficiency - Energy efficient motors - constructional details, characteristics - voltage variation –over motoring – motor energy audit-

UNITV POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS

SUGGESTED READINGS
B. E. Mechanical Engineering 2018-19

18BEEEOE04 PROGRAMMABLELOGICCONTROLLER 3 H – 3 C

Instruction hours / week L : 3 T : 0 P:0 Marks: Internal : 40 External : 60 Total:100

End Semester Exam :3Hours

14. PROGRAMMABLELOGICCONTROLLER

COURSE OBJECTIVES

1. To understand the basic principles of PLC systems.
2. To gain the knowledge about data handling functions.
3. To gain the knowledge of storage techniques in PLC.
4. To acquire the knowledge about how to handle the data and functions.
5. To study about flow charts of ladder and spray process system.
6. To understand the principles of PID.

COURSE OUTCOMES

1. At the end of the course the student will be able to understand the registers and functions in PLC and they are able to do the program.
2. To acquire the knowledge of storage techniques in PLC.
3. Students know how to handle the data and functions.
4. Students known about advanced controller in PLC applications.
5. Students gather real time industrial application of PLC.
6. Students gathered and evaluate the flow charts of ladder and spray process system.

UNITI INTRODUCTION

PLC Basics, PLC system, I/O modules and interfacing CPU processor programming equipment. Programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNITII PLC PROGRAMMING

PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control. Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNITIII REGISTERS AND PLC FUNCTIONS

PLC Registers: Characteristics of Registers module addressing holding registers, input registers, output registers. PLC Functions: Timer functions and industrial applications, counters, counter function, industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNITIV DATA HANDLING FUNCTIONS

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit, shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNITV PID PRINCIPLES

Analog PLC operation: Analog modules and systems. Analog signal processing, multi bit data processing, analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions.

SUGGESTED READINGS

COURSE OBJECTIVES
1. To gain the knowledge about environmental aspects of energy utilization.
2. To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
3. To study about solar energy collectors and its storages
4. To study about the inter connected system in wind power
5. To understand the basic principles fuel cell, Geo thermal power plants.
6. To gain the knowledge about hydro energy.

COURSE OUTCOMES
At the end of this course, students will demonstrate the ability to
1. Analyze the Energy Scenario in India
2. Understand the concept of Solar Energy
3. Understand the concept of Wind Energy
4. Understand the concept of Hydro Energy
5. Analyze the different energy sources
6. Students gathered the real-time inter-connected system modelling in wind power

UNIT I INTRODUCTION

UNIT II SOLARENERGY

UNIT III WINDENERGY

UNIT IV HYDROENERGY
Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

UNIT V OTHERSOURCES
Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

SUGGESTED READINGS
COURSE OBJECTIVES
1. To introduce students to the embedded systems, its hardware and software.
2. To introduce devices and buses used for embedded networking.
3. To study about task management
4. To learn about semaphore management and message passing
5. To study about memory management
6. To understand and gain the knowledge about various energy storage devices

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand overview of embedded systems architecture
2. Acquire knowledge on embedded system, its hardware and software.
3. Gain knowledge on overview of Operating system
4. Discuss about task Management
5. Gain knowledge about semaphore management and message passing.
6. Gain knowledge about memory management

UNIT I INTRODUCTION TO EMBEDDED SYSTEM
Introduction - Embedded systems description, definition, design considerations & requirements - Overview of Embedded system Architecture (CISC and RISC) - Categories of Embedded Systems - embedded processor selection & tradeoffs - Embedded design life cycle - Product specifications - hardware/software partitioning - iterations and implementation - hardware/software integration - product testing techniques – ARM 7

UNIT II OPERATING SYSTEM OVERVIEW

UNIT III TASK MANAGEMENT

UNIT IV SEMAPHORE MANAGEMENT AND MESSAGE PASSING

UNIT V MEMORY MANAGEMENT
Memory Management: Memory Control Blocks – Creating Partition- Obtaining a Memory Block – Returning a Memory Block. Getting Started with µ C/OS-II – Installing µ C/OS-II – Porting µ C/OS-II: Development Tools – Directories and Files – Testing a Port - IAR Workbench with µ C/OS-II - µ C/OS-II Porting on a 8051 CPU – Implementation of Multitasking - Implementation of Scheduling and Rescheduling – Analyze the Multichannel ADC with help of µ C/OS-II
SUGGESTED READINGS

1. Floyd JeanJ. Labrosse Micro C/OS-II The Real Time Kernel CMPBOOKS 2009
COURSE OBJECTIVES
1. To study about various speakers and microphone
2. To learn the fundamental of television systems and standards
3. To learn the process of audio recording and reproduction
4. To study various telephone networks
5. To discuss about the working of home appliances
6. To familiarize with TV services like ISDN.

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand working of various type of loud speakers
2. Acquire knowledge on various types of picture tubes
3. Demonstrate the working of various optical recording systems
4. Distinguish various standards for color TV system
5. Acquire knowledge on various telecommunication networks
6. Demonstrate the working of various home appliances

UNIT I  LOUDSPEAKERS AND MICROPHONES
Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones

UNIT II  TELEVISION STANDARDS AND SYSTEMS

UNIT III  OPTICAL RECORDING AND REPRODUCTION
Audio Disc – Processing of the Audio signal – read out from the Disc – Reconstruction of the audio signal – Video Disc – Video disc formats- recording systems – Playback Systems

UNIT IV  TELECOMMUNICATION SYSTEMS
Telephone services - telephone networks – switching system principles – PAPX switching – Circuit, packet and message switching, LAN, MAN and WAN, Integrated Services Digital Network. Wireless Local Loop. VHF/UHF radio systems, Limited range Cordless Phones; cellular modems

UNIT V  HOME APPLIANCES
Basic principle and block diagram of microwave oven; washing machine hardware and software; components of air conditioning and refrigeration systems.

SUGGESTED READINGS
3. Philip Hoff, Philip Herbert Hoff Consumer Electronics for Engineers Cambridge University Press 1998
COURSE OBJECTIVES
1. To introduce the basic concepts of neural networks and its applications in various domains.
2. To educate how to use Soft Computing to solve real-world problems.
3. To have a solid understanding of Basic Neural Network.
4. To provide students with a sound and comprehensive understanding of artificial neural networks and machine learning.
5. To gain exposure in the field of neural networks and relate the human neural system into the digital world.
6. To provide knowledge of computation and dynamical systems using neural networks.

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand the basic concepts of neural networks and its applications in various domains.
2. Gain knowledge about learning process in Neural Networks.
3. Apply perception concept in design.
4. Design using ART phenomena.
5. Gain knowledge on SOM concepts.
6. Ability to develop the use of Soft Computing to solve real-world problems.

UNIT I INTRODUCTION TO NEURAL NETWORKS

UNIT II LEARNING PROCESS

UNIT III PERCEPTION

UNIT IV ATTRACTOR NEURAL NETWORK AND ART

UNIT V SELF-ORGANIZATION

SUGGESTED READINGS
1. Simon Haykin Neural Networks and Learning Machines 3rd Edition Pearson/Prentice Hall 2009
2. Satish Kumar Neural Networks: A Classroom Approach TMH 2008
B. E. Mechanical Engineering  

18BEECOE04  

FUZZY LOGIC AND ITS APPLICATIONS  

3 H – 3 C  

Instruction hours / week L : 3 T : 0 P:0  

Marks: Internal : 40 External : 60 Total:100  

End Semester Exam : 3 Hours

COURSE OBJECTIVES
1. To introduce the basic concepts of Fuzzy logic and its applications in various domain
2. To educate how to use Fuzzy computation to solve real-world problems
3. To have a solid understanding of Basic fuzzy models.
4. Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
5. To learn about applications on Fuzzy based systems
6. To familiarize with fuzzy fiction and de fuzzy fiction procedures

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand the basic concepts of Fuzzy logic and its applications in various domain
2. Gain knowledge on theory of Reasoning
3. Develop fuzzy controllers
4. Understand concepts of adaptive fuzzy control
5. Ability to develop how to use Fuzzy computation to solve real-world problems
6. Design fuzzy based model for any application

UNIT I  
BASICS OF FUZZY LOGIC
Fuzzy sets, Properties of fuzzy sets, operation in fuzzy sets, fuzzy relations, the extension principle

UNIT II  
THEORY OF APPROXIMATE REASONING
Linguistic variables, Fuzzy proportions, Fuzzy if-then statements, inference rules, compositional rule of inference-fuzzy models

UNIT III  
FUZZY KNOWLEDGE BASED CONTROLLERS (FKBC)
Basic concept structure of FKBC, choice of membership functions, scaling factors, rules, fuzzyfication and defuzzyfication procedures – Design of Fuzzy Logic Controller

UNIT IV  
ADAPTIVE FUZZY CONTROL
Process performance monitoring, adaption mechanisms, membership functions, tuning using gradient descent and performance criteria. Set organizing controller model based controller.

UNIT V  
FUZZY BASED SYSTEMS
Simple applications of FKBC - washing machines- traffic regulations - lift control - fuzzy in medical applications - Introduction to ANFIS.

SUGGESTED READINGS
2. G.J. Klirand T.A. Folger Fuzzy Sets Uncertainty and Information PHI IEEE1995
COURSE OBJECTIVES
1. To provide students with an overview of communication systems
2. To provide an overview on mobile communication
3. To make students to have a better understanding on satellite and radar communication
4. To understand the basic communication techniques which in turn are used as the building blocks of the larger and more complex communication systems.
5. To acquire the basic engineering understanding to the modern communication systems and; the relevant theory and technique.
6. Design simple systems for landing and navigation.

COURSE OUTCOMES
At the end of the course the students will be able to
1. Understand past, present and future trends in mobile communication.
2. Gain knowledge about mobile cellular communication
3. Understand various standards in use for wireless communication and its application.
4. Demonstrate some basic application of GPS.
5. Gain knowledge about RADAR working and its applications
6. Demonstrate how a simple radar system works and its applications.

UNIT I THE EVOLUTION OF ELECTRONIC COMMUNICATION
From smoke signals to smart phones - History of communications: Theoretical Foundations, Development & Applications - Frequencies for communication - Frequency regulations - Overview of communication transmitter and receiver.

UNIT II MOBILE CELLULAR COMMUNICATIONS

UNIT III WIRELESS COMMUNICATION
Introduction - Bluetooth - Infrared communication - IEEE Wireless LANs (Wi-Fi) - IEEE 802.16 (WiMaX) - Future mobile and wireless networks: Introduction to 5G- device to device communication- IoT.

UNIT IV SATELLITE COMMUNICATION
History of Satellite communication, Basics of Satellites, Types of Satellites, Capacity Allocation - Launch Vehicles and Orbits: Introduction to launching vehicles, Important Orbits, working of rocket, Three Pioneers of Rocketry - Basics of Global Positioning System (GPS) - Applications of GPS.

UNIT V RADAR & NAVIGATION
SUGGESTED READINGS

COURSE OBJECTIVES
1. To impart basic knowledge in bioprocess Engineering.
2. To design the bioreactors for various operations.
3. To understand the principle and working of heat transfer equipments.
4. To extend the knowledge in principle of heat transfer inside a bioreactor.
5. To construct the equipments used in mass transfer operations.
6. To learn the equipments used in separation process.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Summarize the basic concepts in bioprocess Engineering.
2. Design the bioreactors for various operations.
3. Understand the principle and working of heat transfer equipments.
4. Develop the heat transfer equipments for Bioprocess Engineering.
5. Construct the equipments used in mass transfer operations.
6. Categorize the equipments used in separation process.

UNIT I ENGINEERING PROPERTIES AND STORAGETANK
Introduction to various mechanical properties of material to be used material of construction, design of cylindrical storage tank.

UNIT II REACTOR DESIGN
Design of Airlift fermentor, Bubble column reactor and Continuous stirred tank reactor.

UNIT III HEAT TRANSFER EQUIPMENTS
Design of Shell and tube Heat exchanger, Double pipe heat exchanger, long tube vertical evaporator and forced circulation evaporator.

UNIT IV MASS TRANSFER EQUIPMENTS
Design of Bollmann extractor, fractionating column, packed tower and spray tray absorber.

UNIT V SEPARATION EQUIPMENTS
Design of plate and frame filter press, leaf filter, rotary drum filter, disc bowl centrifuge, rotart drum drier and Swenson–walker crystallizer.

SUGGESTED READINGS
COURSE OBJECTIVES
1. To learn the scope and importance of food processing.
2. To impart basic knowledge in different food processing methods carried out in the food tech companies.
3. To extend the brief knowledge in food conservation operations.
4. To study the methods of food preservation by cooling.
5. To familiarize the students on the concepts of preservation methods for fruits.
6. To create deeper understanding on preservation methods for vegetables.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Describe the scope and importance of food processing.
2. Outline the various processing methods for foods.
3. Extend the knowledge in food conservation operations.
4. Describe the methods of food preservation by cooling.
5. Summarize the preservation methods for fruits.
6. Demonstrate the preservation methods for vegetables.

UNIT I  SCOPE AND IMPORTANCE OF FOOD PROCESSING
Properties of food - Physical, thermal, mechanical, sensory. Raw material Preparation - Cleaning, sorting, grading, peeling.

UNIT II  PROCESSING METHODS
Heating - Blanching and Pasteurization. Freezing - Dehydration - canning - additives fermentation - extrusion cooking - hydrostatic pressure cooking - dielectric heating - micro wave processing and aseptic processing – Infra red radiation processing - Concepts and equipment used.

UNIT III  FOOD CONVERSION OPERATIONS
Size reduction - Fibrous foods, dry foods and liquid foods - Theory and equipments - membrane separation - filtration - equipment and application.

UNIT IV  FOOD PRESERVATION BY COOLING
Refrigeration, Freezing - Theory, freezing time calculation, methods of freezing, freezing equipments, freeze drying, freeze concentration, thawing, effect of low temperature on food. Water activity, methods to control water activity.

UNIT V  PRESERVATION METHODS FOR FRUITS AND VEGETABLES
Pre processing operations - preservation by reduction of water content: drying / dehydration and concentration – chemical preservation – preservation of vegetables by acidification, preservation with sugar - Heat preservation – Food irradiation - Combined preservation techniques.

SUGGESTED READINGS
3. Mircea Enachescu Dauthy, Fruit and Vegetable Processing, FAO agricultural services bulletin no.119, 1995
5. B. Sivasankar, Food processing and preservation, PHI Learning Pvt. Ltd, 2002
1. To understand the available tools and databases for performing research in bioinformatics.
2. To expose students to sequence alignment tool in bioinformatics.
3. To construct the phylogenetic trees for evolution.
4. To get familiar with the 3D structure of protein and classification.
5. To acquire basic knowledge in protein secondary structure prediction.
6. To extend the brief knowledge in Micro array data analysis.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Summarize the basic concepts and importance of Bioinformatics in various sectors.
2. Demonstrate the sequence alignment tool in bioinformatics.
3. Construct the phylogenetic trees for evolution.
4. Analyze the three dimensional protein structure and classification using various tools.
5. Illustrate the protein secondary structure prediction by comparative modeling.
6. Extend the knowledge in micro array technology and applications of bioinformatics in various sectors.

UNIT I  OVERVIEW OF BIOINFORMATICS
The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases – contents, structure & annotation: file formats; annotated sequence databases; miscellaneous databases.

UNIT II  RETRIEVAL OF BIOLOGICAL DATA
Data retrieval with Entrez & DBGET/ LinkDB; data retrieval with SRS (sequence retrieval system). Searching sequence databases by sequence similarity criteria: sequence similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families: multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

UNIT III  PHYLOGENETICS
Phylogenetics, cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

UNIT IV  STRUCTURAL BIOINFORMATICS
Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure: CATH & SCOP; introduction to protein structure prediction; structure prediction by comparative modeling; secondary structure prediction; advanced protein structure prediction & prediction strategies.

UNIT V  MICROARRAY DATA ANALYSIS
Microarray data, analysis methods; microarray data, tools & resources; sequence sampling & SAGE. Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharma informatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

SUGGESTED READINGS
3. David W. Mount, Sequence and Genome Analysis, Cold Spring Harbor Laboratory, 2004
COURSE OBJECTIVES
1. To impart the skills in the field of nano biotechnology and its applications.
2. To acquire knowledge in the nano particles and its significance in various fields.
3. To extend the knowledge in types and application of nano particles insensors.
4. To define the concepts of biomaterials through molecular selfassembly.
5. To equip students with clinical applications of nanodevices.
6. To describe deeper understanding of the socio-economic issues innanobiotechnology.

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Develop skills in the field of nano biotechnology and its applications.
2. Summarize the nanoparticles and its significance in various fields.
3. Extend the knowledge in types and application of nano particles insensors.
4. Define the concepts of biomaterials through molecular selfassembly.
5. Outline the clinical applications of nanodevices.
6. Describe the socio-economic issues innanobiotechnology.

UNIT I INTRODUCTION

UNIT II NANOPARTICLES

UNIT III APPLICATIONS

UNIT IV NANOBIOENGINEERING

UNITY ETHICAL ISSUES INNANOTECHNOLOGY

SUGGESTED READINGS
COURSE OBJECTIVES

1. To impart knowledge on the constructional details and principle of operation of various automobile components.
2. To learn the function and working of various components in transmission and drive lines.
3. To study the concept and working of steering and suspension systems in an automobile.
4. To give knowledge on the wheels, tyres and brakes of automobiles.
5. To provide information on the current and future trends in automobiles.
6. Identify and explain the types of steering system.

COURSE OUTCOMES

Upon successful completion of the course, the students should be able to:
1. Demonstrate the operating principles and constructional details of various automobile components.
2. Explain the function and working of components in transmission and drive lines.
3. Identify and explain the types of steering system.
4. Identify and explain the types of suspension system.
5. Classify and describe the types of wheels, tyres and brakes of automobiles.
6. Discuss the current and future trends in the automobiles

UNIT I ENGINE AND AUXILIARY SYSTEMS

UNIT II TRANSMISSION SYSTEMS

UNIT III STEERING AND SUSPENSION SYSTEMS

UNIT IV WHEELS AND BRAKES

UNIT V CURRENT AND FUTURE TRENDS

SUGGESTED READINGS:
COURSE OBJECTIVES
1. The objective of this course is to make the students to know and understand the constructional details, operating characteristics and design aspects of Two and Three wheelers.
2. Construct the frames of two and three wheelers of different layouts.
3. Demonstrate the constructional details and principle of operation of various engine components.
4. Identify and explain the types of transmission systems.
5. Identify and explain the types of steering and suspension systems.
6. Classify and describe the types of wheels, tyres and brakes for two and three wheelers.

COURSE OUTCOMES
Upon successful completion of the course, the students should be able to:
1. Construct the frames of two and three wheelers of different layouts.
2. Demonstrate the constructional details and principle of operation of various engine components.
3. Identify and explain the types of transmission systems.
4. Identify and explain the types of steering and suspension systems.
5. Classify and describe the types of wheels, tyres and brakes for two and three wheelers.
6. Explain the servicing of two and three wheelers.

UNIT I INTRODUCTION
History of two and three wheelers – classification and layouts of two wheelers – classification and layouts of three wheelers – main frame for two wheelers and types – main frame for three wheelers and types.

UNIT II INTERNAL COMBUSTION ENGINES
Classification of engines – selection criteria of engine for two and three wheelers – design considerations for two and three wheeler engines – construction and working of two-stroke and four-stroke engines – fuel feed system – lubricating system – cooling system – scavenging system – cranking system – kick start and auto-start mechanisms.

UNIT III TRANSMISSION, STEERING AND SUSPENSION SYSTEMS

UNIT IV WHEELS, TYRES AND BRAKES

UNIT V TWO AND THREE WHEELERS CASE STUDY
Case study of mopeds, scooters, motor cycles, sports bikes, auto rickshaws, pickup vans, delivery vans and trailers – servicing – factors affecting fuel economy and emission.

SUGGESTED READINGS:
COURSE OBJECTIVES
1. The objective of this course is to make the students to know and understand the maintenance and fault diagnosis of basic systems in Automobile.
2. Describe and differentiate the types of maintenance.
3. List the procedure for dismantling, servicing and assembling of engine components.
4. Demonstrate the servicing of transmission and driveline components.
5. Discuss the procedure for steering and suspension
6. Discuss the procedure for wheel and brake maintenance.

COURSE OUTCOMES
Upon successful completion of the course, the students should be able to:
1. Describe and differentiate the types of maintenance.
2. List the procedure for dismantling, servicing and assembling of engine components.
3. Demonstrate the servicing of transmission and driveline components.
4. Discuss the procedure for steering and suspension
5. Discuss the procedure for wheel and brake maintenance.
6. Explain the fault diagnosis in the electrical and air conditioner systems

UNIT I MAINTENANCE OF RECORDS AND SCHEDULES

UNIT II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE
General engine service – dismantling of engine components – engine repair – service of basic engine parts, cooling and lubricating system, fuel system, intake and exhaust system – engine tune-up.

UNIT III TRANSMISSION AND DRIVELINE MAINTENANCE

UNIT IV STEERING, SUSPENSION, WHEEL AND BRAKE MAINTENANCE
Inspection, maintenance and service of steering linkage, steering column, rack and pinion steering, recirculating ball steering, worm type steering, power steering system – inspection, maintenance and service of MacPherson strut, coil spring, leaf spring, shock absorbers – wheel alignment and balance – removing and fitting of tyres – tyre wear and tyre rotation – inspection, maintenance and service of hydraulic brake, drum brake, disc brake, parking brake – bleeding of brakes.

UNIT V ELECTRICAL AND AIR CONDITIONER MAINTENANCE

SUGGESTED READINGS:
6. Service manuals of various OEMs.
COURSE OBJECTIVES
1. To impart knowledge on trends in the vehicle power plants.
2. To learn the various advanced driver assistance systems.
3. To study the working of advanced suspension and braking systems in an automobile.
4. To give information about motor vehicle emission and noise pollution control.
5. To provide knowledge of the vehicle telematics.
6. To give information about the noise control techniques.

COURSE OUTCOMES
Upon successful completion of the course, the students should be able to:
1. Distinguish and describe the various modern vehicle power plant systems.
2. List and explain the various driver assistant mechanisms.
3. Identify and describe the working of advanced suspension and braking systems.
4. Apply the knowledge of motor vehicle emission and noise pollution control.
5. Describe the noise control techniques
6. Describe the vehicle telematics and its applications.

UNIT I TRENDS IN POWERPLANTS

UNIT II DRIVER ASSISTANCE SYSTEMS

UNIT III SUSPENSION, BRAKES AND SAFETY

UNIT IV EMISSION AND NOISE POLLUTION CONTROL

UNIT V VEHICLE TELEMATICS
Building blocks of vehicle telematics system – Global Positioning System (GPS) and Geographic Information System (GIS) for vehicle tracking – automotive navigation system – road recognition system – wireless vehicle safety communications – Usage Based Insurance (UBI).

SUGGESTED READINGS:
COURSE OBJECTIVES
1. To impart knowledge on the personnel management, selection process, training methods and motor vehicle act.
2. To plan the vehicle routes, scheduling of vehicles and fare structure.
3. To design the vehicle maintenance systems.
4. To Study and acquire knowledge on fare structure and analyse the methods of fare collection
5. To introduce the concepts of vehicle parts, supply management and data processing
6. To Study and acquire knowledge on electronically controlled vehicle maintenance system

COURSE OUTCOMES
Upon successful completion of the course, the students should be able to:
1. Apply the knowledge of personnel management and analyse the selection process and training methods.
2. Apply the motor vehicle act in terms of registration and describe the various vehicles and conduct the test of competence to drive.
3. Construct a fare structure and analyse the methods of fare collection.
4. Analyse the vehicle parts, supply management and data processing.
5. Describe the scheduled and unscheduled maintenance
6. Demonstrate an electronically controlled vehicle maintenance system and analyse the work schedule.

UNIT I
INTRODUCTION
Personnel management – objectives and functions of personnel management – psychology, sociology and their relevance to an organization – selection process: job description, employment tests, interviewing, introduction to training objectives, methods of training, training procedure and psychological tests.

UNIT II
MOTOR VEHICLE ACT
Schedules and sections of the motor vehicle act – traffic signs, fitness certificate, registration requirements, permit, insurance and constructional regulations – description of vehicle: goods carrier, tankers, tippers, delivery vans, recovery vans, power wagons and fire fighting vehicles – spread over, running time, test of competence to drive.

UNIT III
SCHEDULING AND FARESTRUCTURE

UNIT IV
VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET

UNIT V
MAINTENANCE

SUGGESTED READINGS:
CIVIL ENGINEERING

18BECEOE01 HOUSING, PLAN AND MANAGEMENT 3 H – 3 C

Instruction hours / week L : 3 T : 0 P:0 Marks: Internal : 40 External : 60 Total:100

End Semester Exam :3 Hours

COURSE OBJECTIVES

1. To examine the role and tasks of basic housing policies and building bye laws
2. Understand the process of integrated service delivery in the context of economic, social, environmental and institutional factors
3. Analyze the Innovative construction methods and Materials
4. Analyze city management strategies and strengthen the urban governance through a problem solving approach
5. To know the Importance of basic housing policies and building bye laws
6. To use Housing Programmes and Schemes

COURSE OUTCOMES

Upon completion of this course, the students will be able to
1. Know the Importance of basic housing policies and building bye laws
2. Use Housing Programmes and Schemes
3. Plan and Design of Housing projects
4. Examine Innovative construction methods and Materials
5. Know Housing finance and loan approval procedures
6. Understand Construction as well as managing techniques

UNIT I INTRODUCTION TO HOUSING

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organisations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL


SUGGESTED READINGS

2. Francis Cherunilam and Odeyar D Heggaide, Housing in India, Himalaya Publishing House, Bombay, 2001
3. CMA, Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002
4. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 2000
COURSE OBJECTIVES
1. Defining and identifying of eng. services systems in buildings.
2. The role of eng. services systems in providing comfort and facilitating life of users of the building.
3. The basic principles of asset management in a building & facilities maintenance environment
4. Importance of Fire safety and its installation techniques
5. To Know the principle of Refrigeration and application
6. To Understand Electrical system and its selection criteria

COURSE OUTCOMES
Upon completion of this course, the students will be able to
1. Machineries involved in building construction
2. Understand Electrical system and its selection criteria
3. Use the Principles of illumination & design
4. Know the principle of Refrigeration and application
5. Importance of Fire safety and its installation techniques
6. Know the principle behind the installation of building services and to ensure safety in buildings

UNIT I MACHINERIES
Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS

UNIT V FIRE SAFETY INSTALLATION
SUGGESTED READINGS

2. NBC, Handbook for Building Engineers in Metric Systems, NBC, New Delhi, 2005
5. National Building Code
COURSE OBJECTIVES
1. To learn various distress and damages to concrete and masonry structures
2. To know the influence of corrosion in durability of structures
3. To understand the importance of maintenance of structures
4. To study the various types and properties of repair materials
5. To learn various techniques involved in demolition of structures
6. To assessing damage of structures and various repair techniques

COURSE OUTCOMES
By the end of this course students will have the capability/knowledge of
1. Various distress and damages to concrete and masonry structures
2. Durability of structures and corrosion mechanism
3. The importance of maintenance of structures, types and properties of repair materials etc
4. Assessing damage of structures and various repair techniques
5. Modern technique and equipment being adopted for the demolition of structures
6. Influence of corrosion in durability of structures

UNIT I INTRODUCTION
Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors.

UNIT II DURABILITY OF STRUCTURES
Corrosion mechanism – diagnosis - causes and effects - cover thickness and cracking, measurements for corrosion - methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT III MAINTENANCE AND REPAIR STRATEGIES
Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT IV MATERIALS FOR REPAIR

UNIT V TECHNIQUES FOR REPAIR AND REPAIR OF STRUCTURES
Non-destructive Testing Techniques, Corrosion protection techniques, Gunite and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure Engineered demolition techniques for dilapidated structures - case studies

SUGGESTED READINGS
2. Dr.B.Vidivelli, Rehabilitation of concrete structures, Standard publishers,Chennai.2011
COURSE OBJECTIVES

1. Develop Parametric design and the conventions of formal engineering drawing
2. Produce and interpret 2D & 3D drawings
3. Communicate a design idea/concept graphically/visually
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings
5. To produce designs using a combination of 2D and 3D software.
6. Get a Detailed study of an engineering artifact.

COURSE OUTCOMES

The students will be able to
1. Develop Parametric design and the conventions of formal engineering drawing
2. Produce and interpret 2D & 3D drawings
3. Communicate a design idea/concept graphically/visually
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
5. Get a Detailed study of an engineering artifact
6. Planning and designing of structures

UNIT I INTRODUCTION
Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, coordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.

UNIT II SYMBOLS AND SIGNCONVENTIONS
Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards

UNIT III MASONRYBONDS
English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall

UNIT IV BUILDINGDRAWING
Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity

UNIT V PICTORIALVIEW
Principles of isometrics and perspective drawing. Perspective view of building.

List of Drawing Experiments:
1. Buildings with load bearing walls including details of doors and windows.
2. Single storey RCC building
3. Multistorey RCC building
SUGGESTED READINGS

3. Sham Tickoo Swapna D (2009), “AUTOCAD for Engineers and Designers”, Pearson Education
COURSE OBJECTIVES
1. To understand the need for energy.
2. To understand the correlation between energy and environment.
3. To understand about the evolution, growth and change in energy.
4. To understand energy management in industries.
5. To understand energy cost analysis.
6. To analyze energy conservation using optimization technique

COURSE OUTCOMES
After completion of the course, students are able to
1. Plan to optimize energy using systems and procedures to meet energy demand
2. Describe the movement of substances in the entire globe
3. Examine the relationship between energy systems and society
4. Use optimization techniques for conservation of energy in chemical industries
5. Evaluate the production rate and analyze the cost from economic balance for energy consumption.
6. Understand the components involved in energy auditing.

UNIT I PLANNING FOR ENERGY NEEDS
Forecasting techniques; energy demand; magnitude and pattern; input and output analysis; energy modelling and optimal mix of energy sources.

UNIT II ENERGY AND ENVIRONMENT
Energy; various forms; energy storage; structural properties of environment; bio-geo-chemical cycles; society, environment, population and technology.

UNIT III ENERGY AND SOCIETY
Energy and evolution; growth and change; patterns of consumption in developing and advanced countries; commercial generation of power requirements and benefit.

UNIT IV MANAGEMENT OF ENERGY CONSERVATION IN CHEMICAL INDUSTRIES
Chemical industries; classification; conservation in unit operations such as separation; cooling tower; drying; conservation applied to refineries, petrochemical, fertilizers, cement, pulp and paper, food and chlor-alkali industries; conservation using optimization techniques.

UNIT V ECONOMIC BALANCE IN ENERGY CONSUMPTION
Cost analysis; capacity; production rate; system rate; system cost analysis; corporate models; production analysis and production using fuel inventories; input-output analysis; economics; tariffs

SUGGESTED READINGS
COURSE OBJECTIVES
1. To study biofertilizers supplement the requirements.
2. To study use of biofertilizers along with chemical fertilizers and organic manures.
3. To study fertilizer transport, application and maintaining field conditions.
4. To develop integrated nitrogenous and phosphatic biofertilizers.
5. To Accelerate biochemical processes.
6. To study nutrients available to the crops by the sue of fertilizers.

COURSE OUTCOMES
After completion of the course, students are able to
1. Illustrate chemical, organic fertilizers and nutrients
2. Develop the flow chart for manufacture of nitrogenous fertilizers
3. Analyze the various processes and develop the flow chart for the manufacture of phosphatic fertilizers.
4. Develop the flow chart for the manufacture of potassic fertilizer and analyze the unit operations involved in the process.
5. Illustrate the quality and pollution standards permissible in fertilizer industry.
6. Ability to distinguish the types of biofertilizers.

UNIT I  INTRODUCTION
Chemical Fertilizers and Organic Manures - Types of chemical fertilizers. Secondary nutrients, micro nutrients.

UNIT II  NITROGENFERTILIZERS
Nitrogenous Fertilizers - Methods of production of Ammonia and Urea. Nitric acid, Ammonium sulphate, Ammonium Nitrate, Calcium Ammonium Nitrate, Ammonium Chloride - Their methods of production, characteristics, storage and handling specifications.

UNIT III  PHOSPHATICFERTILIZERS

UNIT IV  POTASSICFERTILIZERS

UNIT V  FERTILIZERS IMPACTS AND STANDARDS
Fluid fertilizers. Controlled Release of fertilizers. Solid, Liquid and Gaseous pollution from ammonia urea and NPK fertilizer industries and standards laid down for them. Fertilizer production in India.
SUGGESTED READINGS


7. CHEMTECH - II - (Chapter on Fertilizers by Chari, K.S.), Chemical Engineering Education Development Centre, I.I.T., Madras, 1977.

COURSE OBJECTIVES

1. Recognize the properties of the basic industries and the environmental impact of waste generated is able to compare.
2. Define the characteristics of industrial wastewater.
3. Establish a relationship between the properties of industrial wastewater.
4. Explain the principles of industrial wastewater refining.
5. Determine the appropriate treatment methods for textile industry wastewater.
6. Allow the properties of textile industry waste waters

COURSE OUTCOMES

After completion of the course, students are able to

1. Examine the constituents of waste water and its effects.
2. Separate the contaminants from the effluent for treatability.
3. Determine the biomass yield and substrate utilization rate for biological treatment process and design of activated sludge process.
4. Develop a flow sheet for the waste water treatment from dairy, sugar, pulp and paper, textile and pharmaceutical industries.
5. Develop process flow diagram for water reuse and sludge disposal.
6. Students will learn treatment of industrial waste water.

UNIT I INTRODUCTION TO WASTE WATER ENGINEERING

Waste Water Engineering - Overview, inorganic non-metallic constituents and metallic constituents, physical and biological Characteristics.

UNIT II OPERATIONS AND UNIT PROCESS

Screening, Flow Equalization, Mixing, Flocculation, Grit removal, Sedimentation, Coagulation, Precipitation, Oxidation and Neutralization

UNIT III FUNDAMENTALS OF BIOLOGICAL TREATMENT

Introduction, Microbial growth kinetics, types of biological process for wastewater treatment - aerobic and anaerobic oxidation, Biological Nitrification and De-nitrification, biological phosphorous removal, activated sludge process (with design Considerations), trickling filters and lagoons.

UNIT IV WASTE WATER TREATMENT IN SPECIFIC INDUSTRIES


UNIT V WATER REUSE

Wastewater reclamation technologies and reuse, Solid processing flow diagrams, sludge and scum pumping, grinding, screening, degritting, blending, anaerobic digestion, composting, conditioning, dewatering and incineration.

SUGGESTED READINGS

COURSE OBJECTIVES
1. Identify key sources, typical quantities generated, composition, and properties of solid and hazardous waste.
2. Identify waste disposal or transformation techniques.
3. Recognize the relevant regulations that apply for facilities used for disposal, and destruction of waste.
4. Conduct invasive and non-invasive site investigation and apply permitting process for constructing landfills.
5. Estimate typical waste disposal costs.
6. Identify recycling and reuse options.

COURSE OUTCOMES
After completion of the course, students are able to:
1. Outline the salient features of solid waste management and handling.
2. Deduce the source reduction, recycling, and reuse techniques of solid waste.
3. Analyze the collection systems and method of transfer of solid waste.
4. Describe the processing techniques for solid and hazardous waste.
5. Select the suitable methods for disposal of solid and hazardous waste.
6. Interpret the legislation for management, handling and disposal of solid and hazardous waste.

UNIT I CHARACTERISTICS AND SOURCE REDUCTION OF SOLID WASTE
Definition, sources, and types of solid waste - Composition, physical, chemical and biological properties of solid wastes - Percapita generation rates - Sampling and characterization of solid waste - Source reduction of wastes - Waste exchange - Recycling and reuses - Salient features of Indian legislations on management and handling of municipal solid wastes.

UNIT II COLLECTION AND TRANSPORT OF SOLID WASTE
Estimation of solid waste and factors affecting generation rates - On-site handling, storage, and processing - Collection services: municipal and commercial - Industrial services - Collection systems: Hauled-container system (HCS) and stationary containersystem (SCS) - Vehicle and labour assessment - Assessment of collection route - Transfer and transport - Transfer station location - Means and methods of transfer.

UNIT III PROCESSING AND DISPOSAL OF SOLID WASTE
Objective of processing - material separation and processing technologies - Biological, chemical and thermal conversion technologies - disposal in Landfills: site selection methods and operations, leachate and gas generations and movement and control of gas and leachate techniques - Composting: aerobic and anaerobic - Resource and energy recovery schemes.

UNIT IV HAZARDOUS WASTE CHARACTERIZATION AND MANAGEMENT

UNIT V NUCLEAR WASTE AND E-WASTE
SUGGESTED READINGS

FOOD TECHNOLOGY
18BTFTOE01
PROCESSING OF FOOD MATERIALS
3 H – 3 C

Instruction hours / week L : 3 T : 0 P:0
Marks: Internal : 40 External : 60 Total:100
End Semester Exam :3 Hours

COURSE OBJECTIVES
1. Explain the milling, extraction and manufacture of tremendous products from cereals, pulses and oilseeds
2. Summarize the production and processing methods of fruits and vegetables
3. Discuss the chemical composition, processing, production, spoilage and quality of milk and milk products
4. Outline the overall processes involved in the production of meat, poultry and fish products
5. Review the production and processing methods of plantation and spice products
6. To learn food preservation tools.

COURSE OUTCOMES
1. Discuss the various processing technologies involved in cereal, pulses and oilseed technology
2. Demonstrate the major operations applied in fruits and vegetable processing
3. Illustrate the techniques involved in the processing of dairy products
4. Infer the production of different types of milk
5. List the overall processing of meat, poultry and fish processing
6. Outline the processing of spices and plantation products

UNIT I - CEREAL, PULSES AND OIL SEEDS TECHNOLOGY
Rice milling, Pulse milling, Wheat milling - Oil extraction - Methods of manufacture of Bread - different processes of manufacture - types of breads - buns, biscuits, cakes and cookies - Pasta products - Tortilla - Method of manufacture.

UNIT II - FRUITS AND VEGETABLE PROCESSING
Production of Fruits and vegetables in India, Cause for heavy losses, preservation treatments - Basics of Canning, Minimal processing and Hurdle technology as applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing.

UNIT III - DAIRY PROCESSING

UNIT IV - MEAT, POULTRY AND FISH PROCESSING
Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Fish and other Marine Products Processing.

UNIT V - PLANTATION PRODUCT TECHNOLOGY

SUGGESTED READINGS
COURSE OBJECTIVES
1. Explain the basic concepts of food and nutrition
2. Define the overall classification, function, and source of carbohydrates, lipids and proteins
3. Discuss the overall aspects of vitamins
4. Outline the role of health and nutritional importance of micro and macrominerals
5. Summarize the recent trends in nutrition
6. To understand the importance of nutrition for good health.

COURSE OUTCOMES
1. Discuss the basics in the area of nutritional assessment in health and disease
2. Categorize the recommended dietary allowances for different age groups
3. Express the classifications, functions and sources of carbohydrates, lipids and proteins
4. List the various attributes of fat and water soluble vitamins
5. Report the role, bioavailability, sources and deficiency diseases of macro and microminerals
6. Recognize the diets and concepts of foods suggested for nutritional, chronic and acute disorders

UNIT I - HUMAN NUTRITION
Historical perspective of nutrient requirements – Assessment of nutritional status - recommended dietary allowances of macronutrients for all age groups - Assessment of protein quality – Malnutrition and related disorders – Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing.

UNIT II - BIOMOLECULES

UNIT III - VITAMINS

UNIT IV - MINERALS
Physiological role, bio-availability, requirements, sources and deficiency of Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride.

UNIT V - RECENT TRENDS IN NUTRITION
Principles of dietary management in gout, rheumatism, AIDS/HIV - Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer. Role of functional foods, health foods and novel foods, organically grown foods, recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

SUGGESTED READINGS
COURSE OBJECTIVES

1. Outline the current status of snack food industry
2. Describe the production, processing and marketing trends of potato and tortilla chips
3. Outline the overall processing of popcorn
4. Explain the production and processing of fruits involved in snack food preparation
5. Summarize the sensory analysis methods and packaging techniques of snack foods
6. To understand food preservation techniques.

COURSE OUTCOMES

1. Review the overall aspects of snack food industry
2. Develop ready to eat foods from potato and maize flour
3. Demonstrate the various unit operations involved in the production of potato and tortilla chips
4. Illustrate the overall aspects of popcorn production
5. List the production, processing and manufacturing of fruit based snacks
6. Recognize the sensory analysis and packaging methods of snack foods

UNIT I SNACK FOOD INDUSTRY

UNIT II POTATO AND TORTILLA CHIPS PROCESSING
Potato Production- Potato snack Ingredients- Potato Analysis and Composition-Potato chip manufacturing process-Unit Operations-Other value added products from Potato.
Tortilla chips - Raw Materials- Processing steps-Equipment involved-Reconstitution of Dry Maize Flour-Unit operations.

UNIT III POPCORN PROCESSING

UNIT IV FRUIT BASED SNACKS
Introduction-production and processing of fruit crops – fruit purees – fruit powders – canned fruit snacks – alcoholic preservation of fruit snacks – fruit candies – fruit bars – exotic fruits.

UNIT V SENSORY EVALUATION AND PACKAGING

SUGGESTED READING

COURSE OBJECTIVES
1. Categorize the types of agricultural wastes
2. Outline the production and utilization of biomass
3. Explain the various parameters considered to be important in the designing of biogas units
4. Review the various methods employed in the production of alcohol from the byproducts of agricultural wastes
5. Summarize the overall aspects involved in the production of paperboards and particleboards from agricultural wastes
6. To learn about various waste to energy conversion technologies.

COURSE OUTCOMES
1. List and group the types of agricultural wastes
2. Develop a number of value added products from agriculture wastes
3. Discuss the techniques and production involved in the utilization of biomass
4. Assess the various parameters considered to be important in the designing of biogas units
5. Illustrate the various methods employed in the production of alcohol from the byproducts of agricultural wastes
6. Choose the appropriate materials to produce paperboards and particleboards from agricultural wastes

UNIT 1 - TYPES OF AGRICULTURAL WASTES
Introduction and Background Agricultural Waste, Crop Waste, Agricultural Residues (annual crops), Technical terms, rice by-products utilization - rice bran and germ, rice bran oil, economic products from agriculture waste/by-products.

UNIT 2 - BIOMASS PRODUCTION AND UTILIZATION
Biomass Gasifier, Technology used for the utilization of agricultural wastes: Biomass Gasifier, Nimbkar Agricultural Research Institute (NARI) Gasifier, Rice-Husk Based Gasifier, Heat and Steam from Sugarcane Leaf and Bagasse.

UNIT 3 - BIOGAS DESIGN AND PRODUCTION
Biogas: Definition, composition, history of biogas, Production of biogas; types of biogas plant (floating drum type and fixed dome type) and their components (inlet, outlet, stirrer, slanting pipe, digester, gas holder and gas outer pipe), Selection and Design of biogas plant.

UNIT 4 - PRODUCTION OF ALCOHOL FROM WASTE MATERIALS
Production of Alcohol from waste materials: Introduction, Production methods, Cellulolysis (biological approach): Pretreatment, Cellulolytic processes (Chemical and Enzymatic hydrolysis), Microbial fermentation, Gasification process (thermochemical approach).

UNIT 5 - PRODUCTION OF PAPERBOARDS AND PARTICLEBOARDS FROM AGRICULTURAL WASTE
Production and testing of Paperboards and Particleboards from Agricultural Waste: Introduction, History, Terminology and classification, Raw materials, Production steps - Pulping, Classifications of pulp, Bleaching, Plies, Coating, Grades.

SUGGESTED READINGS
COURSES OFFERED TO OTHER DEPARTMENTS

**18BEMEOE01**
**COMPUTER AIDED DESIGN**

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<td>Marks</td>
<td>Internal: 40</td>
<td>External: 60</td>
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<tr>
<td>End Semester Exam</td>
<td>3 Hours</td>
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COURSE OBJECTIVES
1. To apply basic concepts to develop construction (drawing) techniques.
2. To acquire the ability to manipulate drawings through editing and plotting techniques.
3. To understand geometric construction and produce template drawings.
4. To understand and demonstrate dimensioning concepts and techniques.
5. To understand Section and Auxiliary Views.
6. To become familiar with Solid Modelling concepts and techniques.

COURSE OUTCOMES
Upon completion of the course, the students will be able to
1. Apply basic concepts to develop construction (drawing) techniques.
2. Ability to manipulate drawings through editing and plotting techniques.
3. Understand geometric construction and produce template drawings.
4. Understand and demonstrate dimensioning concepts and techniques.
5. Understand Section and Auxiliary Views.

UNIT I
**OVERVIEW OF CAD SYSTEMS**
Conventional and computer-aided design processes-advantages and disadvantages. Subsystems of CAD-CAD hardware and software, analytical and graphics packages, CAD workstations. Networking of CAD systems.

UNIT II
**INTERACTIVE COMPUTER GRAPHICS AND GRAPHIC TRANSFORMATIONS**

UNIT III
**GEOMETRIC MODELING**

UNIT IV
**PARAMETRIC DESIGN AND OBJECT REPRESENTATION**

UNIT V
**PRODUCT DESIGN AND DEVELOPMENT**

SUGGESTED READINGS
COURSE OBJECTIVES
1. To recognize and evaluate occupational safety and health hazards in the workplace.
2. To determine appropriate hazard controls following the hierarchy of controls.
3. To analyse the effects of workplace exposures, injuries and illnesses, fatalities.
4. To prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
5. To teach student the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
6. To prevent or mitigate harm or damage to people, property, or the environment.

COURSE OUTCOMES
At the end of the course, student will be able to
1. Recognize and evaluate occupational safety and health hazards in the workplace.
2. Determine appropriate hazard controls following the hierarchy of controls.
3. Analyse the effects of workplace exposures, injuries and illnesses, fatalities.
4. Prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
5. Understand the concept of Industrial Safety & provide useful practical knowledge for workplace safety.
6. Prevent or mitigate harm or damage to people, property, or the environment.

UNIT I CONCEPTS
Evolution of modern safety concept - Safety policy - Safety Organization - line and staff functions for safety - Safety Committee - budgeting for safety.

UNIT II TECHNIQUES
Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

UNIT III ACCIDENT INVESTIGATION AND REPORTING
Concept of an accident, reportable and non reportable accidents, unsafe act and condition – principles of accident prevention, Supervisory role - Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process - Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports

UNIT IV SAFETY PERFORMANCE MONITORING
Reactive and proactive monitoring techniques - Permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety “t” score, safety activity rate – problems.

UNIT V SAFETY EDUCATION AND TRAINING

SUGGESTED READINGS
COURSE OBJECTIVES
1. To generalized equations for mass, momentum and heat.
2. To understand the concepts of Reynolds and Gauss theorems.
3. To learn combined diffusive and convective transport.
4. To apply Film- and penetration models for mass and heat transfer.
5. To apply Stefan-Maxwells equations for multi-component diffusion.
6. To Solve the given set of equations either analytically or numerically.

COURSE OUTCOMES
2. Understand the concepts of Reynolds and Gauss theorems.
3. Learn combined diffusive and convective transport.
4. Apply Film- and penetration models for mass and heat transfer.
5. Apply Stefan-Maxwells equations for multi-component diffusion.
6. Solve the given set of equations either analytically or numerically.

UNITI INTRODUCTION AND BASIC CONCEPTS
General overview of transport phenomena including various applications, Transport of momentum, heat and mass, Transport mechanism, Level of transport, Driving forces, Molecular transport (diffusion), convective transport (microscopic)

UNITII PROPERTIES, UNITS AND OTHER PHYSICAL PARAMETERS
Unit systems, temperature, mole, concentration, pressure, Gas laws, laws of conservation, energy and heat units

UNITIII MOMENTUM TRANSPORT
Basic concepts in fluid mechanics, Force, unit and dimensions, pressure in fluid, head of fluid, Molecular transport for momentum, heat and mass transfer, Viscosity of fluids, Newton's law, Momentum transfer, Newtonian and non-Newtonian fluids, Fluid flow and Reynolds number, Overall mass balance, Control volume and Continuity equation, Overall energy balance, Bernoulli's equation, Overall momentum balance, Drag coefficient, Stokes law, Flow in packed beds, Flow in fluidized bed

UNITIV ENERGY TRANSPORT
Basic concepts in heat transfer, Heat transfer mechanisms, Fourier's law of heat conduction, thermal conductivity, convective heat transfer coefficient, Conduction heat transfer - through flat slab/wall and through hollow cylinder, Conduction through solids in series, Forced convection heat transfer inside pipes, Heat transfer outside various geometrics in forced convection, General discussion on natural convection heat transfer, Heat exchangers, General discussion on radiation heattransfer

UNITV MASS TRANSPORT
Basic concepts in mass transport, Some application examples, Modes of mass transfer, Molecular diffusion-Fick's law, Analogy between mass, heat and momentum transfer, Dispersion, Hydraulic or Darcy's flow in porous media, Chemical kinetics and activation energy, Film theory, Convective mass transfer, Liquid-solid mass transfer, Liquid-liquid mass transport, Gas-liquid mass transfer, Aeration and oxygen transport, Air stripping

SUGGESTED READINGS
INTRODUCTION TO BIOMECHANICS

18BEMEOE04

2018-19

INTRODUCTION TO BIOMECHANICS

3 H – 3 C

Instruction hours / week L : 3 T : 0 P:0

Marks: Internal : 40 External : 60 Total:100

End Semester Exam : 3 Hours

COURSE OBJECTIVES

1. To describe the principles of the study of human movement.
2. To describe the range of factors that influence the initiation, production and control of human movement.
3. To identify the body's lever systems and their relationship to basic joint movement and classification.
4. To distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
5. To explain joint and muscle function and the forces acting upon the human body during various sporting activities.
6. To relate the different body systems necessary for human movement to occur.

COURSE OUTCOMES

1. Describe the principles of the study of human movement.
2. Describe the range of factors that influence the initiation, production and control of human movement.
3. Identify the body's lever systems and their relationship to basic joint movement and classification.
4. Distinguish between biomechanical principles of kinetics and kinematics when applied to the analysis of human movement.
5. Explain joint and muscle function and the forces acting upon the human body during various sporting activities.
6. Relate the different body systems necessary for human movement to occur.

UNIT I INTRODUCTION
Biomechanics - Improving Performance – Applications - Preventing And Treating Injury - Qualitative And Quantitative Analysis - Scholarly Societies - Computer Searches – Biomechanical Knowledge versus Information - Kinds of Sources - Evaluating Sources

UNIT II KEY MECHANICAL CONCEPTS
Mechanics - Basic Units - Nine Fundamentals of Biomechanics - Principles and Laws - Nine Principles for Application of Biomechanics

UNIT III HUMAN ANATOMY AND SOME BASIC TERMINOLOGY

UNIT IV ANATOMICAL DESCRIPTION
Key Anatomical Concepts - Directional Terms - Joint Motions - Muscle Actions - Active and Passive Tension of Muscle - Limitations of Functional Anatomical Analysis - Mechanical Method of Muscle Action Analysis - The Need for Biomechanics to Understand Muscle Actions - Sports Medicine and Rehabilitation Applications

UNIT V MECHANICS OF THE MUSCULOSKELETAL SYSTEM

SUGGESTED READINGS