## B. E. MECHANICAL ENGINEERING (PART TIME)

### COURSE OF STUDY AND SCHEME OF EXAMINATIONS

(2018 and onwards)

### SEMESTER I

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## PRODUCTION ENGINEERING

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## THERMAL ENGINEERING

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## AUTOMOTIVE ENGINEERING

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## MANAGEMENT SYSTEMS

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Total number of credits: 104

L: Lecture Hour  T: Tutorial Hour  CIA: Continuous Internal Assessment
P: Practical Hour  C: No. of Credits  ESE: End Semester Examinations
**COURSE OBJECTIVES**

1. To develop analytical skills for solving different technological problems.
2. To understand the concepts of Matrices, sequences and series.
3. To solve problems by applying Differential Calculus and Differential equations.
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 (CO’s)**

At the end of this course,

1. The prospective engineers will be familiarized with techniques in calculus, multivariate analysis and linear algebra.
2. The students will be equipped with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.
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 comprehensive manner.
6. Students can solve real time problems using standard concepts and tools.

**UNIT I  MATRICES**

9+3


**UNIT II  DIFFERENTIAL CALCULUS**

9+3

Overview of Derivatives - Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes

**UNIT III  DIFFERENTIAL EQUATIONS**

9+3

Introduction to Ordinary differential equations: linear ordinary differential equations of second and higher order with constant coefficients.
Introduction to Partial differential equations – Linear partial differential equations of second and higher order with constant coefficients

**UNIT IV  ANALYTIC FUNCTIONS**

9+3

Analytic functions – Necessary and Sufficient conditions for an analytic function (Without proof) Cauchy-Riemann equations –Harmonic-Properties of analytic functions- Constructions of an analytic function - Conformal mapping: w = z+a, az, 1/z and bilinear transformation

**UNIT V  Z -TRANSFORM AND DIFFERENCE EQUATIONS**

9+3


**TOTAL** 45 + 15 = 60 PERIODS

**SUGGESTED READINGS**

8. www.efunda.com
9. www.mathcentre.ac.uk
10. www.intmath.com/matrices-determinants
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  9
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  9

UNIT III  CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA  9
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  9


UNIT V  KINETICS OF PARTICLES AND FRICTION  9


TOTAL  45 PERIODS

SUGGESTED READINGS

COURSE OBJECTIVES

1. To impart the basic knowledge about the Electric circuits.
2. To understand the working of various Electrical Machines.
3. To know about various measuring instruments.
4. To understand the basic concepts in semiconductor devices and digital electronics
5. To study the working principles of electrical machines and power converters.
6. To introduce the components of low-voltage electrical installations

COURSE OUTCOMES (CO's)

Upon successful completion of the course, student should be able to

1. To understand and analyze basic Electric and Magnetic circuits
2. To study the working principles of Electrical Machines and Power Converters.
3. To Know broadly the concepts and functionalities of the electronic devices, tools and instruments
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 ELECTRIC CIRCUITS & MEASUREMENTS


UNIT II ELECTRICAL MACHINES


UNIT III MEASURING INSTRUMENTS

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT IV SEMICONDUCTOR DEVICES AND APPLICATIONS


UNIT V DIGITAL ELECTRONICS


SUGGESTED READINGS

2. Sedha R.S (2013), Applied Electronics, S. Chand & Co

TOTAL 45 PERIODS
18PBEME104 MANUFACTURING TECHNOLOGY SEMESTER – I

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 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 FOUNDRY EQUIPMENTS AND MATERIALS 8
Patterns. Moulds-types of moulds, moulding sand characteristics and testing procedures. Core making, melting furnaces.

UNIT II PRODUCTION OF CASTINGS 8

UNIT III WELDING 9

UNIT IV METAL FORMING PROCESSES 9
Cold and hot working, rolling, drawing, extrusion and forging, sheet metal cutting, bending. Drawing applications, defects. Types of presses.

UNIT V SPECIAL FORMING METHODS 8
Explosive forming, electro magnetic forming, electro hydraulic forming, powder metallurgy process, composite mouldings.

INTRODUCTION TO SOFTWARE FOR MANUFACTURING APPLICATIONS (Not for exam) 3
Metal forming and flow analysis software (for metallic/plastic components).

TOTAL 45 PERIODS

SUGGESTED READINGS
5. Begman (2005), Manufacturing Process, John Wiley and Sons
6. www.themetalcasting.com
7. www.industrialmetalcastings.com
8. www.purolator–lp.com

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore-641 021.
18PBEME111 COMPUTER AIDED DESIGN LABORATORY SEMESTER – I
3H: 2C

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

COURSE OBJECTIVES

1. To introduce the basic concepts and the use of engineering drawing in the design and manufacturing field.
2. Ability to develop 2D and 3D models using modeling software’s.
3. To gain practical experience in handling 2D drafting and 3D modeling software systems.
4. To impart training on SOLID WORKS for modelling
5. To provide knowledge on assembly of components
6. To facilitate the understanding of manufacturing drawings from the models created

COURSE OUTCOME

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 computer and CAD assembly of components
6. to understanding manufacturing drawings

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.

TOTAL 45 PERIODS
COURSE OBJECTIVES

1. To impact analytical skills to the students in the areas of multiple integrals and applications of vector calculus.
2. To understand the concepts and applications of Laplace transforms.
3. To study about analytic functions and complex integration
4. To familiarize the prospective engineers with techniques in Multivariate integration.
5. To familiarize the concept of ordinary and partial differential equations and complex variables.
6. To equip the students to deal with advanced level of mathematics and applications

COURSE OUTCOMES (CO’s)

Upon completion of this course, the students will learn

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 engineering problems.
4. The mathematical tools needed in evaluating multiple integrals and their usage.
5. The effective mathematical tools for the solutions of differential equations that model physical processes.
6. The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering Problems

UNIT I  MULTIPLE INTEGRALS

Double integration – Cartesian coordinates – Polar coordinates – Change of order of integration – Triple integration in Cartesian co-ordinates – Area as double integrals.

UNIT II  VECTOR CALCULUS

Gradient, Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration - Green’s theorem, Gauss divergence theorem and Stoke's theorems (Statement only)- Surfaces : hemisphere and rectangular parallelopipeds

UNIT III  FOURIER SERIES


UNIT IV  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded).

UNIT V  LAPLACE TRANSFORMS


TOTAL  45 + 15 = 60 PERIODS

SUGGESTED READINGS

7. www.intimath.com
8. www.efunda.com
9. www.mathcentre.ac.uk
10. www.sosmath.com/diffeq/laplace/basic/basic.html
COURSE OBJECTIVE

1. To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.
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 (CO's)

After completing this course, the students should be able

1. To recognize various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components.
2. To evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.
3. To estimate the deflection in beams and columns in engineering applications.
4. To analyze the effect of torsion on shafts and springs.
5. To determine principal stresses and analyze thin cylinders and shells subjected to pressure forces.
6. To design the components subjected to various loadings with the help of various theories of failures.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS


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 DEFLECTION


UNIT IV TORSION


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.

TOTAL 45 PERIODS

SUGGESTED READINGS

6. www.engineeredge.com
8. wwwglobalsources.com
9. www.dspace.cusat.ac.in
COURSE OBJECTIVES

1. To understand the basic components and layout of linkages in the assembly of a system/machine.
2. 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.
3. To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
4. 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.
5. Understand the theory of cams, gears and gear trains.
6. Understand the role of friction in belt, rope and chain drives.

COURSE OUTCOME (CO's)

At the end of the course students are able to:

1. Understand the basic principles of mechanisms in mechanical engineering.
2. Apply the kinematic analysis in subsequent courses in the design and analysis of various machine components.
3. Understand the importance of cams, gears and gear trains in real time practice.
4. Explain the role of friction in industrial drives.
5. Analyze a mechanism for displacement, velocity and acceleration at any point.
6. Understand the concept of machines, mechanisms and related terminologies.

UNIT I  BASICS OF MECHANISMS


UNIT II  KINEMATICS


UNIT III  KINEMATICS OF CAM


UNIT IV  GEARS


UNIT V  FRICTION IN DRIVES

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

TOTAL  45 PERIODS

SUGGESTED READINGS

COURSE OBJECTIVES
1. To have knowledge on computer hardwares and softwares
2. To understand the various data representation techniques
3. To make the students to get knowledge on software engineering methodologies
4. To know the correct and efficient ways of solving problems
5. To learn to develop algorithm for simple problem solving
6. To learn to program in C

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 COMPUTER BASICS
Evolution of computers- Generations of computers- Classification of computers-Applications of computers-
Computer Organization and Architecture- Computer Memory and Storage- Input Output Devices

UNIT II SOFTWARE, PROGRAMMING AND INTERNET
Algorithm- Flowchart- Pseudo code – Program control structures- Programming paradigms- Programming languages- Generations of Programming languages- Computer Software- Definition- Categories of Software - Internet- Evolution- Basic Internet terms- Internet-Applications

UNIT III C FUNDAMENTALS
Introduction to C- Constants- Variables- Data types- Operators and Expressions-Managing Input and Output operations- Decision Making and Branching- Looping

UNIT IV ARRAYS AND FUNCTIONS
Arrays- Character Arrays and Strings- User defined functions- Storage Classes

UNIT V STRUCTURES AND FILES
Structures- Definition- Initialization- Array of Structures- Structures within structures- Structures and Functions- Unions-
File Management in C

TOTAL 45 PERIODS

SUGGESTED READINGS
2. ITIL Education Solutions Ltd (2008), Introduction to Information Technology, Pearson Education. Delhi
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, Vicker and Rockwell Hardness tests.
4. Impact test on metals–Charpy, Izod impact tests.
5. Shear test on metals–direct shear strength, single shear, double shear.
7. Torsion test on beams–torque and angle of twist characteristics, shear stress, modulus of rigidity, energy.

TOTAL 45 PERIODS
COURSE OBJECTIVES

1. To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.
2. To apply the thermodynamic concepts into various thermal application like IC engines, Refrigeration and Air conditioning systems
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 air using psychometric chart.
6. To acquaint the student with the concepts and applications of the thermodynamics to the various real-life systems

COURSE OUTCOMES (CO’s)

After completing this course,
1. The students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interaction.
2. Students can evaluate changes in thermodynamic properties of substances and evaluate the performance of energy conversion devices
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 psychometric chart.
6. Explain the basic principles and applications of the thermodynamics to the various real life systems

UNIT I  BASIC CONCEPTS AND FIRST LAW  9+3

UNIT II  SECOND LAW AND ENTROPY  9+3
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  PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLES  9+3

UNIT IV  GAS POWER CYCLES AND IC ENGINES  9+3

UNIT V  PSYCHROMETRY, REFRIGERATION AND AIR CONDITIONING  9+3

TOTAL  45 + 15 = 60 PERIODS

SUGGESTED READINGS
7. www.kruse-ltc.com
18PBEME302  ENGINEERING MATERIALS AND METALLURGY  SEMESTER – III
3H: 3C

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 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  9

UNIT II  HEAT TREATMENT  9

UNIT III  FERROUS AND NON FERROUS METALS  9

UNIT IV  NON-METALLIC MATERIALS  9
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  9
Non Destructive Testing: Non Destructive Testing basic principles and testing method of Radiographic testing, Ultrasonic testing, Magnetic particle test and Liquid penetrant test, Eddy current testing.

TOTAL  45 PERIODS

SUGGESTED READINGS
2. William D. Callister & David G. Rethwisch (2016), Material Science and Engineering, John Wiley and Sons, Delhi
18PBEME303 INDUSTRIAL METROLOGY AND MEASUREMENTS SEMESTER – III

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 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 understand the technique for conducting computer aided inspection.
4. To understand the concepts of measurement used for industrial components.
5. To understand the mechanical properties in industrial applications.
6. To understand the temperature properties in industrial applications.

COURSE OUTCOME (CO’s)
1. Describe the concepts of measurements to apply in various metrological instruments
2. Outline the principles of linear and angular measurement tools used for industrial applications
3. Explain the procedure for conducting computer aided inspection
4. Demonstrate the techniques of form measurement used for industrial components
5. Discuss various measuring techniques of mechanical properties in industrial applications
6. Discuss various measuring techniques of temperature properties in industrial applications

UNIT I CONCEPT OF MEASUREMENT

UNIT II LINEAR AND ANGULAR MEASUREMENT

UNIT III FORM MEASUREMENT

UNIT IV LASER AND ADVANCES IN METROLOGY
Precision instruments based on laser–Principles– laser interferometer–application in linear, angular measurements and machine tool metrology - Coordinate measuring machine (CMM) – computer aided inspection - Nano metrology, techniques and applications-TEM,SEM,STM,XRD,AFM.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE RELATED PROPERTIES
Force, torque, strain:–mechanical and electrical type – Flow measurement: Venturi, orifice, rotometer, – Electrical pressure transducers, Temperature: Thermocouples, Resistance temperature detectors, bimetallic strip thermometers, thermistor, pyrometry

TOTAL 45 PERIODS

SUGGESTED READINGS
3. N.V. Raghavendra and L. Krishnamurthy (2013), Engineering Metrology and Measurements, Oxford University press of India
18PBEME304 FLUID MECHANICS AND MACHINERY

COURSE OBJECTIVES
1. The applications of the conservation laws to flow through pipes and hydraulic machines are studied.
2. To understand the importance of dimensional analysis.
3. To understand the importance of various types of flow in pumps and turbines.
4. To enrich the understanding of fluid properties.
5. To make the students conversant with types of flow and calculate Major and minor losses in pipes.
6. To acquaint the student with the concepts of Buckingham’s π theorem.

COURSE OUTCOMES (CO’s)
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 losses 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

TOTAL 45 PERIODS

SUGGESTED READINGS
2. Kumar K.L (2015), Engineering Fluid Mechanics, S. Chand & Co
5. Fox and McDonald (2015), Fluid Mechanics, John Wiley
COURSE OBJECTIVES

1. Ability to use the measurement equipment for flow measurement
2. Ability to do performance trust on different fluid machinery
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 OUTCOME (CO’s)

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. Assess the performance of centrifugal pump and submergible pump.
5. Assess the performance of reciprocating pump and gear pump.
6. Assess the performance of turbines.

LIST OF EXPERIMENTS

• FLUID MECHANICS

1. Determination of the Coefficient of discharge of given Orifice meter.
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.

• METROLOGY

1. Calibration of Vernier / Micrometer / Dial gauge
2. Checking dimensions of part using slip gauges
3. Measurement of gear tooth dimensions – addendum, dedendum, pitch circle diameter and tooth thickness
4. Measurement of taper angle using sine bar / tool makers microscope
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

TOTAL 45 PERIODS

18PBEME401 MECHATRONICS SEMESTER – IV

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 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

TOTAL 45 PERIODS

SUGGESTED READINGS
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 9 + 3

UNIT II CONVECTION 9 + 3

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 9 + 3

UNIT IV RADIATION 9 + 3

UNIT V MASS TRANSFER 9 + 3

TOTAL 45 + 15 = 60 PERIODS

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

SUGGESTED READINGS
1. To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
2. To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
3. To understand the effect of dynamics of undesirable vibrations.
4. To understand the principles in mechanisms used for speed control and stability control.
5. To understand the concepts of various vibrations.
6. To understand the concepts of control mechanism.

COURSE OUTCOMES (CO’s)

After completing this course, the students can do
1. Force analysis and balance rotating masses
2. Solve balancing related problems
3. Solve dynamics of undesirable vibrations
4. Estimate the stability of components
5. Analyze the vibration related problems
6. Solve governor related problems

UNIT I  
FORCE ANALYSIS  

UNIT II  
BALANCING  

UNIT III  
FREE VIBRATION  

UNIT IV  
FORCED VIBRATION AND TORSIONAL VIBRATION  
Torsional systems; Natural frequency of free torsional vibrations, Natural frequency of two and three rotor systems.

UNIT V  
MECHANISMS FOR CONTROL  
Gyroscopes – Gyroscopic forces and Torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes

TOTAL  
45 PERIODS

SUGGESTED READINGS

18PBEME404 ENVIRONMENTAL SCIENCE SEMESTER – IV

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 give a comprehensive insight into natural resources, ecosystem and biodiversity.
2. To educate the ways and means of the environment
3. To protect the environment from various types of pollution.
4. To impart some fundamental knowledge on human welfare measures.
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 OUTCOME (CO’s)
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 TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES
Definition, Scope and Importance – Need for public awareness -Forest resources: Use and over-exploitation, deforestation- Water resources-Use and over-utilization of surface and ground water, floods, drought, conflicts over water- Land resources-Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources- Food resources-World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture- Energy resources-Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources- role of an individual in conservation of natural resources.

UNIT II ECOSYSTEM
Chemistry and Environment- Environmental segments, Composition and Structure of atmosphere- Concept of an ecosystem- Structure, components and function of an ecosystem Energy flow in the ecosystem – Food chain, food web and ecological pyramids, Structure and function of Terrestrial ecosystem (Forest, Desert and Grassland ecosystem) and Aquatic ecosystem (Fresh water and Marine ecosystem)

UNIT III BIODIVERSITY
Introduction to biodiversity, Definition- Genetic diversity, Species diversity and Ecosystem diversity, Biogeographical classification of India, Importance of biodiversity-Value of biodiversity - Hot Spots of biodiversity-Threats to biodiversity - Endangered and Endemic Species of India – Conservation of biodiversity- In-Situ and Ex-Situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION
Definition – Causes, effects and control Measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution and Thermal pollution. Solid waste management- Causes, effects and control measures of urban and industrial wastes- Role of an individual in prevention of pollution-Disaster management:-earthquake, tsunami, cyclone and landslides.

UNIT V SOCIAL ISSUES AND ENVIRONMENT
From unsustainable to Sustainable development, Urban problems related to energy sources, water conservation, Rain water harvesting and watershed management, Resettlement and rehabilitation of people, its problems and concerns,

TOTAL 45 PERIODS

SUGGESTED READINGS
7. www.unesco.org/ext/field/beijing/scienceb.htm,
8. www.infinitepower.org/education.htm

18PBEME411 THERMAL ENGINEERING LABORATORY SEMESTER – IV

<table>
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<tr>
<th>Instruction Hours / Week:</th>
<th>L: 0</th>
<th>T: 0</th>
<th>P: 3</th>
<th>Marks: Internal: 40</th>
<th>External: 60</th>
<th>Total: 100</th>
<th>End Semester Exam: 3 Hours</th>
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COURSE OBJECTIVES
1. Ability to conduct experiment on IC engine to study the characteristic and performance of IC design/steam turbines.
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 instill 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

2. Performance Test on 4–stroke Diesel Engine.
4. Load test on 4–stroke Diesel Engine.
5. Morse Test on multicylinder Petrol Engine.
6. Retardation Test to find Frictional Power of a Diesel Engine.
8. Determination of Flash Point and Fire Point.
9. Study of Steam Generators and Turbines.
10. Performance and energy balance test on a steam generator

HEAT TRANSFER
1. Heat transfer through a composite wall
2. Thermal conductivity measurement by guarded plate method
3. Natural convection heat transfer from a vertical cylinder
4. Heat transfer from pin–fin (natural and forced convection modes)
5. Effectiveness of Parallel/counter flow heat exchanger
6. Determination of Stefan–Boltzmann constant
7. Determination of emissivity of a grey surface

TOTAL 45 PERIODS
18PBEME501 OPERATIONS RESEARCH SEMESTER – V

COURSE OBJECTIVE

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

COURSE OUTCOME (CO’s)

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

UNIT I INTRODUCTION TO OPERATIONS RESEARCH


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

TOTAL 45 PERIODS

SUGGESTED READINGS

5. http://www.informs.org/Pubs/OR
18PBEME502 DESIGN OF MACHINE ELEMENTS SEMESTER – V
4H: 4C

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 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 9 + 3

UNIT II DESIGN OF SHAFTS AND COUPLINGS 9 + 3
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 9 + 3

UNIT IV DESIGN OF SPRINGS AND FLYWHEEL 9 + 3
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 9 + 3
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.

TOTAL 45 + 15 = 60 PERIODS

(Permitted to use PSG design data book in the examination)

SUGGESTED READINGS

18PBEME503 COMPUTER INTEGRATED MANUFACTURING SEMESTER – V
3H: 3C

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 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

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

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

**UNIT V OPEN SYSTEM AND DATABASE FOR CIM**

Open systems – open system inter connection – manufacturing automations protocol and technical office protocol (MAP/TOP).


**TOTAL 45 PERIODS**

**SUGGESTED READINGS**

18PBEMEE-- PROFESSIONAL ELECTIVE - I SEMESTER – V

18PBEME511 COMPUTER AIDED MANUFACTURING SEMESTER – V LABORATORY

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

TOTAL 45 PERIODS

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

COMPUTER AIDED MANUFACTURING (CAM)

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. CNC Controllers like FANUC, Siemens, and Hiedenhain etc.
18PBEME601  ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT  SEMESTER – VI

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 enable students to understand the fundamental economic concepts applicable to engineering
2. To learn the techniques of incorporating inflation factor in economic decision making.
3. To Understand the measures of national income, the functions of banks and concepts of globalization
4. To Apply the concepts of financial management for project appraisal
5. To Understand accounting systems and analyze financial statements using ratio analysis
6. To Understand Financial planning, economic basis for replacement.

COURSE OUTCOMES
1. Evaluate the economic theories, cost concepts and pricing policies.
2. Understand the market structures and integration concepts
3. Understand the measures of national income, the functions of banks and concepts of globalization
4. Apply the concepts of financial management for project appraisal
5. Understand accounting systems and analyze financial statements using ratio analysis
6. Understand the impact of inflation, taxation, depreciation. Financial planning, economic basis for replacement, project scheduling, and legal and regulatory issues are introduced and applied to economic investment and project-management problems

UNIT 1  FUNDAMENTALS OF ENGINEERING ECONOMICS

UNIT II  COMMERCIAL BANKING

UNIT III  CAPITAL MARKET

UNIT IV  FINANCIAL CONCEPTS

UNIT V  COST ANALYSIS AND BREAK EVEN ANALYSIS

TOTAL  45 PERIODS

SUGGESTED READINGS
COURSE OBJECTIVES
1. To understand about industrial revolution
2. To understand the concept of Industry 4.0
3. To understand the benefit of IOT
4. To understand the concepts of automation
5. To understand about cloud computing
6. To understand the challenges in smart manufacturing

COURSE OUTCOMES:
At the end of the course the students
1. Can understand the concepts of industrial knowledge
2. Can apply the concept of Industry 4.0 in industries
3. Can able implement the IOT concept
4. Can able to evaluate the process of automation
5. Can able to apply the concepts of cloud computing
6. Can able to solve the challenges in industries

UNIT I INTRODUCTION
The Various Industrial Revolutions: First, Second, Third and Fourth. Industry 4.0 - Digitalization and the Networked Economy - Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 - The Journey so far: Developments in USA, Europe, China and other countries- Comparison of Industry 4.0 Factory and Today's Factory

UNIT II INDUSTRY 4.0
Definition and Development - Industry 4.0 environment – Exponential technologies – Characteristics of industry 4.0 - the basic Components of Industry 4.0 - the basic Principles of Industry 4.0 - Relations between principles and components of Industry 4.0

UNIT III ROAD TO INDUSTRY 4.0
Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services - Smart Manufacturing - Smart Devices and Products - Smart Logistics - Smart Cities - Predictive Analytics - Technologies for enabling Industry 4.0 - Cyberphysical Systems - Robotic Automation and Collaborative Robots - Mobile Computing - Cyber Security

UNIT IV ROLE OF DATA, INFORMATION, KNOWLEDGE
Resource-based view of a firm, Data as a new resource for organizations, Harnessing and sharing knowledge in organizations, Cloud Computing Basics, Cloud Computing and Industry 4.0. Other Applications and Case Studies - Industry 4.0 laboratories, IIoT case studies

UNIT V BUSINESS ISSUES IN INDUSTRY 4.0
Opportunities and Challenges - Future of Works and Skills for Workers in the Industry 4.0 Era - Strategies for competing in an Industry 4.0 world

TOTAL 45 PERIODS

SUGGESTED READINGS
3. https://www.aspeninstitute.it/system/files/private/.../doc/INDUSTRY%204.0_finale.pdf
4. https://www.researchgate.net/.../INDUSTRY.../56f1a41b08ae1cb29a3d1688.pdf?
18PBEME603 ENTREPRENEURSHIP DEVELOPMENT SEMESTER – VI

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

COURSE OBJECTIVE
1. To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.
2. understanding basic concepts in the area of entrepreneurship.
3. understanding the role and importance of entrepreneurship for economic development
4. developing personal creativity and entrepreneurial initiative,
5. adopting of the key steps in the elaboration of business idea,
6. Understanding the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures.

COURSE OUTCOME
: After the completion of the course, the students will be able to:
1. Have the ability to discern distinct entrepreneurial traits
2. Know the parameters to assess opportunities and constraints for new business ideas
3. Understand the systematic process to select and screen a business idea
4. design strategies for successful implementation of ideas
5. understand about financial management
6. understand about business support

UNIT I ENTREPRENEURSHIP

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

UNIT III BUSINESS

UNIT IV FINANCING AND ACCOUNTING

UNIT V SUPPORT TO ENTREPRENEURS

SUGGESTED READINGS
4. Mathew J Manimala (2005), Enterprenuership theory at cross roads: paradigms and praxis, Dream tech

TOTAL 45 PERIODS
### COURSE OBJECTIVES

1. To gain practical experience in handling 2D drafting and 3D modeling software systems.
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 model 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 Solid Works 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

**Simple Analysis using ANSYS Tool**

1. Stress analysis of rectangular L bracket
2. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
3. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
4. Harmonic analysis of a 2D component
5. Thermal stress analysis of a 2D component
6. Modeling a 3D component. (Single point cutting tool, I beams, etc.,)

**TOTAL 45 PERIODS**
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


TOTAL 45 PERIODS

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.

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

TOTAL 135 PERIODS

PROFESSIONAL ELECTIVES

DESIGN ENGINEERING

18PBEMEED01 DESIGN OF TRANSMISSION SYSTEMS 3H: 3C

Instruction Hours / Week: - L: 3  T: 0  P: 0  Marks: - Internal: 40  External: 60  Total: 100
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

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)

TOTAL 45 PERIODS

SUGGESTED READINGS


18PBEMEED02 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS 3H: 3C
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. Design and development of fixtures for given component.

UNIT IV PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAY OUT

UNIT V DESIGN AND DEVELOPMENT OF DIES

TOTAL 45 PERIODS

SUGGESTED READINGS
5. Hiram E Grant (2003), Jigs and Fixture, Tata McGraw–Hill, New Delhi
6. www.wisetool.com
7. www.invert-a-bolt.com
8. www.diemech.com
9. www.schaeffertools.com
10. www.steelsmith.com
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.

TOTAL 45 PERIODS

SUGGESTED READINGS

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore-641 021.
18PBEMEED04 HYDRAULICS AND PNEUMATICS POWER CONTROL 3H: 3C

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 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
Pneumatic Components: Properties of air – Compressors – Filter, Regulator and Lubricator
UNIT   Air control valves, Quick exhaust valves, pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V   DESIGN OF PNEUMATIC CIRCUITS

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

TOTAL 45 PERIODS

SUGGESTED READINGS
5. http://www.g-w.com/PDF/SampChap/60525_0816_Ch02.pdf
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 EXPERIMENTAL DESIGNS
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. Montgomery, D.C (2012), Design and Analysis of Experiments, John Wiley and Sons
5. http://cran.r-project.org

TOTAL 45 PERIODS
COURSE OBJECTIVE
1. To analyze the stresses and deformations through advanced mathematical models.
2. To estimate the design strength of various industrial equipment.
3. To understand the mechanism of rotating discs.
4. To understand the mechanism of elastic foundation.
5. To understand about stresses distribution.
6. To understand the applications to rolling contact elements.

COURSE OUTCOME (CO’s)
1. On successful completion of this course students will be able to:
   1. Explain the theory, concepts, principles and governing equations of solid mechanics;
   2. Demonstrate the ability to deconstruct complex problems to produce effective outcomes;
   3. Use analytical, experimental and computational tools needed to solve the idealized problem;
   4. Demonstrate the independent judgment required to interpret the results of these solutions;
   5. Use these solutions to guide a corresponding design, manufacture, or failure analysis;
   6. Explain the selection, design and stress analysis.

UNIT I  ANALYSIS OF PLATES

UNIT II  THICK CYLINDERS AND SPHERES
Equilibrium and compatibility conditions - Lame’s Theorem – Boundary conditions – distribution of radial and tangential stresses – compound cylinders – Interference fits - Stresses due to temperature distributions.

UNIT III  ROTATING DISCS
Lame-Clayperon Theorem – radial and tangential stresses in discs due to centrifugal effects – boundary conditions – solid and hollow discs – Interference fit on shafts – Strengthening of the hub – residual stresses – Autofrettege – Discs of variable thickness – Disc profile for uniform strength.

UNIT IV  BEAMS ON ELASTIC FOUNDATION
Infinite beam subjected to concentrated load – Boundary Conditions – Infinite beam subjected to a distributed load segment – Triangular load – Semi infinite beam subjected to loads at the ends and concentrated load near the ends – Short beams.

UNIT V  CURVED BEAMS AND CONTACT STRESSES
Analysis of stresses in beams with large curvature – Stress distribution in curved beams – Stresses in crane hooks and C clamps – Contact Stresses – Hertz equation for contact stresses – applications to rolling contact elements.

TOTAL 45 PERIODS

SUGGESTED READINGS
2. Dally J.W and W.F.Riley (2003), Experimental Stress Analysis, John Wiley and Sons, London
7. www.engin.umich.edu/students/ELRC/me211/beamdef.htmlhttp://www.mech.uwa.edu.au/DANotes/cylinders/thin/thin.html
18PBEMEED07  FINITE ELEMENT METHODS  3H: 3C

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 explain the steps involved in FEA and also the types of weight residual methods.
2. To impart knowledge to formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. To enrich the understanding of two dimensional thermal and torsion problems.
4. To enrich the understanding of axisymmetric bodies, plate and shell.
5. To develop an understanding of the standard techniques on matrix solution techniques to dynamic problems.
6. To impart knowledge on FE equation for structural, heat transfer and vibration problems.

COURSE OUTCOMES
1. Explain the steps involved in FEA and also the types of weight residual methods.
2. Formulate and solve problems in one dimensional structures including trusses, beams and frames.
3. Predict finite element equations for two dimensional thermal and torsion problems.
4. Predict finite element equations for axisymmetric bodies, plate and shell.
5. Apply matrix solution techniques to dynamic problems.
   Formulate FE equation for structural, heat transfer and vibration problems.

UNIT I  INTRODUCTION  9

UNIT II  ONE DIMENSIONAL PROBLEMS  9
Finite element modeling – Coordinates and shape functions- Potential energy approach – Galerkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses.

UNIT III  TWO DIMENSIONAL CONTINUUM  9

UNIT IV  AXISYMMETRIC CONTINUUM  9
Axisymmetric formulation – Element stiffness matrix and force vector – Galerkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures.

UNIT V  ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM  9

TOTAL  45 PERIODS

SUGGESTED READINGS

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore-641 021.
18PBEMEED08 MACHINE TOOL DESIGN 3H: 3C

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

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

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

UNIT I INTRODUCTION TO MACHINE TOOL DRIVES AND MECHANISMS 9
Introduction to the course, Working and Auxiliary Motions in Machine Tools, Kinematics of Machine Tools, Motion Transmission.

UNIT II REGULATION OF SPEEDS AND FEEDS 9
Aim of Speed and Feed Regulation, Stepped Regulation of Speeds, Multiple Speed Motors, Ray Diagrams and Design Considerations, Design of Speed Gear Boxes, Feed Drives, Feed Box Design.

UNIT III DESIGN OF MACHINE TOOL STRUCTURES 9

UNIT IV DESIGN OF GUIDEWAYS, POWER SCREWS AND SPINDLES 9

UNIT V DESIGN OF SPINDLES AND SPINDLE SUPPORTS 9

TOTAL 45 PERIODS

SUGGESTED READINGS
5. N. S. Acherkhan (2010), Machine Tool Design, MIR publications

18PBEMEED09 DESIGN OF MECHATRONIC SYSTEMS 3H: 3C

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 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 9

UNIT II ACTUATORS AND SYSTEM MODELS 9

UNIT III MICROPROCESSORS IN MECHATRONICS 9

UNIT IV CONTROLLERS 9

UNIT V DESIGN OF MECHATRONIC SYSTEMS 9

TOTAL 45 PERIODS

SUGGESTED READINGS


18PBEMEED10 TRIBOLOGY 3H: 3C

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

COURSE OBJECTIVE
1. To impart knowledge in the friction , wear and lubrication aspects of machine components
2. To understand the material properties which influence the tribological characteristics of surfaces.
3. To understand the analytical behavior of different types bearings and design of bearings based on analytical /theoretical approach
4. To make the students understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques.
5. To expose the students to the factors influencing the selection of bearing materials for different sliding applications.
6. To introduce the concepts of surface engineering and its importance in tribology

COURSE OUTCOME (CO's)
After studying this course, students will be able to:
1. Understand the fundamentals of tribology and associated parameters.
2. Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.
3. Analyze the requirements and design hydrodynamic journal and plane slider bearings for a given application.
4. Select proper bearing materials and lubricants for a given tribological application.
5. Select suitable surface treatment methods to enhance tribological properties
6. Apply the principles of surface engineering for different applications of tribology.

UNIT I SURFACE INTERACTION AND FRICITION
Topography of Surfaces – Surface features-Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction –Rolling Friction-Friction properties of metallic and non-metallic materials – friction in extreme conditions –Thermal considerations in sliding contact

UNIT II WEAR AND SURFACE TREATMENT

UNIT III LUBRICANTS AND LUBRICATION REGIMES

UNIT IV THEORY OF HYDRODYNAMIC AND HYDROSTATIC LUBRICATION
Reynolds Equation,-Assumptions and limitations-One and two dimensional Reynolds EquationReynolds and Sommerfeld boundary conditions- Pressure wave, flow, load capacity and friction calculations in Hydrodynamic bearings-Long and short bearings-Pad bearings and Journal bearings-Squeeze film effects-Thermal considerations-Hydrostatic lubrication of Pad bearingPressure , flow , load and friction calculations-Stiffness considerations- Various types of flow restrictors in hydrostatic bearings

UNIT V HIGH PRESSURE CONTACTS AND ELASTO HYDRODYNAMIC LUBRICATION
Rolling contacts of Elastic solids- contact stresses – Hertzian stress equation- Spherical and cylindrical contacts-Contact Fatigue life- Oil film effects- Elasto Hydrodynamic lubrication TheorySoft and hard EHL-Reynolds equation for elasto
hydrodynamic lubrication - Film shape within and outside contact zones - Film thickness and friction calculation - Rolling bearings - Stresses and deflections - Traction drives.

SUGGESTED READINGS

2. Cameron, A. (1981), Basic Lubrication Theory, Ellis Herward Ltd., UK

PRODUCTION ENGINEERING

18PBEMEEP01 ADVANCED MANUFACTURING PROCESSES 3H: 3C

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 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
3. P.N. Rao (2013), Manufacturing technology Volume I, TMH Ltd
8. http://www.me.psu.edu/lamancusa/rapidpro/rpintro2.pdf

TOTAL  45 PERIODS

COURSE OBJECTIVES
1. To impart knowledge about the elements and techniques involved in microprocessors
2. To understand the concepts of connected Factory.
3. To provide an overview of shipment systems.
4. To expose students to product lifecycle
5. To provide knowledge about various types of sensors and controllers
6. To facilitate the understanding Sensor Data Management.

COURSE OUTCOMES
Upon completion of this course, the students can able to
1. Implement the concepts of microprocessors.
2. Design the of connected Factory.
3. Develop the controller model for shipment thermal systems.
4. Explain about various types product lifecycle
5. Understand the applications of sensors and controllers.
6. Design automation system.

UNIT I  INTRODUCTION
General definitions of mini computers, microprocessors, micro controllers and digital signal processors - Overview of 8085 microprocessor - Overview of 8086 microprocessor - Signals and pins of 8086 microprocessor - Description of Instructions - Assembly directives - Algorithms with assembly software programs

UNIT II CONNECTED FACTORY

UNIT III MANUFACTURING ACROSS MULTIPLE FACILITIES
Inter-facility Shipment Tracking, advanced shipment notifications and customs documentation - Managing Capital Assets, balance sheet and digital asset management - Managing Indirect Materials, Tracking inventory location and maintenance status of tooling, transport jigs and specialized materials - Final Assembly Processes

UNIT IV MANAGING THE PRODUCT LIFECYCLE
Sensor-enabled Supplier Networks, Collecting sensor data, suppliers and service partners - Sensors in Aftermarket Services, quality of service and reverse logistics, digital twins - minimize downtime

UNIT V BEST PRACTICES
Integrating with Enterprise Systems of Record - Adding Sensors to Existing Machinery - Connected Factories in the Cloud - Sensor Data Management - Making the Business Case for a Connected Factory

TOTAL 45 PERIODS

SUGGESTED READINGS
1. Sunil Mathur (2016), Microprocessors and Microcontrollers, Prentice-Hall Of India
2. Ramesh Gaonkar (2011), Microprocessor Architecture, Programming, and Applications with the 8085, CBS Publishers
3. www.expertly.com/training/courses/smart-manufacturing-the-connected-factory
4. https://onlinecourses.nptel.ac.in/noc18_ec03

18PBEMEEP03 AUTOMATION IN MANUFACTURING 3H: 3C

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 understand the importance of automation in the of field 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 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**

Automation in production systems, principles and strategies, Product/production relationships, Production concepts and mathematical models, Costs of manufacturing operations.

**UNIT II CONTROL TECHNOLOGIES**

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

**UNIT III NUMERICAL CONTROL AND ROBOTICS**


**UNIT IV AUTOMATED HANDLING AND STORAGE**


**UNIT V COMPUTER-AIDED DESIGN**

Fundamentals of CAD – design process, manufacturing database – Computer graphics – functions, constructing the geometry, transformation, wire frame Vs solid modeling.

**TOTAL 45 PERIODS**

**SUGGESTED READINGS**

18PBEME04 QUALITY CONTROL AND RELIABILITY ENGINEERING  

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  

TOTAL 45 PERIODS

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

SUGGESTED READINGS
1. Grant, Eugene .L (2017), Statistical Quality Control, Mcgraw–Hill, New Delhi  
3. Manohar Mahajan (2016), Statistical Quality Control, Dhanpat Rai and Sons, New Delhi  


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 electronic chips.
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 9

UNIT II POLYMER MATRIX COMPOSITES 9

UNIT III METAL MATRIX COMPOSITES 9

UNIT IV CERAMIC MATRIX COMPOSITES 9
nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

UNIT V  ADVANCES IN COMPOSITES  9

SUGGESTED READINGS
7. http://www.springerlink.com/content/978-1-4020-8771-4

18PBEMEEP06  NON DESTRUCTIVE TESTING  3H: 3C

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 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  BASIC CONCEPTS AND VISUAL INSPECTION  9
Concepts of Non-Destructive Testing - Relative merits and limitations - NDT versus mechanical testing. Unaided and aided visual inspection testing.

UNIT II  LIQUID PENETRANT INSPECTION  9
Principle, applications, advantages and limitations, dyes, developers and cleaners, fluorescent, penetrant test.

UNIT III  MAGNETIC PARTICLE INSPECTION  9
Principles, applications, magnetisation methods, magnetic particles, dry technique and wet technique, demagnetization, advantages and limitations.

UNIT IV  EDDY CURRENT AND ULTRASONIC TESTING  9

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore-641 021.
Principle, applications and instrumentation of eddy current testing. Types of ultrasonic waves, principles of wave propagation, characteristics of ultrasonic waves, Attenuation, couplants. Inspection methods - pulse echo, Transmission and resonance techniques, thickness measurement. Types of scanning, test block, IIW - reference blocks.

UNIT V RADIOGRAPHY TESTING
X-rays and Gamma rays, properties of X-rays relevant to NDE, absorption of rays, scattering, types and use of filters and screens, characteristics of films - graininess, density, speed, contrast, characteristic curves, penetrameters, exposure charts, radiographic equivalence. Fluoroscopy- Xero-Demerits of Radiography.

SUGGESTED READINGS
2. Paul E. Mix (2005), Introduction to Nondestructive Testing, John Wiley & Sons, Newyork
5. https://www.asnt.org/MinorSiteSections/AboutASNT/Intro-to-NDT
6. https://www.asnt.org/
7. www.bindt.org/
8. www.ndt.net/

TOTAL 45 PERIODS

18PBE-MEEP07 PRODUCTION PLANNING AND CONTROL 3H: 3C

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

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  WORK STUDY  

UNIT III  PRODUCT PLANNING AND PROCESS PLANNING  

UNIT IV  PRODUCTION SCHEDULING  

UNIT V  INVENTORY CONTROL AND RECENT TRENDS IN PPC  

SUGGESTED READINGS  
1. Martand Telsang (2016), Industrial Engineering and Production Management, S.Chand and Company, New Delhi  
2. Samson Eilon (1981), Elements of production planning and control, Macmillan, India 

TOTAL 45 PERIODS
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.

Calculate the economic analysis of robots

UNIT I  FUNDAMENTALS OF ROBOT  9

UNIT II  ROBOT DRIVE SYSTEMS AND END EFFECTORS  9
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 MACHINE VISION  9

UNIT IV  ROBOT KINEMATICS AND ROBOT PROGRAMMING  9
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  9

TOTAL 45 PERIODS

SUGGESTED READINGS
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 power sources.
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 power sources.
6. Understand the importance of grain growth mechanism and related properties.

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

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

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

UNIT IV OTHER WELDING PROCESSES

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

TOTAL 45 PERIODS

SUGGESTED READINGS
THERMAL ENGINEERING

18PBEMEET01 GAS DYNAMICS AND JET PROPULSION 3H: 3C

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 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 9

UNIT II FLOW THROUGH DUCTS 9
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 9
 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 9

UNIT V  ROCKET PROPULSION 9

(Permitted to use standard Gas Tables in the examination)

TOTAL 45 PERIODS

SUGGESTED READINGS

18PBEMEET02 POWER PLANT ENGINEERING 3H: 3C

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 give exposure to accessories and layout required for a steam power plant depending upon the requirements.
2. To study performance of steam 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 9
Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants – Combined Power Cycles – Comparison and Selection, Load Duration Curves.

UNIT II  STEAM POWER PLANT 9
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 POWER PLANTS  

UNIT IV  
DIESEL AND GAS TURBINE POWER PLANT  

UNIT V  
OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS  
Cost of Electric Energy – Fixed and operating Costs – Energy Rates – Types of Tariffs – Economics of load sharing, comparison of economics of various power plants.

TOTAL 45 PERIODS

SUGGESTED READINGS
4. Morse Frederick T (1998), Power Plant Engineering, Prentice Hall of India, New Delhi
5. www.solarpaces.org
6. www.igcar.gov.in
7. ga.water.usgs.gov
8. www.mapsofindia.com

18PBEMEET03  
POWER PLANT ENGINEERING  
3H: 3C

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 give exposure to accessories and layout required for a steam power plant depending upon the requirements.
2. To study performance of steam 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 ENERGY AND ENVIRONMENT
Primary energy sources – world energy resources–Indian energy scenario–energy cycle of the earth –environmental aspects of energy utilisation, CO₂ emissions and Global warming–renewable energy resources and their importance. Potential impacts of harnessing the different renewable energy resources.

UNIT II SOLAR ENERGY

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 BIO ENERGY

UNIT V OTHER RENEWABLE ENERGY SOURCES
Direct energy conversion (Description, principle of working and basic design aspects only) – Magneto hydrodynamic systems (MHD) – thermolectric generators – thermionic generators – fuel cells – solar cells – types, Emf generated, power output, losses and efficiency and applications. Hydrogen conversion and storage systems

TOTAL 45 PERIODS

SUGGESTED READINGS
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
Psychrometric processes– use of psychrometric charts – Grand and Room Sensible Heat Factors – bypass factor – requirements of comfort air conditioning – comfort charts – factors governing optimum effective temperature, recommended design conditions and ventilation standards

UNIT IV COOLING LOAD CALCULATIONS

UNIT V AIRCONDITIONING

TOTAL 45 PERIODS

SUGGESTED READINGS
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

UNIT V ECONOMIC ANALYSIS

TOTAL 45 PERIODS
SUGGESTED READINGS
1. R.Kehlhofer, B. Rukes, F. Stirnimann (2009), Combined-cycle gas & steam turbine power plants, PennWell Books

18PBEMEET06 COMPUTATIONAL FLUID DYNAMICS 3H: 3C

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 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 difference method.
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 9

UNIT II DISCRETIZATION AND SOLUTION METHODOLOGIES 9
Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

UNIT III HEAT CONDUCTION 9
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 FLOW FIELD

TOTAL 45 PERIODS

SUGGESTED READINGS
7. http://www.cham.co.uk/website/new/cfdintro.htm

18PBEMEET07 DESIGN OF HEAT EXCHANGERS 3H: 3C

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 learn the thermal and stress analysis on various parts of the heat exchangers
2. To analyze the sizing and rating of the heat exchangers for various applications
3. Students will come to know about different techniques of heat exchanger analysis.
4. Student will be able to learn construction and thermal design methodology of shell and tube, Plate and compact heat exchanger
5. To understand about Stress in tubes
6. To understand about evaporative condensers

COURSE OUTCOME (CO’s)

1. Understand the physics and the mathematical treatment of typical heat exchangers.
2. Employ LMTD and Effectiveness methods in the design of heat exchangers and analyze the importance of LMTD approach over AMTD approach.
3. Examine the performance of double-pipe counter flow (hair-pin) heat exchangers
4. Design and analyze the shell and tube heat exchanger.
5. Understand the fundamental, physical and mathematical aspects of boiling and condensation.
6. Classify cooling towers and explain their technical features.
UNIT I	INTRODUCTION	9
Types of heat exchangers, shell and tube heat exchangers – regenerators and recuperators - Temperature distribution and its implications - Parts description, Classification as per Tubular Exchanger Manufacturers Association (TEMA)

UNIT II	PROCESS DESIGN OF HEAT EXCHANGERS	9

UNIT III	STRESS ANALYSIS	9
Stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses - types of failures, buckling of tubes, flow induced vibration.

UNIT IV	COMPACT AND PLATE HEAT EXCHANGER	9
Types- Merits and Demerits- Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.

UNIT V	CONDENSERS AND COOLING TOWERS	9
Design of surface and evaporative condensers – cooling tower – performance characteristics.

TOTAL	45 PERIODS

SUGGESTED READINGS

18PBEMEET08	CRYOGENIC ENGINEERING	3H: 3C

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 study the basics of cryogenics
2. To understand Cryogenic Refrigerators
3. To know the ways to handle cryogens.
4. To make the students understand the various methods to create cryogenic temperatures and to maintain it
5. To make the students aware of the wide technological applications of cryogenics in various fields.
To recognize the engineering problems solvable by applying cryogenic techniques.

COURSE OUTCOME (CO’s)

At the end of the course students will be able to
1. Synthesise and apply the basic concepts of cryogenic engineering
2. Describe various applications of cryogenics in Engineering and Technology
3. Acquire knowledge in various cryogenic liquefaction and refrigeration systems
4. Identify the various avenues of the subject, to help the students choose a specific area of interest
5. Find applications of cryogenics
6. Demonstrate the knowledge of cryogenic instrumentation

UNIT I INTRODUCTION
Insight on Cryogenics, Properties of Cryogenic fluids, Material properties at Cryogenic Temperatures. Applications of Cryogenics in Space Programs, Superconductivity, Cryo Metallurgy, Medical applications.

UNIT II LIQUEFACTION CYCLES

UNIT III SEPARATION OF CRYOGENIC GASES

UNIT IV CRYOGENIC REFRIGERATORS
J.T.Cryocoolers, Stirling Cycle Refrigerators, G.M.Cryocoolers, Pulse Tube Refrigerators Regenerators used in Cryogenic Refrigerators, Dilution refrigerators, Magnetic Refrigerators

UNIT V HANDLING OF CRYOGENS
Cryogenic Dewar, Cryogenic Transfer Lines. Insulations used in Cryogenic Systems, Instrumentation to measure Flow, Level and Temperature

TOTAL 45 PERIODS

SUGGESTED READINGS
4. www.nasa.gov
5. www.cryogenicsociety.org/
6. www.iifir.org/
8. www.airliquide.com/
9. www.cern.ch
10. www.nist.gov
# ADVANCED THERMODYNAMICS

**COURSE OBJECTIVES**

1. To understand Availability concept and the behavior of real gas
2. To study Statistical and Irreversible thermodynamics
3. To understand the concepts on laws of thermodynamics
4. To understand the concepts of degeneracy of energy levels
5. To understand the concepts of entropy
6. To understand the concepts irreversible thermodynamics

**COURSE OUTCOME (CO's)**

Upon successful completion of the course, the students should be able to:

1. apply the concept of real gas equations
2. apply the concepts of thermodynamics
3. Identify applications of thermodynamics in real time problems.
4. Establish the basic thermodynamic relations in degeneracy of energy levels.
5. Calculate the properties entropy.
6. Explain the basic principles irreversible thermodynamics

## UNIT I

**AVAILABILITY ANALYSIS AND THERMODYNAMIC PROPERTY RELATIONS**


## UNIT II

**REAL GAS BEHAVIOUR AND MULTI – COMPONENT SYSTEMS**


## UNIT III

**CHEMICAL THERMODYNAMICS AND EQUILIBRIUM**


## UNIT IV

**STATISTICAL THERMODYNAMICS**


## UNIT V

**IRREVERSIBLE THERMODYNAMICS**

Conjugate fluxes and forces - entropy production Onsager’s reciprocity relations - thermo – electric phenomena, formulations

**SUGGESTED READINGS**

5. Sonntag, R.E., and Van Wylen, G (1991), Introduction to Thermodynamics, Classical and Statistical Thermodynamics, John Wiley and Sons

**TOTAL 45 PERIODS**
AUTOMOTIVE ENGINEERING

18PBEMEEA01 AUTOMOBILE ENGINEERING 3H: 3C

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 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 AUTOMOBILE ARCHITECTURE AND PERFORMANCE
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 ENGINE
Types of engine, multi valve engine, in-line engine, vee-engine, Petrol engine-direct, single point and multipoint injection,
diesel engine-common rail diesel injection, supercharging and turbo charging, alternate fuels-ethanol and ethanol blend,
compressed natural gas, fuel cells, hybrid vehicles.

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 & belted bias, slip angle, Tread patterns,
Tyre retreading cold & 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.

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 and balancing.
Breaking System - Forces on vehicles, tyre grip, load transfer, braking distribution between axles, stopping distance,
Types of brakes, Mechanical, Hydraulic, Air brakes, Disc & Drum brakes, Engine brakes anti lock braking system.
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
Classifications- design considerations —weight and dimension limitations — requirements stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

UNIT II POWER UNITS, IGNITION SYSTEMS AND OTHER ELECTRICAL SYSTEMS
2 stroke and 4 stroke SI engines and CI engines design criteria— design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburetor types and design. Battery coil ignition, magneto ignition and electronic ignition. Lighting and other electrical system.

UNIT III CLUTCHES AND TRANSMISSION
Types of clutches for 2 and 3 wheelers. Design of clutch system. Gears for two and three wheelers. Design of gear box and gear change mechanism. Belt, chain and shaft drive. Freewheeling devices, starting systems.

UNIT IV FRAMES, SUSPENSION, WHEELS AND TYRES

UNIT V THREE WHEELERS
Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission for 3 wheelers wheel types, wheel attachment tyre types. Brakes and their operating mechanism.

SUGGESTED READINGS

UNIT I DRIVER ASSISTANCE SYSTEMS
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

Karpagam Academy of Higher Education (Deemed to be University), Coimbatore-641 021.
Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, collision avoidance, vehicle status monitoring-Night vision system

UNIT II  TELEMATICS
Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems.

UNIT III  SAFETY AND SECURITY SYSTEMS
Airbags, seat belt tightening system, collision warning systems, child lock, anti lock braking systems. Anti theft technologies, smart card system, number plate coding.

UNIT IV  COMFORT SYSTEMS
Active suspension systems, requirement and characteristics, different types, power steering, collapsible and tiltable steering column, power windows-Adaptive lighting system

UNIT V  ADAPTIVE CONTROL SYSTEMS
Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems, cylinder cut-off technology.-Autonomous vehicles

TOTAL 45 PERIODS

SUGGESTED READINGS
4. Bechhold (1998), Understanding Automotive Electronics, SAE
COURSE OBJECTIVE
1. To familiarize the students with off-road vehicles like land clearing machines, earth moving Vehicles
2. Classification and requirements of off road vehicles
3. To understand about earth moving machines
4. To understand about elevating graders
5. To understand about shovels and ditchers
6. To understand about Capacity of shovels

COURSE OUTCOMES
1. To gain knowledge about off-road vehicles like land clearing machines
2. To gain knowledge about earth moving Vehicles
3. To gain knowledge about requirements of off road vehicles
4. To gain knowledge about elevating graders
5. To gain knowledge about shovels and ditchers
6. To gain knowledge about Capacity of shovels

UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES 9
Power plants, chassis and transmission, Multi axle vehicles.

UNIT II LAND CLEARING MACHINES 8
Bush cutter, Stampers, Tree dozer, Rippers.

UNIT III EARTH MOVING MACHINES 11
Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears, scrapers, drag and self powered types - Dump trucks and dumpers - Loaders, single bucket, multi bucket and rotary types - Power and capacity of earth moving machines.

UNIT IV SCRAPERS AND GRADERS 8
Scrapers, elevating graders, self powered scrapers and graders.

UNIT V SHOVELS AND DITCHERS 9
Power shovel, revolving and stripper shovels - drag lines - ditchers - Capacity of shovels.

TOTAL 45 PERIODS

SUGGESTED READINGS
VEHICLE TROUBLESHOOTING AND MAINTENANCE

Instruction Hours / Week: L: 3  T: 0  P: 0  Marks: Internal: 40  External: 60  Total: 100

COURSE OBJECTIVE
1. To be able to have a complete knowledge of the vehicle maintenance procedures and acquire skills in handling situations where the vehicle is likely to fail.
2. To understand the concepts of schedule, records
3. To understand about power plant and its components
4. To understand about the maintenance, servicing
5. To understand the concepts of radiator boiling
6. To understand the concepts of

COURSE OUTCOMES
1. Understand the different features and procedures of vehicle evaluation process.
2. Understand the various forms and procedures used to maintain the functioning of vehicle and engines.
3. Know the Chassis and suspension maintenance.
4. Maintain the Electrical equipments and trouble shooting.
5. Trouble shoots the fuel block, Radiator boiling and lubrication system.
6. Trouble shoots shooting of shooting of battery

UNIT I MAINTENANCE TOOL, SHOP, SCHEDULE, RECORDS

UNIT II POWER PLANT REPAIR AND OVERHAULING

UNIT III MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS
Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems. Tyre maintenance.

UNIT IV MAINTENANCE AND REPAIR OF VEHICLE BODY
Body panel tools for repairing. Tinkering and painting. Use of soldering, metalloid paste.

UNIT V MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEMS
Care, maintenance, testing and trouble shooting of battery, starter motor, dynamo, alternator and regulator. Transistorized regulator problems.

TOTAL 45 PERIODS

SUGGESTED READINGS
5. Frazee, fledell, Spicer (1953), Automobile collision Work, American technical publications, Chicago
6. John Dolce (1984), Fleet maintenance, Mcgraw Hill, Newyork
COURSE OBJECTIVES

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

UNIT II 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.

UNIT III 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.

UNIT IV 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.

UNIT V 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


TOTAL 45 PERIODS
MANAGEMENT SYSTEMS

18PBEMEEM01  PRINCIPLES OF MANAGEMENT  3H: 3C

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

COURSE OBJECTIVE
1. To understand objectives, Strategies, Policies and Plan.
2. To introduce pans by directing and controlling.
3. To Understand the need of Engineering Ethics.
4. To Understand the forces that shape culture.
5. To develop the entrepreneurial skills.
6. To make the students conversant to execute an engineering plan with ethics.

COURSE OUTCOMES
2. Execute plans by directing and controlling.
3. Understand the need of Engineering Ethics.
4. Understand the forces that shape culture.
5. Show the entrepreneurial skills.
6. Execute an engineering plan with ethics.

UNIT I  OVERVIEW OF MANAGEMENT  9
Definition - Management - Role of managers - Evolution of Management thought -Organization and the environmental factors – Trends and Challenges of Management in Global Scenario

UNIT II PLANNING  9

UNIT III ORGANIZING  9

UNIT IV  DIRECTING
Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership Styles - Leadership theories - Communication - Barriers to effective communication - Organization Culture - Elements and types of culture – Managing cultural diversity

UNIT IV  CONTROLLING
Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control – Maintenance Control - Quality Control - Planning operations.

TOTAL 45 PERIODS

SUGGESTED READINGS
1. Stephen P. Robbins and Mary Coulter (2006), Management, Prentice Hall of India
3. Hellriegel, Slocum & Jackson (2007), Management - A Competency Based Approach, Thomson South Western

18PBEMEM02  PROJECT MANAGEMENT  3H: 3C
Instruction Hours / Week: - L: 3  T: 0  P: 0  Marks: - Internal: 40  External: 60  Total: 100
End Semester Exam: 3 Hours

COURSE OBJECTIVE
1. To learn the concepts of managing project
2. To develop an understanding of the need, concept, objectives and characteristics of project management approach in the industrial context.
3. To develop working knowledge of the technical and financial aspects of project management decisions.
4. To explore the basic concepts in appraisal criteria and learn to handle the problems in appraisal risk analysis.
5. To acquire working knowledge of the tools and techniques for project planning and control.
6. To acquire working knowledge project organizations

COURSE OUTCOMES
The students will be able to:
1. Develop an understanding of the importance and main features of project management approach in the industry context.
2. Obtain knowledge about the technical and financial aspects of project management decisions.
3. Explore the basic concepts in appraisal criteria and shall learn to handle the problems in appraisal risk analysis.
4. Use the tools and techniques for project planning and control.
5. Apply project planning methods in industries
6. Manage team projects

UNIT I  INTRODUCTION TO PROJECT MANAGEMENT  9
UNIT II PLANNING AND BUDGETING

UNIT III SCHEDULING & RESOURCE ALLOCATION

UNIT IV CONTROL AND COMPLETION

UNIT V PROJECT ORGANISATION & CONFLICT MANAGEMENT

TOTAL 45 PERIODS

SUGGESTED READINGS
2. John M. Nicholas (2006), Project Management for Business and Technology - Principles and Practice, Pearson Education
3. Gido and Clements (2003), Successful Project Management, Thomson Learning
4. Harvey Maylor (2006), Project Management, Pearson Education

COURSE OBJECTIVES
1. To understand the basics of Plant Engineering.
2. To study the process planning and various forecasting techniques.
3. To get an overview of Project Management
4. To understand about Break even analysis
5. To understand about scheduling
6. To understand about principles of management

COURSE OUTCOME (CO’s)
The students will be able to:
1. Apply the concepts of Plant Engineering
2. Analysis the process planning and various forecasting techniques
3. Gain knowledge on Project Management
4. Gain knowledge on break even analysis
5. Perform scheduling on various activities
6. Gain knowledge on principles of management

UNIT I  PLANT ENGINEERING

UNIT II  WORK STUDY

UNIT III  PROCESS PLANNING AND FORECASTING
Process planning – Aims of process planning – steps to prepare the detailed work sheets for manufacturing a given component – Break even analysis – Forecasting – Purpose of forecasting – Methods of forecasting – Time series – Regression and Correlation – Exponential smoothing.

UNIT IV  SCHEDULING AND PROJECT MANAGEMENT

UNIT V  PERSONNEL AND MARKETING MANAGEMENT

SUGGESTED READINGS
1. Dr. R. Kesavan, C.Elanchezian and B.Vijayaramnath (2008), Production Planning and Control, Anuratha Publications, Chennai
2. Martand T. Telsang (2007), Production Management, S.Chand & Co
COURSE OBJECTIVES

1. To understand the various processes involved in Marketing and its Philosophy
2. To learn the Psychology of consumers
3. To formulate strategies for advertising, pricing and selling
4. To understand the concepts of marketing management
5. To learn about marketing process for different types of products and services
6. To understand the tools used by marketing managers in decision situations

COURSE OUTCOME

1. Students will demonstrate strong conceptual knowledge in the functional area of marketing management.
2. Students will demonstrate effective understanding of relevant functional areas of marketing management and its application.
3. Students will demonstrate analytical skills in identification and resolution of problems pertaining to marketing management.
4. Students will demonstrate market segmentation
5. Students will demonstrate strategy formulation
6. Students will demonstrate sales promotion

UNIT I MARKETING PROCESS
Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

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

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

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

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION
Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TOTAL 45 PERIODS

SUGGESTED READINGS

5. Donald S. Tull and Hawkins (1997), Marketing Research, Prentice Hall of India
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 SAFETY MANAGEMENT


UNIT II OPERATIONAL SAFETY


UNIT III SAFETY MEASURES

Layout design and material handling - Use of electricity - Management of toxic gases and chemicals - Industrial fires and prevention - Road safety - highway and urban safety - Safety of sewage disposal and cleaning - Control of environmental pollution - Managing emergencies in Industries - planning, security and risk assessments, on-site and off site. Control of major industrial hazards.

UNIT IV ACCIDENT PREVENTION

Human side of safety - personal protective equipment - Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP - Training and development of employees - First Aid- Fire fighting devices - Accident reporting, investigation.
UNIT V SAFETY, HEALTH, WELFARE & LAWS

TOTAL 45 PERIODS

SUGGESTED READINGS
1. John V. Grimaldi and Rollin H. Simonds (1989), Safety Management, All India Travellers bookseller, New Delhi
2. Krishnan N.V (1996), Safety in Industry, Jaico Publisher House

UNIT I INTRODUCTION
Objectives of lean manufacturing–key principles and implications of lean manufacturing– Traditional Vs lean manufacturing – Lean benefits – Case studies

UNIT II LEAN MANUFACTURING CONCEPTS
Value creation and waste elimination– Major kinds of waste– pull production–different models of pull production– continuous flow–continuous improvement / Kaizen– Worker involvement.

UNIT III MANUFACTURING FLOW ELEMENT

UNIT IV PROCESS CONTROL ELEMENT

UNIT V VALUE STREAM MAPPING
The as–is diagram–the current state and future state map–application to the factory simulation scenario – overall equipment effectiveness(OEE)– measurements and case studies.
IMPLEMENTING LEAN: Road map–senior management Involvement – best practices.
INTEGRATING LEAN WITH OTHER SYSTEMS: Toyota production system–lean six sigma–lean and ERP–lean with ISO9001: 2000)

TOTAL 45 PERIODS
SUGGESTED READINGS

5. Alan Robinson (1991), Continuous Improvement in Operations, Productivity Press, Portland, Oregon
6. www.leanmanufacturingconcepts.com
7. www.learnleanblog.com