Prepared:2020-21

# **GOVERNMENT OF RAJASTHAN** BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR

# **SEMESTER SCHEME-2020-21**



# V SEMESTER (SESSION 2021-2022 & ONWARDS)

Course Code	:	ME 5001 (Same in MA/MT 5001)
Course Title	:	ADVANCED MANUFACTURING PROCESSES
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites		Basic Mechanical Engineering (ME 3001)
1 lelequisites		Manufacturing Engineering (ME 3004)
Course Category		PC

# ADVANCED MANUFACTURING PROCESSES

# **COURSE OBJECTIVES:**

- To know the functions of Jigs and Fixtures.
- To know the applications of jig-boring machines.
- To identify different fabrication methods of plastic processing viz., sheet forming, blow moulding, laminating and reinforcing of plastics.
- To distinguish between non-conventional machining and traditional machining processes.
- To know about the advancements in the area of manufacturing and production processes.
- To impart knowledge & skills necessary for working in modern manufacturing environment.
- To get familiarized with working principles and operations performed on non-traditional machines, machining center, SPM, automated machines and maintenance of machine tools.

# **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

CO1	Know the Operation and control of different advanced machine tools and equipments.
CO2	Produce jobs as per specified requirements by selecting the specific machining process.
CO3	Develop the mind set for modern trends in manufacturing and automation.
CO4	Identify the different fabrication methods viz., sheet forming, blow moulding, laminating and reinforcing of plastics.
CO5	Know different non-traditional machining processes, CNC milling machines, special purpose machines.
CO6	Work as maintenance engineer.
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# COURSE CONTENT:

1.2

2.

# 1. JIGS & FIXTURES)

- 1.1 Definition of jig
  - General consideration in the design of drill jigs and bush
- 1.3 Types of fixtures
- 1.4 Basic principles of clamping
- 1.10 Types of clamps

# JIG BORING

- 2.1 Introduction of Jig boring on vertical milling machine
- 2.2 Types and construction details of jig boring machines
- 2.3 Plastic Processing:
  - 2.3.1 Processing of plastics
  - 2.3.2 Introduction of Moulding, Extruding; Casting, Calendering
  - 2.3.3 Fabrication methods
  - 2.3.4 Sheet forming
  - 2.3.5 Blow moulding

# **3. MODERN MACHINING PROCESSES**

3.1 Introduction and Comparison of MMP with traditional machining

3.5

#### 3.3 Ultrasonic Machining:

- 3.3.1 Principle
- 3.3.2 Description of equipment
- 3.3.3 Applications
- 3.4 Electric Discharge Machining:
  - 3.4.1 Principle
  - 3.4.2 Description and its applications
  - Wire cut EDM:
    - 3.5.1 Principle
    - 3.5.2 Description of equipment
    - 3.5.3 Applications
- 3.6 Abrasive Jet Machining:
  - 3.6.1 Principle
  - 3.6.2 Description of equipment
  - 3.6.3 Application
- 3.7 Laser Beam Machining:
  - 3.7.1 Principle
  - 3.7.2 Description of equipment
  - 3.7.3 Application
- 3.8 Electro Chemical Machining
  - 3.8.1 Description of equipment
  - 3.8.2 Application

#### 4. CNC MILLING MACHINES

- 4.1 Vertical and horizontal machining center (Constructional features, Axis identification)
- 4.2 Introduction to Electronic control system, Automatic tool changer and tool magazine
- 4.3 CNC programming
- 4.3 Preparatory functions (G code)
- 4.4 Miscellaneous functions (M code)
- 4.5 Part programming including subroutines and canned cycles
- 4.6 Principles of computer aided part programming

# 5. MACHINE TOOL AUTOMATION:

- 5.1 Introduction and Need
- 5.2 Single spindle automates, transfer lines
- 5.3 Elements of control system in machines for automation
- 5.4 Introduction to PLC
- 5.4.1 Block diagram of PLC

# **REFERENCE BOOKS:**

- 1. Production Technology HMT, Banglore, Tata Mc-Graw Hill.
- 2. CNC machines Pabla B. S. & M. Adithan, New Age international limited.
- 3. Non Conventional Machining P. K. Mistra, NarvasaPublishining House.
- 4. Manufacturing Processes Begman & Amsted, John Willey and Sons.
- 5. Advanced manufacturing technology David L. Goetsch.
- 6. Exploring Advanced Manufacturing Technologies Stephen F. Krar& Arthur Gil, Industrial Press.

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# **THEORY OF MACHINES & MECHANISMS**

Course Code	:	ME 5002 (Same in MA 5002)
Course Title	:	THEORY OF MACHINES & MECHANISMS
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Engineering Mechanics Engineering (2005)
Course Category	:	PC

# **COURSE OBJECTIVES:**

- To understand different types of cams and their motions and also to draw cam profiles for various motions.
- To understand the mechanism of various types of drives available for transmission of power.
- To understand the design of Brakes, Dynamometers, Bearings and Clutches and their function and working. 20-2
- To understand the need for balancing of masses in the same plane
- To know different types of governors.

# **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

CO1	Know different machine elements and mechanisms.
CO2	Understand Kinematics and Dynamics of different machines and mechanisms.
CO3	Select Suitable Drives and Mechanisms for a particular application.
CO4	Appreciate concept of balancing and Vibration.
CO5	Develop ability to come up with innovative ideas.
CO6	Understand different types of cams and their motions and also draw cam profiles for various motions

# **COURSE CONTENT:**

#### **CAMS AND FOLLOWERS** 1.

- Concept Definition and application of Cams and Followers 1.1
- 1.3 Different follower motions and their displacement diagrams, SHM,
- uniform acceleration and Retardation

#### POWER TRANSMISSION 2.

- Types of Drives Belt, Chain, Rope, Gear drives & their comparison 2.1
- 2.2 Types of Belt Drives and Material for flat and V-belt
- 2.3 Angle of lap, Belt length, Slip and Creep, Determination of Velocity Ratio, Ratio of tight side and slack side tension(Basic Definition and Formulae)
- 2.4 Derivation for open belt drive
  - Condition for maximum power transmission (Simple numericals)
- Chain Drives
  - Gear Drives and Gear trains
    - Rope Drives Types, Applications and Advantages & limitations of Steel ropes

#### 3. FLYWHEEL AND GOVERNORS

- 3.1 Flywheel -Concept, function and application of flywheel with the help of turning moment diagram forsingle cylinder 4-Stroke I.C. Engine (Simple Numerical Problems Except Punching Machine Problems)
- Coefficient of fluctuation of energy, 3.2
- 3.3 Coefficient of fluctuation of speed and its significance;
- 3.4 Governors Types
- Explanation with neat sketches (Centrifugal, Watt and Porter); Concept, function and 3.5 applications (No Numericals)
- 3.6 Terminology of Governors

3.7 Comparison between Flywheel and Governor

# 4. BRAKES, DYNAMOMETERS, CLUTCHES & BEARINGS

- 4.1 Function of brakes and dynamometers
- 4.2 Construction and working ofBrakes
- 4.3 Construction and working of Dynamometers
- 4.4 Clutches- (Basic Concept)
- 4.5 Function of Clutch and its application
- 4.6 Simple numericals on single and Multiplate clutch( No Derivation)
- 4.7 Types of Bearings (no derivation)
- 4.8 Simple numericals

# 5. BALANCING & VIBRATIONS:

- 5.1 Concept of balancing
- 5.2 Balancing of single rotating mass
- 5.3 Graphical method for balancing of several masses revolving in same plane 5.3.1 Simple Numerical Problems
- 5.4 Causes of vibrations in machines
- 5.5 Their harmful effects and remedies

# **REFERENCE BOOKS:**

- 1. Theory of machines S.S. Rattan, Tata McGraw-Hill publications.
- 2. Theory of machines R.K.Bansal ,Laxmi publications.
- 3. Theory of machines R.S. Khurmi&J.K.Gupta , S.Chand publications.
- 4. Dynamics of Machines J B K Das, Sapna Publications.
- 5. Theory of machines Jagdishlal, Bombay Metro Politan book Ltd.

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# ECONOMIC POLICIES IN INDIA

Course Code	ME 51001(Same in All Branches of Engg.)
Course Title	Economic Policies in India
Number of Credits	3 (L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

# **COURSE LEARNING OBJECTIVES:**

The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy.

CO1	Understand Indian economics policy, planning strategies
CO2	It will enable to students to comprehend theoretical and empirical development across countries and region for policy purposes
CO3	Development Economics as a discipline encompasses different approach estotheproblemsofunemployment, poverty, income generation, industrialization from different perspec-tives
CO4	$\label{eq:abletoidentifytheproblems} Abletoidentify the problems and capable to decide the application for future development$
CO5	Analyzeeconomicissuesandfindsolutionstocomplexeconomicproblemsandtakecor- recteconomicjudgment

# **COURSE CONTENTS:**

# 1. BASIC FEATURES AND PROBLEMS OF INDIAN ECONOMY:

- 1.1. Economic History of India;
- 1.2. Nature of Indian Economy
- 1.3. Demographic features and Human Development Index,
- 1.4. Problems of Poverty, Unemploy-ment, Inflation, income inequality, Blackmoney in India.

# 2. SECTORAL COMPOSITION OF INDIAN ECONOMY:

- 2.1. Issues in Agriculture sector in India,
- 2.2. land reforms
- 2.3. Green Revolution
- 2.4. agriculture policies of India,

# 3. INDUSTRIAL DEVELOPMENT,

- Small scale and cottage industries,
- 3.2. Industrial Policy,
  - Public sector in India,
  - Service sector in India.

# 4. ECONOMIC POLICIES:

3.1.

.3. 4

- 4.1. Economic Planning in India,
- 4.2. Planning commission v/s NITI Aayog,
- 4.3. Five Year Plans,
- 4.4. Monetary policy in India,
- 4.5. Fiscal Policy in India,
- 4.6. Centre state Finance Relations,
- 4.7. Finance commission in India
- 4.8. LPG policy in India

# 5. EXTERNAL SECTOR IN INDIA

- 5.1. India's foreign trade value composition and direction,
- 5.2. India Balance of payment since 1991,

- 5.3. FDI in India,
- 5.4. Impact of Globalization on Indian Economy,
- 5.5. WTO and India.

# **REFERENCE BOOKS:**

- Dutt Rudder and K.P.M Sunderam (2017). Indian Economy .S Chand & Co.Ltd. New Delhi. 1.
- 2. Mishra S. K & V. K Puri (2017). Indian Economy and Its Development Experience. Himalaya Publishing House.
- 3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
- 4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
- 5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, NewDelhi
- ity P 6. Kaushik Basu (2007): The Oxford Companion to Economics of India ,Oxford University Press.

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Course Code	ME 51002 (Same in All Branches of Engg.)	
Course Title	Engineering Economics & Accountancy	
Number of Credits	3 (L:3,T:0,P:0)	
Prerequisites	NIL	
Course Category	OE	

# ENGINEERING ECONOMICS & ACCOUNTANCY

# **COURSE OBJECTIVES**

•To acquire knowledge of basic economicst of a cilitate the process of economic decision making.

- •To acquire knowledge on basic financial management aspects.
- •To develop the basic skills to analyze financial statements.

# **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

CO1	Understand the macro-economic environment of the business and its impact on enterprise
CO2	Understand cost elements of the product and its effect on decision making
CO3	Prepare accounting records and summarize and interpret the accounting datafor managerial decisions
CO4	Understand accounting systems and analyze financial statements using ratio analysis
CO5	Understand the concepts of financial management and investment

# COURSE CONTENTS

# 1. INTRODUCTION:

- 1.1. Managerial Economics;
- 1.2. Relationship with other disciplines;
- 1.3. Firms: Types, objectives and goals;
- 1.4. Managerial decisions;
- 1.5. Decision analysis,

# 2. DEMAND & SUPPLY ANALYSIS:

- 2.1. Demand;
  - 2.1.1 Types of demand;
  - 2.1.2. Determinants of demand;
  - 2.1.3. Demand function;
  - 2.1.4. Demand elasticity;
  - 2.1.5. Demand forecasting;
  - 2. Supply;
    - 2.2.1. Determinants of supply;
    - 2.2.2. Supply function;
    - 2.2.3. Supply elasticity.

# 3. PRODUCTION AND COST ANALYSIS:

- 3.1. Production function;
- 3.2. Returns to scale;
- 3.3. Production optimization;
- 3.4. Least cost input; Iso quants;
- 3.5. Managerial uses of production function;
- 3.6. Cost Concepts;
  - 3.6.1. Cost function;
  - 3.6.2. Types of Cost;

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- 3.6.3. Determinants of cost;
- 3.6.4. Short run and Long run cost curves;
- 3.6.5. Cost Output Decision;
- 3.6.6. Estimation of Cost.

#### 4. PRICING:

- 4.1. Determinants of Price;
- 4.2. Pricing under different objectives and different market structures;
- 4.3. Price discrimination;
- 4.4. Pricing methods in practice;
- 4.5. Role of Government in pricing control.

# 5. FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT):

- 5.1. Balance sheet and related concepts;
- 5.2. Profit & Loss Statement and related concepts;
- 5.3. Financial Ratio Analysis;
- 5.4. Cash flow analysis;
- 5.5. Funds flow analysis;
- 5.6. Comparative financial statements;
- 5.7. Analysis & Interpretation of financial statements;
- 5.8. Investments;
- 5.9. Risks and return evaluation of investment decision;
- 5.10. Average rate of return;
- 5.11. Payback Period;
- 5.12. Net Present Value;
- 5.13. Internal rate of return,

#### **REFERENCE BOOKS:**

- 1.Mc Guigan, Moyer and Harris, 'Managerial Economics; Applications, Strategy and Tactics', Thomson South Western, 10<sup>th</sup> Edition, 2005.
- 2.Prasanna Chandra. 'Fundamentals of Financial Management', Tata Mcgraw Hill Publishing Ltd., 4<sup>th</sup> edition,2005.
- 3.Samuelson. Paul A and Nordhaus W. D., 'Economics', Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.
- 4.Paresh Shah, 'Basic Financial Accounting for Management', Oxford University Press, NewDelhi, 2007.
- 5.Salvatore Dominick, 'Managerial Economics in a global economy'. Thomson SouthWestern, 4<sup>th</sup> Edition, 2001.

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Course Code	:	ME 5003 (Same in MP/MT 5003)
Course Title	:	INDUSTRIAL ENGINEERING & MANAGEMENT
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

# INDUSTRIAL ENGINEERING & MANAGEMENT

#### **COURSE OBJECTIVES:**

- To take the right decisions to optimize resources utilization by improving productivity of the Lands, Buildings, People, Materials, Machines, Money, Methods and Management effectively.
- To eliminate unproductive activities under the control of the Management, Supervisor, worker and the Design of Products and Processes.
- To use the Charts to record the Activities of the people, materials and Equipment to find alternative methods which minimize waste and to implement the best method.

#### **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

CO1	Explain the different types of layout and plant maintenance with safety
CO2	List and explain the need of method study and work measurements
CO3	Explain the production planning and quality control, and its functions
CO4	Understand the basic principles, approaches and functions of management and identify concepts to specific situations
CO5	List and explain the different financial sources and methods of inventory management

# **COURSE CONTENT:**

# 1. PLANT ENGINEERING

- 1.1 Plant
- 1.2 Selection of site of industry
- 1.3 Plant layout
- 1.4 Principles of a good layout
- 1.5 Types; Process; Product and Fixed position;
- 1.6 Techniques to improve Layout

# 2. WORK STUDY

- 1 Productivity,
- 2 Standard of living
  - Method of improving Productivity
  - 2.3.1 Objectives
  - Importance of good working conditions
- .5 Method Study
  - 2.5.1 Definition
    - 2.5.1.1 Objectives
  - 2.5.2 Selection of a job for method study
  - 2.5.3 Basic procedure for conduct of Method study
  - 2.5.4 Tools used: Operation, Flow and Two-handed process chart
  - 2.5.5 Man Machine chart
  - 2.5.6 String diagram
  - 2.5.7 Flow diagram
- 2.6 Work Measurement
  - 2.6.1 Definition
  - 2.6.2 Basic procedure in making a time study

- 2.6.3 Employees rating factor
- 2.6.4 Application of time allowances
- 2.7 Calculation of standard time
- 2.8 Numerical Problems
- 2.9 Basic concept of production study
- 2.10 Techniques of Work Measurement
- Pre-determined Motion Time System (PMTS) 2.11

#### 3. **PRODUCTION PLANNING AND CONTROL**

- 3.1 Introduction
- 3.2 Major functions of Production Planning and Control Atradad
- 3.3 Pre planning
- 3.4 Methods of forecasting
- 3.5 Routing and Scheduling
- Dispatching and Controlling 3.6
- Concept of Critical Path Method (CPM) 3.7
- 3.8 **Types of Production** 
  - Mass Production 3.8.1
  - 3.8.2 **Batch Production**
  - Job Order Production; Characteristics 3.8.3
- 3.9 Economic Batch Quantity (EBQ)
- 3.10 Principles of Product and Process Planning
- Make or Buy decision 3.11
- 3.12 Numerical problems
- 3.13 Quality Control
  - 3.13.1 Definition
  - 3.13.2 Objectives
  - 3.13.3 Types of Inspection
    - 3.13.3.1 First piece
      - 3.13.3.2 Floor
      - 3.13.3.3 Centralized Inspection
  - 3.13.4 Advantages and Disadvantages
  - Sampling Inspection; Single and Double Sampling plan 3.13.5
  - 3.13.12 Concept of ISO 9001:2008
  - 3.13.13 Quality Management System Registration/Certification procedure
  - 3.13.14 Benefits of ISO to the organization

#### PRINCIPLES OF MANAGEMENT 4.

- Definition of Management 4.1
- 4.2 Administration; Organization
- F.W. Taylor's and Henry Fayol's Principles of Management 4.3
- Functions of Manager 4.4
- Types of Organization 4.5
  - 4.5.1 Line
    - 4.5.2 Staff
    - 4.5.3 Taylor's Pure functional types
    - 4.5.4 Line and staff and committee type
  - Directing
- 4.6 Leadership 4.7
- Styles of Leadership 4.8
- 4.9 Qualities of a good leader
- 4.10 Motivation; Positive and Negative Motivation
- 4.11 Management Information Systems
- 4.13 Personnel Management
  - 4.13.1 Responsibility of Human Resource Management
  - 4.13.2 Selection Procedure
  - 4.13.3 Training of Workers
    - 4.13.3.1 Apprentice Training
    - 4.13.3.2 On the Job training

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4.13.3.3 Vestibule School Training

4.13.4 Job Evaluation

# 5. FINANCIAL MANAGEMENT

- 5.1 Fixed and Working Capital
- 5.2 Resources of Capital
- 5.3 Shares Preference and Equity Shares
- 5.4 Debentures
  - 5.4.1 Type of debentures
- 5.5 Public Deposits
- 5.6 Factory Costing
  - 5.6.1 Direct Cost
  - 5.6.2 Indirect Cost
  - 5.6.3 Factory Overhead
  - 5.6.4 Selling Price of a product
  - 5.6.5 Profit
- 5.7 Numerical Problems
- 5.8 Depreciation; Causes
- 5.9 Methods
  - 5.9.1 Straight line
  - 5.9.2 Sinking fund
  - 5.9.3 Percentage on Diminishing Value Method
- 5.10 Numerical Problems
- 5.11 Material Management
  - 5.11.1 Objectives of good stock control system
  - 5.11.2 ABC analysis of Inventory
  - 5.11.3 Procurement and Consumption cycle
  - 5.11.4 Minimum Stock, Lead Time, Reorder Level
  - 5.11.5 Economic Order Quantity problems
  - 5.11.6 Supply Chain

# **REFERENCE BOOKS:**

- 1. Industrial Engineering & Management, S.C. Sharma, Khanna Book Publishing Co. (P) Ltd., Delhi.
- 2. Industrial Engineering and Management, O.P. Khanna, Revised Edition, Dhanpat Rai Publications (P) Ltd., New Delhi 110002.
- 3. Management, A global perspective, Heinz Weihrich, Harold Koontz, 10<sup>th</sup> Edition, McGraw Hill International Edition 1994.

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- 4. Essentials of Management, 4th Edition, Joseph L.Massie, Prentice-Hall of India, New Delhi 2004.
- 5. Principles and Practices of Management, Premvir Kapoor, Khanna Publishing House, N. Delhi



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# POWER PLANT ENGINEERING

Course Code	:	ME 50041 (Same in MA 50041)
Course Title	:	POWER PLANT ENGINEERING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Thermal Engineering - I Engineering (ME 3004)
Course Category	:	РЕ

#### **COURSE OBJECTIVES:**

- To understand the present scenario of power in India.
- To recognize various load terminologies used in power plants.
- To understand hydro working principles
- To understand working of Diesel, Gas and Nuclear power plants.
- To understand the issues and safety precautions in power plants.

# **COURSE OUTCOMES**

At the end of the course, the student will be able to:

CO1	Familiarised with the present and future power scenario of India.
CO2	Enlist various load terminologies in power plants
CO3	Working and classifications in hydro power plant
CO4	Working principles of Diesel, Gas and Nuclear power plants,
CO5	Understand the issues and necessity of safety concepts of power plants.

#### COURSE CONTENT:

# UNIT-I: INTRODUCTION TO POWER PLANT

Introduction to power plant; Indian Energy scenario in India; Location of power plant; Choice of Power plant; Classification of power plants. Basic layout of thermal power plant ; Construction and Working.

# **UNIT-II: ECONOMICS OF POWER PLANT**

Terminology used in power plant: Peak load, Base load, Load factor, Load curve; Various factor affecting the operation of power plant; Methods of meeting the fluctuating load in power plant; Performance and operating characteristics of power plant. Simple numerical problems

# UNIT-III: HYDRO POWER PLANT

Introduction to Hydro electric power plant; Rainfall, Runoff and its measurement, Hydrograph, flow duration curve; Selection of sites for hydro electric power plant; General layout of Hydro electric power plant and its working; Classification of the hydro electric power Plant. Advantages and disadvantages of hydro electric power plant.

# UNIT-IV: DIESEL AND GAS TURBINE PLANT

The layout of diesel power plant; Components and the working of diesel power plant; Advantages and disadvantages of diesel power plant; Gas turbine power Plant-Schematic diagram, components and its working; Combined cycle power generation- Combined gas and steam turbine power plant operation (only flow diagram). **Nuclear power plant:** Introduction; Nuclear Power-Radio activity-Radioactive charge-types of reactions; Thermal fission Reactors- PWR, BWR and gas cooled reactors; Advantages and Disadvantages of Nuclear power plant.

# UNIT-V: ENVIRONMENTAL IMPACT OF POWER PLANT

Social and Economical issues of power plant; Green house effect; Acid precipitation-Acid rain, Acid snow, Dry deposition, Acid fog; Air, water, Thermal pollution from power plants; Radiations from nuclear power plant effluents.

**Power plant safety:** Plant safety concept; Safety policy to be observed in power plants; Safety practices to be observed in boiler operation.

#### **REFERENCE BOOKS:**

- 1. Power plant Engineering-P.K. Nag 4th edition, Tata McGraw Hill Education, 2014.
- 2. Power plant Engineering Frederick T. Morse, Litton Educational Publishing Inc. 1953.
- 3. A Course in Power Plant Engineering Subhash C. Arora, S. Domakundwar, Dhanpat Rai, 1984.
- 4. Power Plant Engineering P.C. Sharma, S.K.Kataria& sons, 2009.
- 5. Power System Engineering R.K. Rajput, Firewell Media, 2006.

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# HEAT TRANSFER

Course Code	:	ME 50042
Course Title	:	HEAT TRANSFER
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Basic Mechanical Engineering Engineering (ME 3001)
Course Category	:	PE

#### **COURSE OBJECTIVES:**

- To understand the concepts of conduction.
- To understand the concepts of Fins heat transfer.
- To understand the concepts of radiation.
- To understand the concepts of convection.
- To understand the basics of heat exchangers.

#### **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

CO1	Understand the concepts of conduction
CO2	understand the concepts of fins
CO3	Understand the concepts of radiation.
CO4	Understand the concepts of convection
CO5	Understand the basic concepts of heat exchangers.
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**COURSE CONTENT:** 

# **UNIT-I: CONDUCTION**

Fourier law of heat conduction for isotropic material; Thermal conductivity; Derivation of the energy equation in three dimensions, Types of boundary conditions (Dirchlet, Neumann, mixed type); One dimensional solution with and without heat generation; Analogy with electrical circuits.Simple Numerical Problem

#### **UNIT-II: FINS**

rectangular and pin fins. Fin effectiveness and efficiency. Critical thickness of insulation. Simple Numerical Problem

# UNIT-III: CONVECTION

Introduction, Newton's law of cooling; Momentum and energy equations in two dimensions; importance of nondimensional quantities and their physical significance, Velocity and thermal boundary layer thickness by integral method, effect of coupling on the conservation equations.Simple Numerical Problem

# **UNIT-IV: RADIATION**

Physical mechanism of thermal radiation, laws of radiation, dfeinition of black body, emissive power, intensity of radiation, emissivity, reflectivity, transmittivity, irradiation, radiosity. Radiation exchange between black bodies, concept of Gray-Diffuse Isotropic (GDI) surface. Radiation exchange between GDI surfaces by radiation network and radiosity matrix method. Radiation shielding.

#### **UNIT-V: HEAT EXCHANGERS**

Types of heat exchangers, parallel and counterflow types, Introduction to LMTD. Correction factors, fouling factor. NTU method for heat exchangers.

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# **REFERENCE BOOKS:**

1. Fundamentals of Heat and Mass Transfer by F.P.Incropera and D.P.Dewitt, 4th ed., John Wiley & Sons.

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- 2. Heat Transfer A Basic Approach by M.N.Ozisik, McGrawhill.
- 3. Heat Transfer by J.P.Holman, 8th ed., McGrawhill.
- 4. Elements of Heat & Mass Transfer by Vijay Gupta, 2nd ed., New Age International Publishers.

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2 South Mit Mit Market

Course Code	:	ME 50051
Course Title	:	COMPUTER AIDED DESIGN AND MANUFACTURING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Computer Aided Machine Drawing Practice Engineering (ME
-		309)
Course Category	:	PE

# **COMPUTER AIDED DESIGN AND MANUFACTURING**

#### **COURSE OBJECTIVES:**

To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture. 220-2

- To understand concepts of drafting and modelling using CAD.
- To understand the need for integration of CAD and CAM.
- To understand the concepts of flexible manufacturing system.

# **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

CO1	Develop mathematical models to represent curves and surfaces and Model engineering components using solid modeling techniques.
CO2	Understand geometric transformation techniques in CAD.
CO3	Develop programs for CNC to manufacture industrial components.
CO4	Understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.
CO5	Utilize Flexible manufacturing system tools.

# **COURSE CONTENT:**

# UNIT-I: FUNDAMENTALS OF CAD/CAM

Automation; Design process; Application of computers for design; Benefits of CAD; Computer configuration for CAD applications; Design workstation; Graphic terminal; CAD Software: Definition of system software and application software; CAD database and structure.

Geometric Modeling: 3D-Whe frame modeling; Wire frame entities and their definitions; Interpolation and Approximation of curves; Concept of Parametric and Non-parametric representation of curves; Curve fitting techniques.

# **UNIT-II: SURFACE MODELING**

Algebraic and Geometric form; Parametric space of surface; Blending functions; Parametrization of surface patch; Subdividing; Cylindrical surface; Ruled surface; Surface of revolution; Spherical surface; Composite surface; Bezier surface; Solid Modelling: Definition of cell composition and spatial occupancy enumeration; Sweep representation; Constructive solid geometry; Boundary representations.

#### **UNIT-III: NC CONTROL PRODUCTION SYSTEMS**

Numerical control; Elements of NC system; NC part programming; Methods of NC part programming; Manual part programming, Computer assisted part programming; Post processor; Computerized part program.

#### **UNIT-IV: GROUP TECHNOLOGY**

Part families; Parts classification and coding; Production analysis; Machine cell design; Computer aided process planning: Retrieval type and Generative type; Machinability data systems; MRP and its Benefits.

# **UNIT-V: FLEXIBLE MANUFACTURING SYSTEM**

F.M.S equipment; Layouts; Analysis methods and benefits; Computer aided quality control; Automated inspection: Off-line, On-line, Contact, Non-contact; Coordinate measuring machines; Machine vision; CIM

Prepared : 2020-21

system and Benefits.

#### **REFERENCE BOOKS:**

- 1. CAD/CAM Principles and Applications, P.N.Rao, Tata McGraw-Hill
- 2. Computer Aided Design and Manufacturing, Groover M.P. &Zimmers Jr, Prentice hall of India
- 3. CAD/CAM/CIM, RadhaKrishna P. & Subramanyam, Wiley Eastern Ltd

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Course Code	:	ME 50052 (Same as in MA 50052)
Course Title	:	INDUSTRIAL ROBOTICS & AUTOMATION
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites (Course code)	:	NIL
Course Category	:	PE

# **INDUSTRIAL ROBOTICS & AUTOMATION**

# **COURSE OBJECTIVES:**

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
- To select the robots according to its usage.
- To discuss about the various applications of robots, justification and implementation of robot.
- To Conceptualize automation and understand applications of robots in various industries

#### **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

CO2 Explain the various robotic actuators on hydraulic, pneumatic and electrical drives.	
CO3 Explain about various types of sensors and concepts on robot vision system.	
CO4 Explain the concepts of robot programming languages and various methods of robot programming.	
CO5 Explain the various applications of robots.	

**COURSE CONTENT:** 

# UNIT-I: FUNDAMENTALS OF ROBOTICS

Introduction; Definition; Robot anatomy (parts) and its working; Robot Components: Manipulator, End effectors; Construction of links, Types of joints; Classification of robots; Structural Characteristics of robots; Mechanical rigidity; Effects of structure on control work envelope and work Volume; Robot work Volumes, comparison; Advantages and disadvantages of robots.

#### UNIT-II: ROBOTIC DRIVE SYSTEM AND CONTROLLER

Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives; AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion; Feedback devices; Potentiometers; Optical encoders; DC tachometers; Robot controller; Controller programming.

# **UNIT-III: SENSORS**

Requirements of a senso used in Robotics; Proximity sensing; Force and torque sensing.

**Introduction to Machine Vision:** Robot vision system (scanning and digitizing image data); Image processing and analysis; Cameras (Acquisition of images); Videocon camera (Working principle & construction); Applications of Robot vision system: Inspection, Identification, Navigation & serving.

# UNIT-IV: ROBOT KINEMATICS AND ROBOT PROGRAMMING

Forward Kinematics; Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Deviations and Problems. Teach Pendant Programming; Lead through programming; Robot programming Languages; VAL Programming; Motion Commands; Sensor Commands; End effecter commands; and Simple programs

#### **UNIT-V: AUTOMATION**

Basic elements of automated system, advanced automation functions, levels of automation. **Industrial Applications:** Application of robots in machining; welding; assembly and material handling.

#### **REFERENCE BOOKS:**

- 1. Introduction to Robotics: Analysis, Systems, Applications Saeed B. Niku, Pearson Education Inc. New Delhi 2006.
- 2. Industrial Robotics: Technology, Programming and Applications M.P. Groover, Tata McGraw Hill Co, 2001.
- 3. Robotics Control, Sensing, Vision and Intelligence Fu.K.S. Gonzalz.R.C and Lee C.S.G, McGraw Hill Book Co, 1987.
- 4. Robotics for Engineers Yoram Koren, McGraw Hill Book Co, 1992.
- 5. A Text book on Industrial Robotics Ganesh S. Hedge, Laxmi Publications Pvt. Ltd., New Delhi, 2008.
- 6. Robotics Technology and Flexible Automation S.R. Deb & Sankha Deb, Tata McGraw-Hill, 2010.
- 7. Elements of Robotics Process Automation, Mukherjee, Khanna Publishing House, Delhi, 2018

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# CAD/CAM LAB

Course Code	:	ME 5006 (Same in MA 5006)
Course Title	:	CAD/CAM LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Computer Aided Machine Drawing Engineering (ME 3009)
Course Category	:	PC

# **COURSE OBJECTIVES:**

- To understand the fundamentals and use CAD. •
- To conceptualize drafting and modelling in CAD. •
- To interpret the various features in the menu of solid modelling package.
- To synthesize various parts or components in an assembly.
- To prepare CNC programmes for various jobs.

# **COURSE OUTCOMES:**

# At the end of the course, the student will be able to:

• T	o conceptualize drafting and modelling in CAD.					
To interpret the various features in the menu of solid modelling package.						
• T	• To synthesize various parts or components in an assembly.					
• T	o prepare CNC programmes for various jobs.					
COURSE A	OUTCOMES: .t the end of the course, the student will be able to:					
CO1	Explain the 3D commands and features of a CAD software					
CO2	Create 3D solid model and find the mass properties of simples solids					
CO3	Demonstrate the working of CNC turning and milling machine					
CO4	Develop the part program using simulation software for Lathe and Milling					
CO5	Assess the part program, edit and execute in CNC turning and machining centre					
COUDSE	CONTENT.					

#### COURSE CONTENT:

S.No.	Topics for practice
	<b>Introduction:</b> 1.Part modelling; Datum Plane; constraint; sketch; dimensioning; extrude; revolve; sweep; blend; protrusion; extrusion; rib; shell; hole; round; chamfer; copy; mirror; assembly; align; orient.
PART-A	<ul> <li>2.Exercises: 3D Drawings of</li> <li>2.1). Geneva Wheel;</li> <li>2.2). Bearing Block;</li> <li>2.3). Bushed bearing;</li> <li>2.4). Gib and Cotter joint;</li> <li>2. 5). Screw Jack;</li> <li>2.6). Connecting Rod:</li> </ul>
	Note: Print the orthographic view and sectional view from the above assembled 3D drawing.
S	<ul> <li>3.1. Study of CNC lathe, milling;</li> <li>3.2. Study of international standard codes: G-Codes and M-Codes;</li> <li>3.3. Format – Dimensioning methods;</li> <li>3.4. Program writing – Turning simulator – Milling simulator, IS practice – commands menus;</li> </ul>
PART-B	<ul><li>3.5). Editing the program in the CNC machines;</li><li>3.6). Execute the program in the CNC machines;</li><li>3.7). Exercises</li><li>Note: Print the Program from the Simulation Software and make the Component in the CNC Machine.</li></ul>
	<ul> <li>CNC Turning Machine:</li> <li>4 (Material: Aluminium/Acrylic/Plastic rod)</li> <li>4.1) Using Linear and Circular interpolation - Create a part program and produce component in the Machine.</li> <li>4.2) Using Stock removal cycle – Create a part program for multiple turning operations and produce component in the Machine.</li> </ul>

4.3) Using canned cycle - Create a part program for thread cutting, grooving and produce
component in the Machine.
CNC Milling Machine
5(Material: Aluminium/ Acrylic/ Plastic)
5.1 Using Linear interpolation and Circular interpolation – Create a part program for grooving
and produce component in the Machine.
5.2 Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce
component in the Machine.
5.3Using subprogram - Create a part program for mirroring and produce component in the
Machine.

#### **REFERENCE BOOKS:**

- 1. Machine Drawing P.S. Gill S. K. Kataria& Sons, Delhi., 17th Revised edition, 2001
- 2. Mechanical Draughtsmanship G.L. TamtaDhanpat Rai & Sons, Delhi, 1992
- 3. Inside AutoCAD D. Raker and H. Rice, BPB Publications, New Delhi, 1985
- 4. CAD/CAM/CIM P. Radhakrishnan, S. Subramaniyan& V. Raju, New Age International Pvt. Ltd., New Delhi, 3rd Edition,

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5. Engineering AutoCAD, A.P. Gautam & Pradeep Jain, Khanna Book Publishing Co., Delhi

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ME

Course Code	:	ME 5007(Same in MA 5007)
Course Title	:	MANUFACTURING ENGINEERING -II LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Manufacturing Engineering (ME 3003)
Course Category	:	PC

#### MANUFACTURING ENGINEERING -II LAB

#### **COURSE OBJECTIVES:**

- To know the working of Drilling machine, shaper, slotter, planer, milling and grinding machines and be in a position to operate the same.
- To make use of various measuring instruments for taking dimensions.
- To Practice different operations on drilling shaper, slotter, planer, milling and grinding machines.

#### **COURSE OUTCOMES:**

At the end of the course, the student will be able to:

CO1	Dismantle and assemble the components on drilling, shaping, milling and grinding machines.
CO2	Perform operations on drilling, shaping, milling and grinding machines.
CO3	Produce articles of industrial application such as Spur gear, square headed bolt, V- block
CO4	Make use of various measuring instruments for taking dimensions

#### **PRACTICALS:**

- 1. Drilling Exercise (Three different sized holes for different materials maintaining uniform distance between them).
- 2. Milling-square-hexagon from round bars with indexing and without indexing.
- 3. Generation of spur gear teeth on a round bar.
- 4. Simple planning exercise cutting 'T' slots (one model).
- 5. Shaping a Hexagon on a round bar, key ways, groovessplines.
- 6. Shaping step block cut dovetail to angles 60, 90, 120 degrees.
- 7. Cylindrical grinding of external surface and internal surface using universal grinding machines.
- 8. Grinding Cutting tools to the required angles.
- 9. Grinding of milling cutters etc, on a tool and cutter grinder.
- 10. Grinding flat surface on a surface grinder using magnetic chuck and clamping devices.
- 11. Dismantling some of the components of drilling machine and service, assemble the same.
- 12. Dismantling some of the components of shaper head and then assemble the same.
- 13. Dismantling some of the components of Milling machines and service, assemble the same.

14. Servicing of universal grinding machine.

#### **REFERENCE BOOKS:**

- 1. Elements of Workshop Technology (Volume I & II) Hajra Chowdry & Bhattacharaya, Media Promoters, 11th Edition, 2007.
- Introduction of Basic Manufacturing Processes and Workshop Technology Rajender singh, New age International (P) Ltd. New Delhi, 2006.
- 3. Production Technology -HMT, 18th edition, Tata McGraw Hill, New Delhi.
- 4. Manufacturing process Myro N Begman, 5<sup>th</sup> edition, Tata McGraw Hill, New Delhi.

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