

KARANATAKA STATE OPEN UNIVERSITY

M Tech in MECHANICAL

(COMPUTER INTEGRATED MANUFACTURING)

SEMESTER SYSTEM

SYLLABUS

M Tech in MECHANICAL(Computer Integrated Manufacturing)

Subject Code	Subject Title	Max Marks	Max Credits
Semester – I			
MT1001	Engineering statistics and probability	100	6
MT1002	Computer Application Production Design	100	6
MT1003	Computer Aided Metrology and Inspection	100	6
MT1004	Finite Element Analysis	100	6
	Elective I	100	6
MTP001	CAD & CAM LAB	100	3
Semester – II			
MT2001	Precision Engineering	100	6
MT2002	Integrated Manufacturing Systems	100	6
MT2003	Computer Integrated Manufacturing	100	6
	Elective II	100	6
	Elective III	100	6
MTP002	CIM LAB	100	3

Semester – III			
Subject Code	Subject Title	Max Marks	Max Credits
MT3001	Robotics and Sensors	100	6
MT3002	Advanced Material Technology	100	6
MT3003	Advances in CNC Systems	100	6
	Elective IV	100	6
	Elective V	100	6
MTP003	Project Work – Phase I	100	3
Semester – IV			
MT4001	Advances in Production Management	100	6
	Elective VI	100	6
MTP 004	Project Work – Phase II	400	12

Total Marks = 2400

Total Credits = 123

Note: Out of these Electives 2 are to be taken from CAD, 2 from CAM and 2 from Production

List of Electives – CAD

Subject Code	Subject Title
MTE001	Advanced Machine Tool Design
MTE002	Integrated Mechanical Design
MTE003	Optimization Techniques in Design
MTE004	Mechanical Vibration
MTE005	Flexible Competitive Manufacturing System
MTE006	Design for Manufacture, Assembly and Environments

List of Electives – CAM

Subject Code	Subject Title
MTE007	Mechatronics in Manufacturing Systems
MTE008	Industrial Safety Management
MTE009	Manufacturing System & Simulation
MTE010	Metrology and Non Destructive Testing
MTE011	Maintenance Management
MTE012	Integrated Product and Process Development

List of Electives – Production

Subject Code	Subject Title
MTE013	Fluid Power Automation
MTE014	Advances in Casting and Welding
MTE015	Total Quality Management
MTE016	Maintenance and Reliability Engineering

SEMESTER : I
Subject Code : MT1001
Subject Title : Engineering Statistics and Probability

Structure of the Course Content

BLOCK 1 Random Variables (One Dimensional)

- Unit 1: Probability Function
- Unit 2: Moment Generating Function
- Unit 3: Binomial and Poisson Distributions
- Unit 4: Geometric and Exponential Distributions

BLOCK 2 Random variables (Two Dimensional)

- Unit 1: Joint Distributions
- Unit 2: Marginal and Conditional distributions
- Unit 3: Functions of Two Dimensional Random Variables
- Unit 4: Regression Curve and Correlation

BLOCK 3 Estimation Theories

- Unit 1: Unbiased Estimators
- Unit 2: Method of Moments
- Unit 3: Maximum Likelihood Estimation
- Unit 4: Curve Fitting by Principle of Least Squares

BLOCK 4 Testing of Hypothesis

- Unit 1: Sampling Distributions
- Unit 2: Type I and Type II errors
- Unit 3: Tests Based on Normal, t, χ^2 and F Distributions
- Unit 4: Tests for Independence of Attributes

BLOCK 5 Multivariate Analyses

- Unit 1: Covariance Matrix
- Unit 2: Correlation Matrix
- Unit 3: Multivariate Normal Density Function
- Unit 4: Principal Components

Books:

1. Richard A. Johnson and Dean W. Wichern, "Applied Multivariate Statistical Analysis", Pearson Education, Asia, 5th Edition
2. Dallas E Johnson et al., "Applied multivariate methods for data analysis",
3. Richard Johnson. "Miller & Freund's Probability and Statistics for Engineer Prentice – Hall of India, Private Ltd., New Delhi, 7th Edition
4. Gupta, S.C. and Kapoor, V.K."Fundamentals of Mathematical statistical", sultanansons, New Delhi
5. Jay L. Devore, "Probability and statistics for Engineering and the Sciences", Thomson and Duxbury, Singapore
6. James, G, Advanced Modern Engineering Mathematics, 3rd edition, Pearson
7. Grewal, B.S., Numerical methods in Engineering and Science, 7th edition, Khanna
8. Gupta, A.S., Calculus of variations with applications, Prentice-Hall of India,
9. O'Neil, P.V., Advanced Engineering Mathematics, Thomson Asia Pvt. Ltd.,
10. Andrews, L.C. and Philips, R. L. Mathematical Techniques for Engineers and Scientists, Prentice Hall of India

SEMESTER : I
Subject Code : MT1002
Subject Title : Computer Application Production Design

Structure of the Course Content

BLOCK 1 Computer Graphics Fundamentals

- Unit 1: 2-D & 3-D Transformation
- Unit 2: Clipping Transformation
- Unit 3: Surface modelling Techniques
- Unit 4: Volume modelling and Boundary Models

BLOCK 2 CAD Software Basics

- Unit 1: Writing Interactive Programs to Solve Design Problems Using Auto LISP
- Unit 2: Writing Interactive Programs to solve Production of Drawings
- Unit 3: Creation of Surfaces
- Unit 4: Creation of Solids

BLOCK 3 Solid Modelling

- Unit 1: Regularized Boolean Set Operations and Primitive Instancing
- Unit 2: Sweep Representations and Boundary Representations
- Unit 3: Constructive Solid Geometry
- Unit 4: Graphics and Computing Standards

BLOCK 4 Visual Realism

- Unit 1: Hidden, Line and Surface
- Unit 2: Solid Removal Algorithms, Shading and Colouring
- Unit 3: Introduction to Parametric and Variational Geometry Based Software's
- Unit 4: Creation of Prismatic and Lofted Parts Using These Packages

BLOCK 5 Assemblies of Parts

- Unit 1: Assembly Modelling
- Unit 2: Interferences of Positions and Orientation
- Unit 3: Tolerances Analysis
- Unit 4: Mass Property Calculations

Books:

1. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc
2. Ibrahim Zeid Mastering CAD/CAM – McGraw Hill, International Edition
3. Donald Hearn and M. Pauline Baker "Computer Graphics", Prentice Hall, Inc
4. William M Neumann and Robert F. Sproul "Principles of Computer Graphics", Mc Graw Hill Book Co. Singapore
5. Foley, Wan Dam, Feiner and Hughes – Computer graphics principles & practices, Pearson Education
6. Rao, "CAD/CAM: Principles and Applications, TMH
7. Zeid, "CAD/CAM: Theory and Practice, Tata McGraw Hill
8. Zeid, "Mastering CAD/CAM, Tata McGraw Hill, New Delhi
9. Chenna Kesava R. Alavala, CAD/CAM: Concepts and Applications, PHI
10. Dr. Rajendra Karwa, A Text book of Machine Design, Lakshmi Publications Pvt Ltd

SEMESTER : I
Subject Code : MT1003
Subject Title : Computer Aided Metrology and Inspection

Structure of the Course Content

BLOCK 1 Basic Concept of Measurement

- Unit 1: Definition and Standards of Measurement
- Unit 2: Errors in Measurement
- Unit 3: Interchange ability and Selective Assembly
- Unit 4: Accuracy and Precision

BLOCK 2 Surface Measurements

- Unit 1: Definitions and Types of Surface Texture
- Unit 2: Surface Roughness Measurement Methods
- Unit 3: Comparison, Profilometer
- Unit 4: 3D Surface Roughness Measurement

BLOCK 3 Interferometry

- Unit 1: Introduction of Interferometry
- Unit 2: Principles of Light Interference
- Unit 3: Interferometers
- Unit 4: Measurement and Calibration, Laser Interferometers

BLOCK 4 Computer Based LASER Metrology

- Unit 1: Tool Makers Microscope
- Unit 2: Co – Ordinate Measuring Machine
- Unit 3: Applications and Laser Micrometer
- Unit 4: Non Contact and Process Inspection, Vision system.

BLOCK 5 Image Techniques

- Unit 1: Overview, Computer Imaging Systems
- Unit 2: Image Analysis, Pre-Processing
- Unit 3: Human Vision System, Image Model, Image Enhancement
- Unit 4: Image Transforms

Books:

1. Graham T.Smith, “Industrial Metrology”, Springer
- 2.R.K.RAJPUT, “Engineering Metrology and Instrumentations”, Kataria & Sons Publishers
- 3.Milan Sonka, Vaclav Hlavac and Roger Boyle, “Image Processing, Analysis, and Machine Vision”, Cengage-Engineering; 3 edition
4. “ASTE Handbook of Industries Metrology”, Prentice Hall of India Ltd
5. G.N.GALYER F.W. and C.R.SHOTBOLT, “Metrology for engineers”, ELBS
6. GUPTA, I.C, “A Text Book of engineering metrology”, Dhanpat Rai and Sons
7. www.metrologytooling.com
8. www.iuk'tu-harburg.de
9. Bewoor, ”Metrology&Measurement”, Tata McGraw Hill, New Delhi
10. Holman, ”Exprimental Methods for Engineers, TMH

SEMESTER : I
Subject Code : MT1004
Subject Title : Finite Element Analysis

Structure of the Course Content

BLOCK 1 One Dimensional Finite Element Analysis

Unit 1: Historical Background and Weighted Residual Methods
Unit 2: Basic Concepts of FEM and Variation Formulation of B.V.P
Unit 3: Finite Element Modelling - Element Equations
Unit 4: Linear and Quadratic Shape Functions, Bar, Beam Elements

BLOCK 2 Two Dimensional Finite Element Analysis

Unit 1: Basic Boundary Value Problems in 2 Dimensions
Unit 2: Triangular, Quadrilateral, Higher Order Elements and Laplace Equations
Unit 3: Weak Formulation, Elements Matrices and Vectors
Unit 4: Application to Solid Mechanics, Heat transfer, Fluid Mechanics

BLOCK 3 ISO Parametric Formulation

Unit 1: Natural Co-ordinate System, Lagrangian Interpolation Polynomials
Unit 2: ISO-Parametric Elements, Formulation
Unit 3: Numerical Integration, 1D ,2D Triangular Elements
Unit 4: rectangular elements - Illustrative Examples

BLOCK 4 Solutions to Plane Elasticity Problems

Unit 1: Introduction to Theory of Elasticity and Plane Stress
Unit 2: Plane Strain and Axis Symmetric Formulation
Unit 3: Principle of Virtual Work
Unit 4: Element Matrices Using Energy Approach

BLOCK 5 Special Topics

Unit 1: Dynamic Analysis, Equation of Motion and Mass Matrices
Unit 2: Free Vibration analysis, Natural frequencies of Longitudinal
Unit3: Transverse and Torsion Vibration, Introduction to Transient Field Problems
Unit 4: Non Linear Analysis, Use of Software

Books:

1. Reddy J.N. "An Introduction to the Finite Element Method", Mc Graw Hill, International Edition
2. Rao S.S., "Finite Element Method in Engineering", Pergamon Press
3. George R Buchanan, "Schaum's Outline of Finite Element Analysis", McGraw Hill
4. Bathe, K.J., "Finite Element Procedures in Engineering Analysis
5. Kobayashi, S, Soo-IK-Oh and Altan, T, "Metal forming and the Finite element Methods", Oxford University Press
6. Lewis, R.W., Morgan, K, Thomas, H.R., and Seetharaman, K.N., "The Finite Element Method in Heat Transfer Analysis", John Wiley
7. Buchanan,"Finite Element Analysis", Tata McGraw Hill
8. Hutton," Fundamentals of Finite Element Analysis", Tata McGraw Hill
9. Krishnamurthy," Finite Element Analysis: Theory and Programming", TMH
10. Chennakesava R. Alavala,"Finite Element Methods: Basic Concepts and App, PHI

SEMESTER : I
Subject Code : MTP001
Subject Title : CAD & CAM Lab
Structure of the Course Content

CAD Lab

2D modelling and 3D modelling of components such as

1. Bearing
2. Couplings
3. Gears
4. Sheet metal components Jigs, Fixtures and Die assemblies

CAM Lab

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle
2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned Cycle.
3. Study of Sensors, Transducers & PLC: Hall-effect sensor, Pressure sensors, Strain Gauge, PLC, LVDT, Load cell, Angular potentiometer, Torque, Temperature & Optical Transducers.

SEMESTER : II
Subject Code : MT2001
Subject Title : Precision Engineering

Structure of the Course Content

BLOCK 1 Basics of Precision Engineering

- Unit 1: Accuracy and Precision
- Unit 2: Need for High Precision
- Unit 3: Concept of Accuracy, Tolerance and fits, System
- Unit 4: Expected Accuracy of a Manufacturing Process

BLOCK 2 Materials for Precision Engineering

- Unit 1: Diamond, Types, Single Crystal and PCD
- Unit 2: Natural, Synthetic CBN and Ceramics
- Unit 3: Coated Metals and Non-Metals, High Performance Polymer
- Unit 4: Cutting Tools, Performance and Components of Instruments

BLOCK 3 Precision Engineering

- Unit 1: Precision Grinding, IC Chip Manufacturing
- Unit 2: Spherical Surface Generation Grinding wheel
- Unit 3: High-speed grinding, High-speed milling, Micro machining
- Unit 4: Diamond Turning, MEMS, and Micro Finishing Process

BLOCK 4 Errors, Causes and Remedies

- Unit 1: Static Stiffness and Influence on Machining Accuracy
- Unit 2: Errors Due to Variation of Cutting Forces and Clamping Forces
- Unit 3: Heat Sources and War Dissipation
- Unit 4: Error Due to Clamping and Setting Location

BLOCK 5 Precision Machine Elements

- Unit 1: Guide Ways, Drive Systems, Rolling Element Bearings
- Unit 2: Lubricated Sliding Bearings, Construction and Principles
- Unit 3: Hydrostatics Bearings, Types and Aerostatic Bearings
- Unit 4: Linear Drive Motors, Magnetic Bearings, Applications and Limitations

Books:

1. R.L. Murthy, Precision Engineering in Manufacturing, New age Instruction Publishes, New Delhi
2. V.C. Venkatesh and Sudin, Izwan, Precision engineering:- Tata McGraw Hill Co., New Delhi
3. JAMESD, MEADOWS, - "Geometric Dimensioning and tolerancing", Marcel Dekker Inc

SEMESTER : II
Subject Code : MT2002
Subject Title : Integrated Manufacturing Systems

Structure of the Course Content

BLOCK 1 Introduction to IMS

- Unit 1: Objectives of a Manufacturing System
- Unit 2: Identifying Business Opportunities and Problems
- Unit 3: Classification of Production Systems
- Unit 4: Linking Manufacturing Strategy and Systems Analysis

BLOCK 2 Computer aided Process Planning

- Unit 1: Introduction, Part Families, Parts Classification and Cooling
- Unit 2: Group Technology Machine Cells
- Unit 3: Benefits of Group Technology
- Unit 4: Process Planning Function CAPP

BLOCK 3 Computer Aided Planning and Control

- Unit 1: Production Planning and Control
- Unit 2: Cost Planning and Control and Inventory Management
- Unit 3: Material Requirements Planning (MRP)
- Unit 4: Automatic Identification System and Barcode Technology.

BLOCK 4 Computer Monitoring

- Unit 1: Types of Production Monitoring Systems
- Unit 2: Structure Model of Manufacturing Process
- Unit 3: Process Control and Strategies
- Unit 4: Supervisory Computer Control

BLOCK 5 IMS

- Unit 1: Definition, Application, Features and Types of Manufacturing Systems
- Unit 2: Machine Tools, Materials Handling System and Computer Control System
- Unit 3: Flexible Manufacturing Systems (FMS)
- Unit 4: CAD/CAM System

Books:

1. Groover M.P., "Automation, Production Systems and Computer Integrated Manufacturing ", Third Edition, Prentice-Hall
2. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi
3. Yorem Koren, "Computer Integrated Manufacturing Systems", McGraw Hill
4. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International
5. R.W. Yeomamas, A. Choudry and P.J.W. Ten Hagen, "Design rules for a CIM system", North Holland Amsterdam

SEMESTER : II
Subject Code : MT2003
Subject Title : Computer Integrated Manufacturing

Structure of the Course Content

BLOCK 1 Introduction to CIM

- Unit 1: Types of Production and Functions
- Unit 2: Automation Strategies
- Unit 3: Production Economics
- Unit 4: Cost in Manufacturing and Breakeven Analysis

BLOCK 2 Automated Flow Lines

- Unit 1: Transfer Mechanism
- Unit 2: Buffer Storages
- Unit 3: Analysis of Transfer Lines
- Unit 4: Line Unbalancing Concepts and Automated Assembly Systems

BLOCK 3 Computer Controlled Systems

- Unit 1: NC and CNC Part Programming
- Unit 2: DNC Systems and Adaptive Control
- Unit 3: Pallets and Fixtures Systems
- Unit 4: Manufacturing Cells

BLOCK 4 Automatic Handling Storage and Inspection

- Unit 1: Automated Transfer System
- Unit 2: Automated Material Handling System
- Unit 3: Automated Storage or Retrieval System
- Unit 4: Automated Inspection

BLOCK 5 Machines and System Control

- Unit 1: Cell Control and Cell Controllers
- Unit 2: Linear Feedback Control and Optimal Control
- Unit 3: Sequential Programmable Controller
- Unit 4: Automatic Tracking, Barcodes and RFID System

Books:

1. Mikell P.Groover, Automation, "Production systems and Computer Integrated Manufacturing" PHI
2. Weatherall, "Computer Integrated Manufacturing", A total company strategy, 2nd edition
3. Ronald G.Askin, "Modelling and Analysis of Manufacturing Systems", John Wiley
4. Radhakrishnan, P., Subramanian, S., and Raju, V., "CAD/CAM/CIM" New Age International Publishers
5. James A.Retrg, Herry W.Kraebber, "Computer Integrated Manufacturing", Pearson Education, Asia
6. Gideon Halevi and Ronald D.Weill, Principles of Process Planning", Chapman Hall
7. Viswanathan, N., and Narahari, Y., "Performance Modeling and Automated Manufacturing Systems", Prentice Hall of India Pvt. Ltd
8. Kant Vajpayee, S., "Computer Integrated Manufacturing", Prentice Hall of India,
9. Alavudeen and Venkateshwaran, "Computer Integrated Manufacturing", PHI Learning Pvt. Ltd., New Delhi

SEMESTER : II
Subject Code : MTP002
Subject Title : CIM Lab
Structure of the Course Content

List of Experiments

1. Using of Pre-processor and post processor in finite element analysis (Exercise must include importing model from a modelling package, model correction, meshing, and addressing quality of mesh issues).
2. Model analysis of engineering structures (Exercises must include model analysis of simple beams and plates and comparison of FEA and analytical solutions, and model analysis of actual components like brackets, machine tool structures etc).
3. Nonlinear analysis (Exercise must include plastic deformation of simple objects or crash analysis simple structures.
4. 3 Axis CNC code generations for CNC machining.
5. CNC Machining of complex features like machining of hemispherical cavity, Tapered hole, hole of parabolic shape etc...
6. Automated component inspection using vision System.
7. Automation using programmable Logic Control.
8. Dimensional and geometric measurement using CMM.
9. Study on RDBMS and its application in problems like inventory control MRP etc.
10. Robot Programming

SEMESTER : III
Subject Code : MT3001
Subject Title : Robotics and Sensors

Structure of the Course Content

BLOCK 1 Introduction to ROBOTS

- Unit 1: Definition, Need and Application
- Unit 2: Types of Robots and Classifications
- Unit 3: Configuration, Work Volume, Control Loops, Controls and Intelligence
- Unit 4: Specifications of Robot, Degrees of Freedoms

BLOCK 2 ROBOT Kinematics

- Unit 1: Introduction and Matrix Representation
- Unit 2: Homogeneous Transformation, Forward and Inverse
- Unit 3: Kinematic Equations, Denavit – Hartenbers Representations
- Unit 4: Fundamental Problems with D-H Representation

BLOCK 3 ROBOT Dynamics and Trajectory Planning

- Unit 1: Lagrangeon Mechanics
- Unit 2: Static Force Analysis of Robots, Trajectory Planning
- Unit 3: Joint Space, Cartesian Space Description and Trajectory Planning
- Unit 4: Third Order, Fifth Order and Polynomial Trajectory Planning

BLOCK 4 ROBOT Programming and AI Techniques

- Unit 1: Types of Programming
- Unit 2: Teach Pendant Programming
- Unit 3: Basic Concepts in AI Techniques
- Unit 4: Concept of knowledge Representations

BLOCK 5 ROBOT Sensors and Actuators

- Unit 1: Design of Robots
- Unit 2: Characteristics of Actuating Systems
- Unit 3: Position, Velocity, Force, Temperature, Pressure Sensors
- Unit 4: Contact and Non Contact Sensors, Infrared Sensors, RCC, Vision Sensors.

Books:

1. Groover.M.P. Industrial Robotics, McGraw – Hill International edition
2. Gordon Mair, 'Industrial Robotics', Prentice Hall (U.K.)
3. Wesley E Snyder R, 'Industrial Robots, Computer Interfacing and Control', Prentice Hall International Edition
4. Saeed.B.Niku, 'Introduction to Robotics, Analysis, system, Applications', Pearson educations
5. Deb, 'Robotics and Technology and Flexible Automation, TMH
6. Fu, 'Robotics: Control, Sensing, Vision and Intelligence, Tata McGraw Hill
7. Mittal & Nagrath, 'Robotics and Control', Tata McGraw Hill
8. Saha, 'Introduction to Robotics, TMH

SEMESTER : III
Subject Code : MT3002
Subject Title : Advanced Material Technology

Structure of the Course Content

BLOCK 1 Elastic and Plastic Behaviour

- Unit 1: Elasticity in Metals and Polymers an Elastic and Viscous-Elastic Behaviour
- Unit 2: Strengthening Mechanisms, Work Hardening, Solid Solutioning
- Unit 3: Grain Boundary Strengthening, Poly phase Mixture
- Unit 4: Effect of Temperature, Strain and Strain Rate on Plastic Behaviour

BLOCK 2 Fracture Behaviour

- Unit 1: Griffith's Theory, Stress Intensity Factor and Fracture Toughness
- Unit 2: High Temperature Fracture
- Unit 3: Deformation and Fracture Mechanism Maps
- Unit 4: Fracture of Non Metallic Materials

BLOCK 3 Selections of Materials

- Unit 1: Motivation for Selection, Cost Basis and Service Requirements
- Unit 2: Selection for Mechanical Properties, Strength, Toughness
- Unit 3: Materials Selection with Relevance to Aero, Auto, Applications
- Unit 4: Selection with Relevance to Nuclear, Marine Applications

BLOCK 4 Modern Metallic Materials

- Unit 1: Dual Phase Steels, High Strength Low Alloy (HSLA) Steel
- Unit 2: Transformation Induced Plasticity (TRIP) Steel, Managing Steel
- Unit 3: Intermetallics, Ni and Ti Aluminides
- Unit 4: Smart Materials, Shape Memory Alloys

BLOCK 5 Non Metallic Materials

- Unit 1: Polymeric Materials and Formation of Polymer Structure
- Unit 2: Production Techniques of Fibers, Foams, Adhesives and Coating
- Unit 3: Structure, Properties and Applications of Engineering Polymers
- Unit 4: Advanced Structural Ceramics, WC, TIC, TaC, Al₂O₃, SiC, Si₃N₄ CBN

Books:

1. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill
2. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., Selection and use of engineering materials, (3rd edition), Butterworth-Heiremann
3. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth
4. George E.Dieter, Mechanical Metallurgy, McGraw Hill
5. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico

SEMESTER : III
Subject Code : MT3003
Subject Title : Advances in CNC Systems

Structure of the Course Content

BLOCK 1 Metal Cutting and Tool Materials

- Unit 1: Orthogonal and Oblique Cutting
- Unit 2: Types of Tool Wear, Abrasion, Diffusion, Oxidation and Fatigue
- Unit 3: Monitoring of Wear, Cutting Forces and Vibration
- Unit 4: Selection of Machining Parameters and Tools

BLOCK 2 Special Machining Processes

- Unit 1: Deep Hole Drilling Honing and Lapping
- Unit 2: Super finishing and Burnishing
- Unit 3: Broaching high speed Machining, Measurement of Cutting Forces
- Unit 4: Temperature, Vibration and Tool Wear in Machining Processes.

BLOCK 3 Unconventional Machining

- Unit 1: Principles, Processes. Various Influencing Parameters
- Unit 2: Applications of Ultrasonic Machining, Electro Discharge Machining
- Unit 3: Electro Chemical Machining, Electron and Laser Beam Machining
- Unit 4: Plasma Arc Machining and Water Jet Machining

BLOCK 4 Micro Machining

- Unit 1: Introduction to MEMS, Principle, Process Capabilities
- Unit 2: Types, Advantages and Applications of Bulk Micro Machining
- Unit 3: Surface Micro Machining
- Unit 4: Tool Based Micro Machining Processes.

BLOCK 5 Rapid Prototyping

- Unit 1: Introduction, Classification, Principle Advantages and Limitations
- Unit 2: Stereo Lithography, Laminated Object Manufacturing
- Unit 3: Selective Laser Sintering
- Unit 4: FDM, SGC, 3D Printing

Books:

1. Armarego E.J.A. and Brown R.H., "The Machining of metals", Prentice Hall
2. Marc J. Madou, Fundamentals of Micro fabrication: The Science of Miniaturization, Second Edition, CRC Press
3. Sadasivan T.A., and Sarathy.D. "Cutting Tools for Productive Machining", Widia (India) Limited
4. Shaw Milton.C., "Metal Cutting Principles", Second Edition, Oxford University, Press
5. Battacharya, " theory of metal cutting", NCB Agency
6. HMT Manual, "Non – t5raditional Machining Methods"
7. Pandley P.S. and shah.N. "Modern Manufacturing Processes",
8. Rich F. and Knight'K., "Artificial Intelligence", McGraw Hill Inc,

SEMESTER : III
Subject Code : MTP003
Subject Title : Project Work – Phase I
Structure of the Course Content

SEMESTER : IV
Subject Code : MT4001
Subject Title : **Advances in Production Management**

Structure of the Course Content

BLOCK 1 Field of Manufacturing Management

Unit 1: Introduction to Manufacturing
Unit 2: Manufacturing Strategies and Competitiveness
Unit 3: Meeting the Competitive Project Management
Unit 4: Quality Management

BLOCK 2 Designing of Products

Unit 1: Process Selection and Process Flow Design
Unit 2: Operations Technology
Unit 3: Waiting Line Management
Unit 4: Computer Simulation of Waiting Lines

BLOCK 3 Designs of Facilities and Jobs

Unit 1: Capacity Planning and Strategies
Unit 2: Planning Service Capacity and JIT
Unit 3: Facility Location and Layout
Unit 4: Job Design and Work Measurement

BLOCK 4 Inventory Systems and MRP

Unit 1: Definition, Purposes of Inventory and Inventory models
Unit 2: Fixed Order Quantity Models and Fixed and Time Period Models.
Unit 3: MRP System Structures, Improvements in the MRP system
Unit 4: Advanced MRP and Type Systems

BLOCK 5 Revising the System

Unit 1: Operations Consulting
Unit 2: BPR
Unit 3: Synchronous Manufacturing and Theory of Constraints
Unit 4: Case Studies

Books:

1. Production and Operations Management, Chase, Aquilano and Jacobs, eighth Edition, Tata McGraw Hill
2. Manufacturing management: a quantitative approach, Robert A. Olsen, International Textbook Co,
3. Production and Operations Management, S. N. Chary, Tata McGraw-Hill,
4. Production and Operations Management: Strategic and Tactical Decisions, Jay Heifer, Barry Render - Business & Economics
5. Operations Management, Jae K. Shim, Joel G. Siegel - Business & Economics

SEMESTER : IV
Subject Code : MTP004
Subject Title : Project Work – Phase II
Structure of the Course Content

ELECTIVE

Subject Code : MTE001

Subject Title : Advanced Machine Tool Design

Structure of the Course Content

BLOCK 1 Introduction to Tool Design

Unit 1: Introduction, Tool Engineering and Tool Classifications

Unit 2: Tool Design Objectives and Tool Design in Manufacturing

Unit 3: Surface Finish, Fits and Tolerances

Unit 4: Ferrous and Non Ferrous Tooling Materials

BLOCK 2 Designs of Cutting Tools

Unit 1: Mechanics of Metal Cutting, Oblique and Orthogonal Cutting

Unit 2: Chip Formation and Shear Angle, Single-Point Cutting Tools

Unit 3: Milling Cutters and Broaching Tools

Unit 4: Design of Gear and Thread Milling Cutters

BLOCK 3 Designs of Jigs and Fixtures

Unit 1: Fixed Gages, Gage Tolerances and Selection of Material for Gages

Unit 2: Principles of Clamping and Drill Jigs

Unit 3: General Considerations in the Design of Drill Jigs

Unit 4: Boring Fixtures, Broaching Fixtures and Lathe Fixtures

BLOCK 4 Designs of Press Tool Dies

Unit 1: Types of Dies and Method of Die Operation

Unit 2: Blanking and Piercing Die Design

Unit 3: Presswork Materials, Strip Layout, Short-run Tooling for Piercing

Unit 4: Forming Dies, Drawing Dies, Design and Drafting.

BLOCK 5 CNC Machine Tools Design

Unit 1: Tooling Requirements for Numerical Control Systems

Unit 2: Fixture Design for CNC Machine Tools

Unit 3: Universal Fixtures, Cutting Tools and Tool Holding Methods

Unit 4: Automatic Tool Changers and Tool Positioners, Tool Presetting

Books:

1. Cyril Donaldson, George H. LeCain, V.C. Goold, "Tool Design", Tata McGraw Hill Publishing Company Ltd
2. Venkataraman K., "Design of Jigs, Fixtures and Press tools", TMH
3. Haslehurst M., "Manufacturing Technology", the ELBS
4. Pollack H.W., "Tool Design" Reston Publishing Company, Inc.
5. Joshi P.H., "Jigs and Fixtures, Tata Mc-Graw Hill
6. Hiram E. Grant, "Jigs and Fixtures, Tata Mc-Graw Hill
7. Prakash Hiralal Joshi, "Tooling data", Wheeler Publishing
8. E.G.Hoffman, "Jig and Fixture Design", Thomson Asia Pvt Ltd, Singapore

ELECTIVE

Subject Code : MTE002

Subject Title : Integrated Mechanical Design

Structure of the Course Content

BLOCK 1 Fundamentals of Mechanical Design

Unit 1: Phases of Design

Unit 2: Standardization and Interchange ability of Machine Elements

Unit 3: Selection of Fits for Different Design Situations

Unit 4: Design for Assembly and Modular Constructions

BLOCK 2 Designs of Shafts

Unit 1: Principal Stresses, Maximum Shear Stress and Theories of Failure

Unit 2: Ductile vs. Brittle Component Design

Unit 3: Analysis and Design of Shafts for Different Applications

Unit 4: Integrated Design of Shaft, Bearing and Casing, Design for Rigidity

BLOCK 3 Designs of Gear and Gear Boxes

Unit 1: Principles of Gear Tooth Action

Unit 2: Gear Correction, Gear Tooth Failure Modes

Unit 3: Component Design of Spur, Helical, Bevel and Worm Gears

Unit 4: Integrated Design of Speed Reducers and Multi-Speed Gear Boxes

BLOCK 4 Designs of Brakes

Unit 1: Dynamics and Thermal Aspects of Vehicle Braking

Unit 2: Integrated Design of Brakes for Machine Tools

Unit 3: Integrated Design of Brakes for Automobiles

Unit 4: Integrated Design of Brakes for Mechanical Handling Equipments

BLOCK 5 Integrated Designs

Unit 1: Integrated Design of Systems Consisting of Shaft, Bearings

Unit 2: Integrated Design of Systems Consisting of springs, Motor

Unit 3: Integrated Design of Systems Consisting of Gears, Belt, Rope

Unit 4: Integrated Design of Systems Consisting of Chain, Pulleys, Cam

Books:

1. Maitra G.M., "Hand Book of Gear Design", Tata McGraw Hill
2. Alexandrov, M., Materials Handling Equipments, MIR Publishers
3. Norton L. R., "Machine Design – An Integrated Approach" Pearson Education
4. Newcomb, T.P. and Spur, R.T., "Automobile Brakes and Braking Systems", Chapman and Hall, 2nd Edition
5. Shigley, J.E., "Mechanical Engineering Design", McGraw Hill
6. Prasad. L. V., "Machine Design", Tata McGraw Hill, New Delhi
7. Boltzharol, A., Materials Handling Handbook, The Ronald Press Company
8. P.S.G. Tech., "Design Data Book", Kalaikathir Achchagam, Coimbatore
9. Lingaiah. K. and Narayana Iyengar, "Machine Design Data Hand Book",

Vol. 1 & 2, Suma Publishers, Bangalore

ELECTIVE

Subject Code : MTE003

Subject Title : Optimization Techniques in Design

Structure of the Course Content

BLOCK 1 Unconstrained Optimization Techniques

Unit 1: Introduction to Optimum Design

Unit 2: General Principles of Optimization

Unit 3: Single Variable and Multivariable Optimization

Unit 4: Golden Section, Random, Pattern and Gradient Search Methods

BLOCK 2 Constrained Optimization Techniques

Unit 1: Optimization with Equality and Inequality Constraints

Unit 2: Direct Methods, Indirect Methods Using Penalty Functions

Unit 3: Direct Methods, Indirect Methods Using Lagrange Multipliers

Unit 4: Geometric Programming

BLOCK 3 Advanced Optimization Techniques

Unit 1: Multi Stage Optimization

Unit 2: Dynamic Programming, Stochastic Programming

Unit 3: Genetic Algorithms and Simulated Annealing Techniques

Unit 4: Neural Network and Fuzzy Logic Principles in Optimization

BLOCK 4 Static Applications

Unit 1: Structural Applications, Design of Simple Truss Members

Unit 2: Design Applications, Design of Simple Axial

Unit 3: Design of Shafts and Torsionally Loaded Members

Unit 4: Design of springs

BLOCK 5 Dynamic Applications

Unit 1: Dynamic Applications

Unit 2: Optimum Design of Single, Two Degree of Freedom Systems,

Unit 3: Application in Mechanisms

Unit 4: Optimum Design of Simple Linkage Mechanisms

Books:

1. Rao, Singaresu, S., "Engineering Optimization – Theory & Practice", New Age International (P) Limited, New Delhi
2. Johnson Ray, C., "Optimum design of mechanical elements", Wiley, John & Sons
3. Goldberg, D.E., "Genetic algorithms in search, optimization and machine", Barmen, Addison-Wesley, New York
4. Kalyanamoy Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall of India Pvt.

ELECTIVE

Subject Code : MTE004

Subject Title : Mechanical Vibration

Structure of the Course Content

BLOCK 1 Fundamentals of Vibration

Unit 1: Introduction, Sources of Vibration and Mathematical Models

Unit 2: Displacement, Velocity and Acceleration

Unit 3: Vibration Isolation Vibrometers and Accelerometers

Unit 4: Transient Vibration, Impulse loads, Critical Speed of Shaft-Rotor Systems.

BLOCK 2 Two Degree Freedom Systems

Unit 1: Introduction of Two Degree Freedom Systems

Unit 2: Free Vibration of Undamped and Damped

Unit 3: Forced Vibration with Harmonic Excitation System

Unit 4: Coordinate Couplings and Principal Coordinates

BLOCK 3 Multi Degree Freedom Systems

Unit 1: Influence Coefficients and Stiffness Coefficients

Unit 2: Flexibility Matrix and Stiffness Matrix

Unit 3: Dunkerley, Rayleigh's, and Holzer Method

Unit 4: Continuous System, Vibration of String, Shafts and Beams

BLOCK 4 Vibration Control

Unit 1: Specification of Vibration Limits, Vibration Severity Standards

Unit 2: Vibration as Condition Monitoring Tool, Vibration Isolation methods

Unit 3: Damped Vibration Absorbers

Unit 4: Vibration Control by Design Modification, Active Vibration Control

BLOCK 5 Vibration Analyses

Unit 1: Experimental Methods in Vibration Analysis

Unit 2: Vibration Measuring Instruments, Selection of Sensors

Unit 3: Vibration Exciters, Mechanical, Hydraulic, Electromagnetic

Unit 4: Frequency Measuring Instruments

Books:

1. Rao, S.S., "Mechanical Vibrations," Addison Wesley Longman
2. Ramamurti. V, "Mechanical Vibration Practice with Basic Theory", Narosa, New Delhi
3. S. Graham Kelly & Shashidar K. Kudari, "Mechanical Vibrations", Tata McGraw Hill Publishing Com. Ltd New Delhi
4. Thomson, W.T. – "Theory of Vibration with Applications", CBS Publishers and Distributors, New Delhi

ELECTIVE

Subject Code : MTE005

Subject Title : Flexible Competitive Manufacturing System

Structure of the Course Content

BLOCK 1 Manufacturing in Competitive Environment

Unit 1: Automation of Manufacturing Process

Unit 2: Numerical Control and Adaptive control

Unit 3: Industrial Robots and Sensor Technology

Unit 4: Design for Assembly, Disassembly and Service

BLOCK 2 Group Technologies

Unit 1: Part Families, Classification and Coding

Unit 2: Production Flow Analysis

Unit 3: Machine Cell Design

Unit 4: Benefits of Group Technology

BLOCK 3 Flexible Manufacturing Systems

Unit 1: Components of FMS, Application Workstations

Unit 2: Computer Control and Functions, Planning, and Control of FMS

Unit 3: Scheduling, Knowledge Based Scheduling

Unit 4: Hierarchy of Computer Control, Supervisory Computer

BLOCK 4 Computer Software and Simulation of FMS

Unit 1: System Issues, Types of Software, Specification and Selection

Unit 2: Trends, Application of Simulation, Software

Unit 3: Manufacturing Data Systems and Data Flow

Unit 4: CAD/CAM Considerations and Planning FMS Database.

BLOCK 5 Just In Time

Unit 1: Characteristics of JIT, Pull method

Unit 2: Small Lot Sizes, Work Station Loads and Close Supplier Ties

Unit 3: Flexible Work Force, Line Flow Strategy

Unit 4: Strategic Implications, Implementation Issues

Books:

1. Groover M.P., "Automation, Production Systems and Computer Integrated Manufacturing", Prentice-Hall of India Pvt. Ltd., New Delhi
2. Kalpakjian, "Manufacturing Engineering and Technology", Addison-Wesley Publishing Co
3. Jha, N.K., "Handbook of Flexible Manufacturing Systems", Academic Press Inc
4. Taiichi Ohno, Toyota, "Production System Beyond Large-Scale production", Productivity Press (India) Pvt.Ltd

ELECTIVE

Subject Code : MTE006

Subject Title : Design for Manufacture, Assembly and Environments

Structure of the Course Content

BLOCK 1 Introduction to Design for Manufacturing

Unit 1: General Design Principles for Manufacturability

Unit 2: Strength and Mechanical Factors, Mechanisms Selection

Unit 3: Evaluation Method, Process Capability and Feature Tolerances

Unit 4: Assembly Limits, Datum Features, Tolerance Stacks

BLOCK 2 Factors Influencing Form Design

Unit 1: Working Principle, Material, Manufacture

Unit 2: Design, Possible Solutions and Materials Choice

Unit 3: Influence of Materials on Form Design

Unit 4: Form Design of Welded Members, Forgings and Castings

BLOCK 3 Component Design for Machining Consideration

Unit 1: Design Features to Facilitate Machining, Drills and Milling Cutters

Unit 2: Doweling Procedures, Counter Sunk Screws

Unit 3: Simplification by Separation, Simplification by Amalgamation

Unit 4: Design for Machinability, Design for Economy, Design for Clampability

BLOCK 4 Component Design for Casting Consideration

Unit 1: Redesign of Castings Based on Parting Line Considerations

Unit 2: Minimizing Core Requirements, Machined Holes

Unit 3: Identification of Uneconomical Design

Unit 4: Modifying the Design, Group Technology

BLOCK 5 Designs for the Environment

Unit 1: Environmental Objectives, Global Issues

Unit 2: Regional and Local Issues, Basic DFE Methods

Unit 3: Weighted Sum Assessment Method, Lifecycle Assessment Method

Unit 4: Design for Disassembly, Design for Recyclability

Books:

1. Boothroyd, G, 1980 Design for Assembly Automation and Product Design. New York, Marcel Dekker
2. Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA
3. Keven Otto and Kristin Wood, Product Design. Pearson Publication
4. Bralla, Design for Manufacture handbook, McGraw hill
5. Boothroyd, G, Hertz and Nike, Product Design for Manufacture, Marcel Dekker
6. Fixel, J. Design for the Environment McGraw hill
7. Graedel T. Allen By. B, Design for the Environment Angle Wood Cliff, Prentice Hall. Reason Pub

ELECTIVE

Subject Code : MTE007

Subject Title : Mechatronics in Manufacturing Systems

Structure of the Course Content

BLOCK 1 Introduction to Mechatronics

Unit 1: Introduction to Mechatronics and Systems

Unit 2: Need for Mechatronics, Emerging Area of Mechatronics

Unit 3: Classification of Mechatronics

Unit 4: Measurement Systems and Control Systems.

BLOCK 2 Sensors and Transducers

Unit 1: Introduction, Performance Terminology and Potentiometers

Unit 2: LVDT, Capacitance Sensors, Strain Gauges and Eddy Current Sensor

Unit 3: Hall Effect Sensor, Temperature Sensors and Light Sensors

Unit 4: Selection of Sensors and Signal Processing

BLOCK 3 Actuators

Unit 1: Actuators, Mechanical and Electrical

Unit 2: Fluid Power, Piezoelectric and Magnetostrictive

Unit 3: Shape Memory Alloy and Applications

Unit 4: Selection of Actuators

BLOCK 4 Programmable Logic Controllers

Unit 1: Introduction, Basic Structure

Unit 2: Input and Output Processing

Unit 3: Programming, Mnemonics, Timers, Counters and Internal Relays

Unit 4: Data Handling and Selection of PLC

BLOCK 5 Case Studies in Mechatronics

Unit 1: Designing, Possible Design Solutions

Unit 2: Traditional and Mechatronics Design Concepts

Unit 3: Pick and Place Robot, Conveyor Based Material Handling System

Unit 4: PC based CNC Drilling Machine, Engine Management System

Books:

1. Bolton.W, "Mechatronics", Pearson education, second edition, fifth Indian Reprint
2. Smaili.A and Mrad.F, "Mechatronics integrated technologies for intelligent machines", Oxford university press
3. Devadas Shetty and Richard A.Kolk, "Mechatronics systems design", PWS
4. Godfrey C. Onwubolu, "Mechatronics Principles and Applications", Elsevier
5. Nitaigour Premchand Mahalik, "Mechatronics Principles, Concepts and Applications" Tata McGraw-Hill Publishing company Limited
6. Michael B.Histand and Davis G.Alciatore," Introduction to Mechatronics and Measurement systems". McGraw Hill International edition
7. Bradley D.A, Dawson.D, Buru N.C and Loader A.J, "Mechatronics" Nelson Thornes ltd, Eswar press, Indian print
8. Lawrence J.Kamm, "Understanding Electro-Mechanical Engineering – An Introduction to Mechatronics", Prentice Hall of India Pvt Ltd,
9. Dan Neculescu, "Mechatronics", Pearson education
10. Newton C.Braga, "Mechatronics Sourcebook", Thomson Delmar Learning, Eswar

ELECTIVE

Subject Code : MTE008

Subject Title : Industrial Safety Management

Structure of the Course Content

BLOCK 1 Safety Management

Unit 1: Evaluation of Modern Safety Concepts, Safety Management Functions

Unit 2: Safety Organization, Safety Department, Safety Committee

Unit 3: Safety Audit, Performance Measurements and Motivation

Unit 4: Employee Participation in Safety, Safety and Productivity

BLOCK 2 Operational Safeties

Unit 1: Hot Metal Operation, Boiler, Pressure Vessels, Heat Treatment Shop

Unit 2: Gas Furnace Operation, Electroplating and hot Bending Pipes

Unit 3: Safety in Welding and Cutting, Safety in Machine shop

Unit 4: Cold Bending and Chamfering of Pipes, Metal Cutting

BLOCK 3 Safety Measures

Unit 1: Layout Design and Material Handling, Use of Electricity

Unit 2: Management of Toxic Gases, Industrial Fires and Prevention

Unit 3: Road Safety, Highway and Urban Safety, Safety of Sewage Disposal

Unit 4: Control of Environmental Pollution, Managing Emergencies in Industries

BLOCK 4 Accident Prevention

Unit 1: Human Side of Safety, Personal Protective Equipment

Unit 2: Causes and Cost of Accidents. Accident Prevention Programmes

Unit 3: Specific Hazard Control Strategies

Unit 4: Training and Development of Employees and First Aid

BLOCK 5 Safety, Health, Welfare and Laws

Unit 1: Safety and Health Standards, Industrial Hygiene

Unit 2: Occupational Diseases Prevention, Welfare Facilities

Unit 3: History of Legislations Related to Safety, Pressure Vessel Act

Unit 4: Indian boiler Act, The Environmental Protection Act

Books:

1. John V. Grimaldi and Rollin H. Simonds, "Safety Management", All India Travellers bookseller, New Delhi
2. Krishnan N.V., "Safety in Industry", Jaico Publishery House
3. Singh, U.K. and Dewan, J.M., "Safety, Security and risk management", APH Publishing Company, New Delhi
4. Occupational Safety Manual BHEL
5. Industrial safety and the law by P.M.C. Nair Publisher's, Trivandrum
6. Managing emergencies in industries, Loss Prevention of India Ltd., Proceedings
7. Safety security and risk management by U.K. Singh & J.M. Dewan, A.P.H. Publishing company, New Delhi

ELECTIVE

Subject Code : MTE009

Subject Title : Manufacturing System & Simulation

Structure of the Course Content

BLOCK 1 Introduction to manufacturing System

Unit 1: Basic Concepts of System, Elements of Manufacturing System

Unit 2: Concept of Simulation, Simulation as a Decision Making Tool

Unit 3: Types of Simulation, Monte-Carlo simulation, System Modelling

Unit 4: Types of Modelling, Limitations and Areas of Application of Simulation.

BLOCK 2 Random Numbers

Unit 1: Probability and Statistical Concepts of Simulation

Unit 2: Pseudo Random Numbers, Methods of Generating Random Numbers

Unit 3: Discrete and Continuous Distribution, Testing of Random Numbers

Unit 4: kolmogorov-Smirnov Test, The Chi-Square Test and Sampling

BLOCK 3 Designs of Simulation Experiments

Unit 1: Problem Formulation, Data Collection and Reduction

Unit 2: Time Flow Mechanical, key Variables, Logic Flow Chart

Unit 3: Experimental Design Consideration, Output Analysis, Interpretation

Unit 4: Application of Simulation in Engineering Industry.

BLOCK 4 Simulation Languages

Unit 1: Comparison and Selection of Simulation Languages

Unit 2: Study of GPSS (Basic blocks only) Generate, Queue

Unit 3: Depart, Size, Release, Advance, Terminate

Unit 4: Transfer, Enter and Leave.

BLOCK 5 Case Studies

Unit 1: Development of Simulation Models Using GPSS for Queuing

Unit 2: Development of Simulation Models Using GPSS for Production

Unit 3: Development of Simulation Models Using GPSS for Inventory

Unit 4: Development of Simulation Models Using GPSS for Maintenance

Books:

1. Jerry Banks and John S. Carson, "Discrete event system simulation", Prentice Hall
2. Geoffrey Gordon "System simulation" – Prentice Hall of India
3. Averill M. Law and W. David Kelton, "Simulation Modelling and analysis", McGraw Hill International Editions
4. John H. Mize and J. Grady Cox, "Essentials of simulation" – Prentice hall
5. Jeffrey L. Written, Lonnie D. Bentley and V.M. Barice, "System analysis and Design Methods", Galgotia publication

ELECTIVE

Subject Code : MTE010

Subject Title : Metrology and Non Destructive Testing

Structure of the Course Content

BLOCK 1 Measuring Machines

Unit 1: Tool Maker's Microscope, Co-ordinate Measuring Machines

Unit 2: Universal Measuring Machine, Laser viewers for production profile checks

Unit 3: Image Shearing Microscope, Use of computers

Unit 4: Machine Vision Technology, Microprocessors in Metrology

BLOCK 2 Statistical Quality Control

Unit 1: Data Presentation, Statistical Measures and Tools

Unit 2: Process Capability, Confidence and Tolerance Limits

Unit 3: Control Charts for Variables and Fraction Defectives

Unit 4: Sampling, ABC Standard, Reliability and Life Testing

BLOCK 3 Liquid Penetrant and Magnetic Particle Tests

Unit 1: Characteristics of Liquid Penetrants

Unit 2: Different Washable Systems, Developers and Applications

Unit 3: Methods of Production of Magnetic Fields

Unit 4: Principles of Operation of Magnetic Particle Test

BLOCK 4 Radiography

Unit 1: Sources of ray, x-ray Production

Unit 2: Properties of d and x rays

Unit 3: Film Characteristics, Exposure Charts, Contrasts

Unit 4: Operational Characteristics of x ray Equipment

BLOCK 5 Ultrasonic and Acoustic Emission Techniques

Unit 1: Production of Ultrasonic waves

Unit 2: Different Types of Waves

Unit 3: General Characteristics of waves, Pulse Echo Method, A, B, C Scans

Unit 4: Principles of Acoustic Emission Techniques

Books:

1. JAIN, R.K. " Engineering Metrology ", Khanna Publishers
2. Barry Hull and Vernon John, " Non Destructive Testing ", MacMillan
3. American Society for Metals, "Metals Hand Book"
4. Progress in Acoustic Emission, " Proceedings of 10th International Acoustic
5. Emission Symposium ", Japanese Society for NDI
6. www.metrologytooling.com
7. www.sisndt.com
8. www.iuk'tu-harburg.de

ELECTIVE

Subject Code : MTE011

Subject Title : Maintenance Management

Structure of the Course Content

BLOCK 1 Introduction to Maintenance system

Unit 1: Introduction to Repair and Maintenance

Unit 2: Maintenance Systems Such as Reactive, Preventive, Predictive Systems

Unit 3: Human Resources Management in Maintenance Management

Unit 4: Design for Maintenance

BLOCK 2 Condition Based Maintenance

Unit 1: Condition Based Monitoring of Equipment and Systems

Unit 2: Vibration Analysis, Ultrasonic Detection Techniques

Unit 3: Oil and Lubricant Analysis, Motor Condition Monitoring

Unit 4: Shaft Alignments through Laser, Vibration Instruments

BLOCK 3 RCM, TPM, and CMMS

Unit 1: Reliability Centred Maintenance, Failure Mode and Effect Analysis

Unit 2: Root Cause Analysis, Logic Tree Analysis and Criticality Matrix

Unit 3: Lean Manufacturing, TPM and TPO

Unit 4: Computerized Maintenance Management System in a Business Scenario

BLOCK 4 Assets Planning and Scheduling of Activities in Maintenance

Unit 1: Asset and Spare Part Management

Unit 2: Latest Trends in Monitoring through Bar Codes

Unit 3: Different Aspects of Planning and Scheduling of Maintenance

Unit 4: Bar Charts, PERT Network during Shut Down

BLOCK 5 Safety and Other Aspects of Maintenance Functions

Unit 1: Safety Engineering, Hazard Analysis

Unit 2: General Rules and Guidelines in Safety and Hazard Prevention

Unit 3: Fault Tree Analysis, Sneak Circuit Analysis

Unit 4: Integrated Approach to Maintenance

Books:

1. Maintenance Engineering and Management”: K.Venkataraman-PHI Learning
2. Kelly. A and Harris, M. J, “Management of Industrial maintenance”, Butterworth & Co
3. John V.Grimaldi & Rollin H.Simonds, “Safety Management”, AITBS Publishers & Distributors
4. David J. Smith, “Reliability and Maintainability in Perspective”, McMillan,2nd Edition
5. Gwidon W Stachowiak and Andrew W. Batchelor, “Engineering Tribology”, Butterwork-Heinmann

ELECTIVE

Subject Code : MTE012

Subject Title : Integrated Product and Process Development

Structure of the Course Content

BLOCK 1 Introduction to IPPD

Unit 1: Need for IPPD, Strategic Importance of Product Development

Unit 2: Integration of Customer, Designer, Material Supplier and Process Planner

Unit 3: Behaviour Analysis, Understanding Customer

Unit 4: Organization Process Management and Improvement

BLOCK 2 Concept Generation, Selection and Testing

Unit 1: Plan and Establish Product Specifications, Task

Unit 2: Structured Approaches, Clarification, Search, Externally and Internally

Unit 3: Concept Selection, Methodology, Benefits and Implications

Unit 4: Product Change, Variety and Component Standardization

BLOCK 3 Product Architecture

Unit 1: Product Development Management, Establishing the Architecture

Unit 2: Creation, Clustering, Geometric Layout Development

Unit 3: Related System Level Design Issues and Secondary Systems

Unit 4: Creating Detailed Interface Specifications and Portfolio Architecture

BLOCK 4 Industrial Designs

Unit 1: Integrate Process Design, Managing Costs, Robust Design

Unit 2: Integrating CAE, CAD, CAM Tools

Unit 3: Need for Industrial Design, Impact and Design Process

Unit 4: Technology Driven Products, User and Driven Products

BLOCK 5 Designs for Manufacturing and Product Development

Unit 1: Definition, Estimation of Manufacturing Cost

Unit 2: Reducing the Component Costs and Assembly Costs

Unit 3: Prototype Basics, Principles of Prototyping, Planning for Prototypes

Unit 4: Accelerating the Project and Project Execution

Books:

1. Product Design and Development, Karl T. Ulrich and Steven D. Eppinger, McGraw –Hill International Edns
2. Effective Product Design and Development, Stephen Rosenthal, Business One Orwin, Homewood
3. Tool Design – Integrated Methods for successful Product Engineering, Stuart Pugh, Addison Wesley Publishing, New York, NY
4. Concurrent Engg./Integrated Product Development. Kenneth Crow, DRM Associates, 6/3, Via Olivera, Palos Verdes, CA 90274 (310) 377-569, Workshop Book

ELECTIVE

Subject Code : MTE013

Subject Title : Fluid Power Automation

Structure of the Course Content

BLOCK 1 Introduction to Automation

Unit 1: Need for Automation

Unit 2: Hydraulic & Pneumatic Comparison

Unit 3: ISO Symbols for Fluid Power Elements, Hydraulic, Pneumatics

Unit 4: Selection Criteria

BLOCK 2 Fluid Power Generating Elements

Unit 1: Hydraulic Pumps and Motor Gears, Vane, Piston Pumps

Unit 2: Motors, Selection and Specification, Drive Characteristics, Linear Actuator

Unit 3: Types, Mounting Details, Cushioning, Power Packs and Construction

Unit 4: Reservoir Capacity, Heat Dissipation, Accumulators

BLOCK 3 Control and Regulation Elements

Unit 1: Direction Flow and Pressure Control Valves

Unit 2: Methods of Actuation, Types, Sizing of Ports

Unit 3: Pressure and Temperature Compensation

Unit 4: Electro Hydraulic Servo Valves, Different Types

BLOCK 4 Circuit Design

Unit 1: Typical Industrial Hydraulic Circuits

Unit 2: Design Methodology, Ladder Diagram

Unit 3: Cascade, Method-Truth Table-Karnaugh Map Method

Unit 4: Sequencing Circuits, Combinational and Logic Circuit.

BLOCK 5 Electro Pneumatic and Hydraulic Circuits

Unit 1: Electrical Control of Pneumatic and Hydraulic Circuits

Unit 2: Use of Relays, Timers, Counters, Ladder Diagram

Unit 3: Programmable Logic Control of Hydraulics Pneumatics Circuits

Unit 4: Electronic Drive Circuits for Various Motors

Books:

1. Antony Esposito, Fluid Power Systems and control Prentice-Hall
2. Durbey.A.Peace, Basic Fluid Power, Prentice Hall Inc
3. Peter Rohner, Fluid Power Logic Circuit Design, Mcmelan Prem
4. Herbert R. Merritt, Hydraulic control systems, John Wiley & Sons, Newyork
5. E.C.Fitch and J.B.Suryaatmady. Introduction to fluid logic, McGraw Hill
6. W.Bolton, Mechatronics, Electronic control systems in Mechanical and Electrical Engineering Pearson Education
7. Peter Rohner, Fluid Power Logic Circuit Design, Mcmelan Prem

ELECTIVE

Subject Code : MTE014

Subject Title : Advances in Casting and Welding

Structure of the Course Content

BLOCK 1 Casting Design

Unit 1: Heat Transfer between Metal and Mould

Unit 2: Design considerations in casting

Unit 3: Designing for directional solidification and minimum stresses

Unit 4: Principles and design of gating and risering

BLOCK 2 Casting Metallurgy

Unit 1: Solidification of pure metal and alloys

Unit 2: Shrinkage in cast metals

Unit 3: Progressive and directional solidification

Unit 4: Degasification of the melt-casting defects

BLOCK 3 Recent Trends in Casting and Foundry Layout

Unit 1: Shell moulding, precision investment casting, CO₂ moulding

Unit 2: Centrifugal casting, Die casting, Continuous casting

Unit 3: Counter gravity low pressure casting, Squeeze casting

Unit 4: Computer aided design of casting

BLOCK 4 Welding Metallurgy and Design

Unit 1: Heat affected Zone and its characteristics

Unit 2: Carbon Equivalent of Plain and alloy steels Hydrogen embrittlement

Unit 3: Lamellar tearing – Residual stress – Distortion and its control

Unit 4: Analysis of stresses in welded structures

BLOCK 5 Recent Trends in Welding

Unit 1: Friction welding, frictions stir welding – explosive welding

Unit 2: Diffusion bonding, high frequency induction welding

Unit 3: Electro slag welding- narrow gap, hybrid twin wire active TIG

Unit 4: Hot gas, wave and vapour phase soldering

Books:

1. Parmer R.S., Welding Engineering and Technology, Khanna Publishers
2. Jain P.L., Principles of Foundry Technology, Tata McGrawHill Publishers
3. LANCASTER.J.F. – Metallurgy of welding – George Alien & Unwin Publishers
4. ASM Handbook, Vol 15, Casting
5. ASM Handbook vol.6, welding Brazing & Soldering
6. Srinivasan N.K., Welding Technology, Khanna Tech Publishers
7. HEINELOPER & ROSENTHAL, Principles of Metal Casting, Tata McGraw
8. Carry B., Modern Welding Technology, Prentice Hall Pvt Ltd
9. IOTROWSKI – Robotic welding – A guide to selection and application – Society of mechanical Engineers
10. CORNU.J. Advanced welding systems – Volumes I, II and III, JAICO Publishers
11. SCHWARIZ, M.M. – Source book on innovative welding processes – American Society for Metals (OHIO)

ELECTIVE

Subject Code : MTE015

Subject Title : Total Quality Management

Structure of the Course Content

BLOCK 1 Introduction to TQM

Unit 1: Need for TQM, evolution of quality

Unit 2: Definition of quality, TQM philosophy

Unit 3: CONTRIBUTIONS OF Deming Juran

Unit 4: Crosby and Ishikawa, TQM models

BLOCK 2 Planning

Unit 1: Vision, Mission, Quality policy and objective Planning for quality

Unit 2: Quality policy Deployment

Unit 3: Quality function deployment

Unit 4: Introduction to BPR and analysis of Quality Costs.

BLOCK 3 TQM Principles

Unit 1: Customer focus, Leadership and Top management commitment

Unit 2: Employee involvement – Empowerment and Team work

Unit 3: Supplier Quality Management, Continuous process improvement

Unit 4: Training, performance Measurement and customer satisfaction

BLOCK 4 TQM Tools and Techniques

Unit 1: PDCA, the Seven Tools of Quality

Unit 2: New Seven management tools

Unit 3: Concept of six sigma, FMEA, Bench Marking

Unit 4: JIT, POKA YOKE, 5S, KAIZEN, Quality circles

BLOCK 5 Quality Systems

Unit 1: Need for ISO 9000 Systems

Unit 2: Clauses Documentation, Implementation

Unit 3: Introduction to ISO14000 and OSHAS18000

Unit 4: Implementation of TQM, Case Studies

Books:

1. Dale H.Besterfield, “Total Quality Management”, Pearson Education Asia, (Indian reprint)
2. Oakland.J.S. “Total Quality Management”, Butterworth–Heinemann Ltd., Oxford
2. Brain Rethery, ISO 9000, Productivity and Quality Publishing Pvt. Ltd
3. Narayana V. and Sreenivasan, N.S., “Quality Management – Concepts and Tasks”, New Age International
4. Zeiri. “Total Quality Management for Engineers”, Wood Head Publishers
5. Juran J.M and Frank M.Gryna Jr., “Quality Planning and Analysis”, TMH, India
6. D.Mills, Quality Auditing, Chapman and Hall

ELECTIVE

Subject Code : MTE016

Subject Title : Maintenance and Reliability Engineering

Structure of the Course Content

BLOCK 1 Introduction to Reliability

Unit 1: Reliability function

Unit 2: MTBF - MTTF

Unit 3: Mortality curve

Unit 4: Availability -Maintainability

BLOCK 2 Failure Data Analysis

Unit 1: Repair time distributions

Unit 2: Exponential, normal, log normal, gamma, and Weibull

Unit 3: Reliability data requirements

Unit 4: Graphical evaluation

BLOCK 3 Reliability Predictions

Unit 1: Failure rate estimates

Unit 2: Effect of environment and stress

Unit 3: Series and Parallel systems - RDB analysis

Unit 4: Standby Systems - Complex Systems

BLOCK 4 Reliability Management

Unit 1: Reliability demonstration testing

Unit 2: Reliability growth testing

Unit 3: Duane curve -Risk assessment

Unit 4: FMEA, Fault tree

BLOCK 5 Total Productive Maintenance

Unit 1: Causes of Machine Failures - Downtime - Maintenance policies

Unit 2: Restorability predictions - Replacement models - Spares provisioning

Unit 3: Maintenance management – Total Productive Maintenance

Unit 4: Organizing for TPM implementation

Books:

1. Paul Kales, "Reliability for technology Engineering and Management ", Prentice Hall, New Jersey
2. Gopalakrishnan.P, and Banerji A.K., "Maintenance and Spare Parts Management ", Prentice Hall of India, New Delhi
3. Nakajima, Seiichi, "Introduction to TPM", Productivity Press
4. Andrew K.S.Jardine & Albert H.C.Tsang, "Maintenance, Replacement and Reliability", Taylor and Francis
5. Bikas Badhury & S.K.Basu, "Tero Technology: Reliability Engineering and Maintenance Management", Asian Books
6. Seiichi Nakajima, "Total Productive Maintenance", Productivity Press
7. Charles E. Ebeling, "An introduction to Reliability and Maintainability Engg, TMH
8. Roy Billington and Ronald N. Allan, "Reliability Evaluation of Engineering Systems", Springer
9. Andrew K.S.Jardine & Albert H.C.Tsang, "Maintenance, Replacement and Reliability", Taylor and Francis