SCHOOL OF MECHANICAL AND BUILDING SCIENCES

CURRICULUM

M.Tech Manufacturing Engg.

(2014 - 15 Onwards)

University Core

<table>
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<tr>
<th>S.No</th>
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University Elective

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Programme Core

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## Programme Elective

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Total Credits to be taken: 19

### Credit Summary

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<td>Objectives</td>
<td>To develop the professional and communication skills of learners in a technical environment. To enable the students to acquire functional and technical writing skills. To acquire state-of-the-art presentation skills in order to present technical topics to both technical and non-technical audience.</td>
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<td>Expected Outcome</td>
<td>The learners will be able to exhibit their language proficiency and skill in Describing, Investigating, Designing and Making and Using Technology.</td>
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### Unit 1
**Functional Language**
Basic structures - Tense agreement, Prepositional phrases
Techno-words: Basic Concepts 62,63
Pronunciation: sounds of syllables: Past tense & plural endings

**Technical Expression**
Organizational techniques in technical writing
Guided writing: Paragraph Writing, Note Making

**Presentation Skills**
Techniques of presentation (general topics: speech without visual aids)
Listening to speeches and comprehending

**Graphical Skills**
Flow chart: Process and Functional description

### Unit 2
**Functional Language**
Basic structures - Voice, Conditionals
Techno-words: Basic Concepts 64,65,67
Pronunciation: Word Stress: two syllable words

**Technical Expression**
Mechanics of Technical Writing and Syntax
Guided writing: Letter and email

**Presentation Skills**
Interpersonal Communication Skills
Writing techniques for Power point presentation, Group Discussion

**Graphical Skills**
Technical Illustrations and Instructions

### Unit 3
**Functional Language**
Basic structures - Modal Verbs and Phrasal verbs
Techno-words: Basic Concepts 68,69,70,71
Pronunciation: Word Stress: compound words

**Technical Expression**
Mechanics of Technical Writing and Syntax
Guided writing: Technical Description

**Presentation Skills**
Career advancement: Technical Resume and Company Profile Presentation and Group Discussion

**Graphical Skills**
Pie chart, Bar chart, Line graphs: analysis and interpretation

### Unit 4
**Functional Language**
Basic structures - Modal Verbs and Phrasal verbs
Techno-words: Basic Concepts 72,73,74, Functional vocabulary 87
Pronunciation: Sentence Stress

**Technical Expression**
Guided and Free writing: Abstract and Technical articles
Presentation Skills

Nuances of Presentation to a Technical audience

Graphical Skills

Oral Presentation of graphical representation

Text Books & Software


Sky Pronunciation CD-ROM

Cambridge Advanced Learner’s Dictionary CD-ROM

Reference Books


Mode of Evaluation

Online quizzes, Speaking Skills tests, PowerPoint presentation

Recommended by the Board of Studies on: 12.05.2012
Date of approval by the Academic Council: 18.05.2012
Aims & Objectives:
The aim of this course is to introduce the concepts of solving Partial Differential equations by reducing to normal forms, finding solutions of differential equations by using the principles of calculus of variations along with Eigen Value problems and iteration methods.

Expected Outcome:
Upon completion of this course the student shall be able to:

- Acquire good knowledge of solving differential, Partial differential equations
- Solve Eigen value problems with relevant applications in their discipline

Unit-I
Boundary Value Problems Linear second order partial differential equations in two independent variables - normal forms -
hyperbolic, parabolic and elliptic equations - Cauchy problem.

Unit-II
Wave equations equations - solution of initial value problem - significance of characteristic curves-
Laplace transform solutions - displacements in a long string - along string under its weight - a bar
with prescribed force on one end - free vibrations of a string.

Unit-III
Calculus of variations Concepts of functional and their stationary values - Euler’s equation and solution
for the problem and for more general causes - natural boundary conditions - variational problems
with moving boundaries - condition variational problems - Isoparametric problems-Direct
Methods: Ritz,
Kantorovich and Galerkin techniques

Unit-IV
Eigen Value Problems Standard Eigen value problems - properties of Eigen values and Eigen vectors
- Generalized Eigen value problems - strum sequence - Jacobi, Givens and Householder
transformations.

Unit-V
Iteration Problems Forward and inverse iteration schemes - Graham Schmidt deflation -
simultaneous iteration method - subspace iteration - Lanczo’s algorithm - Estimation of core
and time requirements.

References:

Mode of Evaluation: Written Examination/ Assignment/ Seminar

**Recommended by the Board of Studies on:** 14 July 2011
**Date of approval by the Academic Council:** 30 Aug 2011
Objective: To introduce the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics.

Expected Outcome: Upon completion of this course, the student will be able to:
- Derive finite element stiffness and mass matrices
- Analyze linear solid mechanics or heat-transfer problems using commercial FEM codes.

**Unit I**  
**Fundamental Concepts**

Physical problems, Mathematical models, and Finite Element Solutions. Finite Element Analysis as Integral part of Computer Aided Design.; Stresses and Equilibrium; Boundary Conditions; Strain-Displacement Relations; Stress –strain relations, Linear and nonlinear material laws; Temperature Effects; Definition of Tensors and indicial notations; Deformation gradients; Classification of different types of deformations: Deformations and stresses in bars, thin beams, thick beams, plane strain- plane stress hypothesis, thin plate, thick plate, axisymmetric bodies.; Approximate nature of most of these deformation hypotheses; General 3D deformation (linear small deformation), Large deformation (nonlinear).

**Unit II**  
**General Techniques and Tools of Displacement Based Finite Element Analysis**

Energy and Variational principles for boundary value problems; Strong, or classical, form of the problem and weak, or Variational, form of the problem; Integral Formulations; Galerkin’sand Weighted residual approaches; Shape and interpolation functions for 1D, 2D & 3D applications; Use of shape (interpolation) functions to represent general displacement functions and in establishment of coordinate and geometrical transformations; Hermite, Lagrange and other interpolation functions; Numerical integration of functions; Gauss and other integration schemes.

**Unit III**  
**One-Dimensional Problems: Trusses, Beams & Frames**

Introduction; Local and global coordinate systems; Transformation of vectors in two and three dimensional spaces; Finite Element Modeling of a basic truss element in local coordinate system using energy approach; Assembly of the Global Stiffness Matrix and Load vector; The Finite Element Equations; Treatment of boundary Conditions; Euler Barnoulli (thin) beam element and Timoshenko (thick) beam element; Beam element arbitrarily oriented in space; Plane Trusses, Plane frames and Three-dimensional frames; Solution algorithms of linear systems.

**Unit IV**  
**Plane Stress and Plane Strain Problems & 3D Problems**

Plane stress and plane strain problems; Isoparametric Elements; Constant Strain Triangles (CST); Bilinear Quadrilateral Q4; Modeling boundary conditions; Orthotropic materials; Numerical integration; Higher Order Elements; Four-node Quadrilateral for Axisymmetric Problems; Hexahedral solid elements; Tetrahedral solid elements; Numerical integration.

**Unit V**  
**Plate elements and Dynamical Analysis**

Basic assumptions and formulations of classical Kirchhoff thin plate bending elements and thick Mindlin plate elements including bending and transverse shear energies; Degenerated shell elements; Construction of stiffness matrices. Dynamical equations of motion; Consistent and lumped Mass Matrices; Damping matrices; Vibration Analysis; Eigenvalue problems and solution techniques; Transient dynamical and structural dynamical problems, Explicit and implicit schemes of integrations, Stability issues.

**Text Books**

**References**

**Mode of Evaluation**  
Quiz/Assignment/ Seminar/Written Examination

**Recommended by the Board of Studies on**  
12.05.2012

**Date of Approval by the Academic Council**  
18.05.2012
Objectives:

- This course provides in-depth coverage of computer Integrated Manufacturing. It contains a high proportion of hands-on study, particularly in the areas of computer Aided Design and Computer Aided Manufacturing. Apart from the key area of CAD/CAM, it includes studies of Data Communication systems (as applicable to CIM), classification systems, and Group Technology, Computer Aided Process Planning and Flexible Manufacturing systems.

Expected Outcome:

- Upon completion of this course, the student shall be able to understand and
- Be familiar with using CAD/CAM systems and with programming and operating of CNC machine Tools.

Unit I

Introduction to Geometric Modelling, Geometric Modelling Approaches, Wire-Frame Modelling, Surface Modelling, Solid Modelling, Computer-Aided Design, CAD System Architecture, CAD Data Exchange and CAD Standards, CAD Kernels, Data Interoperability, Different Types of Data Translation, Dual Kernel CAD Systems, Direct Data Translator, Common/Neutral Translators. CIM Introduction, CIM Wheel, CIM Models.

Unit II

Computer Aided Process Planning and Manufacturing


Unit III

CNC Machine tools and Programming


Unit IV

Automated Control structures in Manufacturing systems

Automated storage and retrieval systems, Robotics, Interfacing Handling and Storage with Manufacturing, Automated inspection and testing, Sensor technologies, Coordinate measuring machines, Machine vision, Cellular manufacturing, Group Technology, Flexible manufacturing systems, Programmable controllers

Unit V

Key technologies for the integration


Text Books


References


Mode of Evaluation

Quiz/Assignment/ Seminar/Written Examination

Recommended by the Board of Studies on 12.05.2012

Date of Approval by the Academic Council 18.05.2012
Laboratory Exercises

1. 3D solid modelling and assembly using CAD/CAM system
2. Generation of CNC program and machining in CNC machine.
3. Inspection planning for automated inspection
4. Concurrent costing using DFMA software
5. Simulation of Product, Process and FMS layouts
6. Industrial Robot Programming
7. Optimisation of Computer aided Process planning
8. PLC Programming
Objectives: To provide a comprehensive Knowledge of fluid power systems including both hydraulics, used for factory automation, and pneumatics.

Expected Outcome: On completion of this course the students will be able to acquire the applied knowledge of fluid in various engineering fields PLC is factory automation (and the role of)

Unit I Introduction to Fluid Power

Unit II Control Components and Basic Circuits
Cylinders-accumulators –FRL-Directional control Valves- Pressure control valves-Flow control Valves-electronic control components- DCV controlling single acting, double acting cylinder-counter balance circuit-Fail safe circuit- AND and OR valve circuit-regenerative circuit-meter in and meter out circuit-pressure intensifier circuit-accumulator circuits etc.

Unit III Design of Fluid power circuit
Design method consideration for sequential circuits-intuitive circuit design method-cascade method- sequential logi circuit design using KV method- compound circuit design-step counter design

Unit IV Factory Automation
Introduction- automation principle and strategies-basic elements of an automated system advanced automation function- levels of automation-automation and control techniques continuous Vs discrete control- introduction to control component using PLC

Unit V Programmable Logic controller
Introduction-architecture-hardware components-Basics of PLC programming-programming timers-programming counters-master and jump controls-Data manipulation instructions

Text Books Nil

References
2. Antony Esposito, Fluid power system and control, Prentice hall, 1988
4. Peter Rohner, Fluid power logic circuit design, The emillan press 1979
5. M.P Groover, Fluid power logic circuit design, The emillan press 1979

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination
Recommended by the Board of Studies on 12.05.2012
Date of Approval by the Academic Council 18.05.2012
FLUID POWER SYSTEM AND FACTORY AUTOMATION LABORATORY

Aim and Objective:

The lab provides a hands-on training on Pneumatics, Hydraulics and PLC Kits

List of exercises:

1. Design, development and analysis of pneumatic circuits using Automation studio /Pneumosim software and Pneumatic trainers.
4. Study of Modular Automation Production System.
5. Development of MMI /HMI with PLC systems.
MEE547  |  Quality Management  |  3 | 0 | 0 | 3

**Version No.** 1.00  
**Prerequisite** Nil  
**Objectives:** To provide student with the basic understanding of the approaches and techniques to assess and improve process and or product quality and reliability  
**Expected Outcome:** Upon completion of this course the student will  
- Have good knowledge of quality management principles  
- Be well versed with Total Quality Management  
- Have good knowledge of quality implementation techniques  

### Unit I  
**Introduction to Quality Management**  

### Unit II  
**Total Quality Management**  

### Unit III  
**Problem Solving Tools**  
Old & QC Tools – Seven new management tools – Problem solving techniques – Case studies – Problems – Continuous improvement tools – Benchmarking. Quality circle.

### Unit IV  
**QM Techniques**  
Design FMEA, Process FMEA Characteristics Matrix, Variation analysis, Process capatrilling control cliants, Measurements system analysis, Taigneilors function.

### Unit V  
**Quality System Implementation**  

**Text Books**

**References**
5. Introduction to statistical quality control: Montgomery D. C. Johnley (Asia) 2001

**Mode of Evaluation** Quiz/Assignment/ Seminar/Written Examination

**Recommended by the Board of Studies on** 12.05.2012

**Date of Approval by the Academic Council** 18.05.2012
Recommended by the Board of Studies on 12.05.2012
Date of Approval by the Academic Council 18.05.2012

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination

Unit I Review of Mechanical Behavior of Materials

Unit II Engineering Alloys
Cast iron, steels, alloy steels and stainless steels – an overview of phases and microstructure, types, specifications applications, heat treatment, effect of alloying elements, Aluminum, Magnesium and Ti wrought and cast alloys used in engineering applications –Types, specifications, applications, heat treatment

Unit III Surface Modifications of Materials
Mechanical surface treatment and coating - Case hardening and hard facing - thermal spraying – vapour deposition-ion implantation - Diffusion coating - Electroplating and Electrolysis - Conversion coating - Ceramic and organic coatings – Diamond coating

Unit IV Nonmetallic Materials
Composite materials, ceramics, plastics -Introduction, an overview of processing, their characteristic features, types and applications.

Unit V Modern Materials and Alloys

Text Books

References
Objectives: To develop understanding of fundamental mechanics of machining in high speed machining, non-traditional machining and micro-machining processes.

Expected Outcome: Upon completion of this course, the student shall be able to:
- Understand various advanced machining processes and their practical applications.
- Select suitable advanced machining processes for the new materials.

Contents
- Fundamentals of Machining
- High speed machining
- Non-traditional machining processes – I
- Non-traditional machining processes – II
- Micromachining

Unit I Fundamentals of Machining

Unit II High Speed Machining

Unit III Non-traditional machining processes – I

Unit IV Non-traditional machining processes – II

Unit V Micromachining

Text Books

References

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination

Recommended by the Board of Studies on 14 July 2011

Date of Approval by the Academic Council 30 Aug 2011
**Version No.** 1.00  
**Prerequisite** Nil  
**Objectives:** To make the student to be familiar with  
- Use of automation technologies in manufacturing  
- CNC hardware and control systems  
- CNC programming  
- Program verifications  

**Expected Outcome:** Upon completion the course, student will be familiar with  
- Different automation strategies  
- How to control manufacturing operations through the use of CNC controllers  
- Advanced programming concepts using various controllers  
- Verify the tool path for complex geometries  

**Unit I**
Concept and scope of industrial automation – automation strategies - devices, drives and control circuits in automation - Semi-automats, automats and transfer lines, Introduction to NC/CNC/DNC and its role in FMS and CIMS, Basics elements of CNC System  

**Unit II**
CNC Hardware Elements including drives, actuators & sensors, Construction of modern CNC machine tool controllers, microprocessor and CNC adaptive control – ACO and ACC systems.  

**Unit III**
Introduction to Part Programming, Radius and Length Compensation Schemes, Tooling & Work-holding for CNC machine tools, Advanced Programming Features & Canned Cycles  

**Unit IV**
Geometric Modeling for NC machining & Machining of Free-form Surfaces, NC program generation from CAD models,  

**Unit V**
NC Program verification and Virtual NC, Recent developments in CNC machine tools.  

**Text Books**

**References**

**Mode of Evaluation** Quiz/Assignment/ Seminar/Written Examination  
**Recommended by the Board of Studies on** 12.05.2012  
**Date of Approval by the Academic Council** 18.05.2012
Laboratory Exercises

- Manual part programming on simple lathe operations
- CNC part programming on lathe, milling and drilling
- CAD/CAM integration with CNC machine tool
- Generate CNC program for machining centers
- Mould and Die design and manufacture
- Programming on CMM, Wire-cut EDM
**Objectives:**
- To impart the knowledge on joining of materials.
- To acquire knowledge in various class of joining processes and their applications.
- To impart knowledge on various arc welding techniques and its characterisation.

**Expected Outcome:**
Upon completion of this course, the student shall be able to:
- Describe the joining technology of metallic systems and its importance
- Knowledge on welding of engineering alloys and dissimilar weldments.
- Gain knowledge on different types of automated welding processes.

**Unit I**

**Unit II**

**Unit III**

**Unit IV**
Pressure welding processes: solid phase bonding, friction welding, friction stir welding, ultrasonic welding, explosive welding, diffusion bonding and adhesive bonding.

**Unit V**
Weldability - weldability of cast iron, plain carbon and low alloy steels, stainless steels, determination of preheat temperature, use of Schaeffler’s diagram, weldability tests, Automated welding systems; microprocessor control of arc welding and resistance welding, quality assurance in welding, welding fumes and their effect on the environment, Welding innovations

**Text Books**
1. Dr.R.S.Parmar “Welding processes and technology” Khanna Publishers.

**Mode of Evaluation**
Quiz/Assignment/ Seminar/Written Examination

**Recommended by the Board of Studies on** 12.05.2012
**Date of Approval by the Academic Council** 18.05.2012
### Objectives:
1. To provide the fundamental knowledge on the different types of errors in a typical machine tool.
2. To understand the measurement techniques for evaluating the machine tool performance.
3. To analyze the effect of machine tool errors on the machining accuracy of the components.
4. To develop the error compensation techniques for the different machine tool errors.

### Expected Outcome:
1. To assess, characterize and understand the accuracy of machine tools.
2. To perform the necessary tests for performance evaluation of machine tools.
3. To compare the performance of similar machines.

### Unit I
**Introduction to machine tool errors**
- Basic Elements and Structures of a Machine - Accuracy, Repeatability (Precision), and Resolution - Error sources in machine tools - Classification of errors - Static, quasi static, dynamic errors, Geometric error, thermal error, Spindle error, Effect on machining accuracy.

### Unit II
**Modeling of machine tools errors**
- Linear axes errors, Rotary axes errors - Degrees of freedom - Rigid body kinematics - Homogeneous transformation matrix - Relative position of tool and work piece - Modeling and analysis of thermal errors.

### Unit III
**Error measurement in machine tools**
- Contact and non contact methods - dial indicators - Ball bar - Inductive sensors - LVDT-Capacitive sensors - Laser interferometer - Measurement of geometric error, thermal error in machine tools - On machine measurement.

### Unit IV
**Test procedures for machine tools**
- Schlesinger alignment tests - Straightness and flatness measurement - Reversal method - Squareness measurement - Inspection techniques for spindles - Standards for machine tool testing - ANSI/ASME/ISO - Performance tests.

### Unit V
**Error compensation techniques**

### Text Books

### References

### Mode of Evaluation
- Quiz/Assignment/ Seminar/Written Examination

### Recommended by the Board of Studies on
- 14 July 2011

### Date of Approval by the Academic Council
- 30 Aug 2011
Version No. 1.00  
Prerequisite Nil  
Objectives: To provide the Basic understanding of mechatronic systems used in manufacturing 
automation such as:  
  - Basic electronics and drives in manufacturing systems  
  - Hydraulic and pneumatic systems to be used in manufacturing automation  
Expected Outcome: Upon completion the course, student will be familiar with:  
  1. Different automation strategies used in factory automation  
  2. Control of manufacturing operations through the use sensors and signal processing devices  
  3. Advanced concepts in hydraulic and pneumatic systems  

Unit I  
Definition of mechatronics. Mechatronics in manufacturing. Elements of a mechatronics system, Role of 
mechatronics systems in factory automation.  

Unit II  
Review of fundamentals of electronics. Data conversion devices, sensors, microsensors, transducers, signal 
processing devices, relays, contactors and timers. Microprocessors controllers and PLCs.  

Unit III  
Drives: stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, 
electronic cams, indexing mechanisms, tool magazines, transfer systems.  

Unit IV  
Hydraulic systems: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic 
power packs, pumps. Design of hydraulic circuits.  

Unit V  
Pneumatics: production, distribution and conditioning of compressed air, system components and graphic 
representations, design of systems. Description of PID controllers. CNC machines and part programming.  

Industrial Robotics.  

Text Books  

References  
2. Boltan, W., Mechatronics: electronic control systems in mechanical and electrical engineering, Longman, 

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination  
Recommended by the Board of Studies on 14 July 2011  
Date of Approval by the Academic Council 30 Aug 2011
Version No. 1.00
Prerequisite Nil
Objectives: To make the students

1. understand the computational techniques useful in the analysis of fluid flow and heat transfer;
2. expose and train in using commercial CFD software and in writing codes for specific CFD applications.

Expected Outcome: At the end of the course the student will be able to

1. formulate equations for fluid flow and heat transfer problems
2. understand the basic concepts of CFD techniques
3. solve conduction and convection & diffusion problems
4. solve incompressible fluid flow problems
5. use FLUENT to solve problems

Contents
Review of the equations governing fluid flow and heat transfer
- Finite difference method
- Heat conduction, convection and diffusion
- Solution of Navier-Stokes equations for incompressible flows
- Problem solving

Unit I
Introduction to equations governing fluid flow and heat transfer – Conservation of mass, conservation of energy - expanded and special forms of Navier-Stokes equations - Potential theory - Boundary layer theory - Compressible flows – Turbulent flows.

Unit II
Introduction to finite differences, difference equations and discretization – Finite difference methods: Explicit, implicit and Crank-Nicholson – Convergence and stability conditions - ADI – Boundary conditions - Applications to steady and transient heat conduction equations.

Unit III

Unit IV
Representation of the pressure gradient term and continuity equation - Staggered grid - Momentum equations – Pressure and velocity corrections - Pressure correction equation - SIMPLE algorithm - Boundary conditions for the pressure correction method.

Unit V
Introduction to Fluent software – Problem solving using Fluent.

Text Books

References

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination
Recommended by the Board of Studies on 14 July 2011
Date of Approval by the Academic Council 30 Aug 2011
Version No. 1.00
Prerequisite Nil

Objectives: To make the student to be familiar with
- Design of welded joints
- Selection of materials for welding
- Heat flow, distortion during welding
- Weldability of commonly used materials

Expected Outcome: Upon completion the course, student will be familiar with
- Problems and difficulties in weld structures
- How to obtain a sound weld structure
- Heating and cooling cycles in welding
- Metallurgy of welded joints

Unit I
Introduction to importance of welding in fabrication, Problems & difficulties in welded structures, testing of welded structures and analysis

Unit II
Properties for selection of materials, Characteristic properties and behavior of commonly used materials, Effect of alloying materials

Unit III
Heat flow in welds, Heating and cooling cycles in welding, Effect of HAZ, Hot cracking, Development of phases, Microstructure etc, causes and cures for various discontinuities & defects in weldments,

Unit IV
Weldability, Weldability of commonly used materials, Mechanical testing of weldments, Service and fabrication weldability tests and their importance, Thermal stresses and distortion, Brittle fracture and fatigue in welded joints, NDT of welds,

Unit V
Introduction to engineering physical metallurgy, Joining metallurgy and microstructures, Joint preparation weld symbols, Weld joint designs for strength and quality, Automation in welding, Cost analysis

Text Books

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination
Recommended by the Board of Studies on 14 July 2011
Date of Approval by the Academic Council 30 Aug 2011
**Version No.** | 1.00
---|---
**Prerequisite** | Nil

**Objectives:** To make the student to be familiar with
- Classification and construction of robots
- Serial and parallel Manipulators
- Programming method of robots
- Understand various control systems

**Expected Outcome:** Upon completion the course, student will be familiar with
- Anatomy of Robots
- Applications of Robots
- Programming languages of robots
- Control system and components of Robots

**Unit I**
Introduction to Robotics: Definitions, historical development, classification, work volume, Control systems and dynamic performance. - Grippers

**Unit II**
Robot Arm Kinematics and Dynamics: Frame transformation, D-H parameters, Forward kinematics, Inverse kinematics, - Rotation matrix - Homogeneous coordinates and transformation matrix

**Unit III**

**Unit IV**

**Unit V**
Control system and components: Control system concepts and models, controllers, Control system analysis, Robot Activation and Feed back components – position control - velocity control – Actuation

**Text Books**

**Mode of Evaluation**
Quiz/Assignment/ Seminar/Written Examination

**Recommended by the Board of Studies on** 14 July 2011

**Date of Approval by the Academic Council** 30 Aug 2011
Version No. 1.00  
Prerequisite Nil  
Objectives:
- Impart the knowledge of quality assurance and inspection techniques.  
- Familiarize with the various inspection and measurement techniques like contact and non-contact measurement by adapting Computer Aided Inspection.  
- Impart the knowledge of working principles and calibration of various Systems.  

Expected Outcome:  
Upon completion of this course, the student shall be able to:
- Acquire the knowledge in CMM and Image Processing  
- Understand the concept of Laser Metrology and Computer Integrated Quality Assurance  
- Acquire knowledge of magnetic particle testing  

Unit I  
Measuring Machines  

Unit II  
Statistical Quality Control  

Unit III  
Liquid Penetrant and Magnetic Particle Tests  

Unit IV  
Radiography  
Sources of ray X-ray production-properties of d and x rays – film characteristics – exposure charts – Contrasts – operational characteristics of x ray equipment – applications.  

Unit V  
Ultrasonic and Acoustic Emission Techniques  

Text Books  

References  

Mode of Evaluation  
Quiz/Assignment/ Seminar/Written Examination  

Recommended by the Board of Studies on  

Date of Approval by the Academic Council
# MEE550 DESIGN FOR MANUFACTURING

<table>
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<td>Prerequisite</td>
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**Objectives:**
The course is aimed at developing students to acquire skills to analyze product design and be able to design products that are easier to manufacture, assemble, service and more friendly to environment, etc.

**Expected Outcome:**
Upon completion of this course, the student shall be able to:
- Have customer-oriented, manufacturing and life-cycle sensitive approach to product design and development, with product design principles and structured design methodologies.
- Have Methods and approaches for developing, implementing, and nurturing an effective DFM process within the firm.

## Unit I Introduction
General design principles for manufacturability – strength and mechanical factors, evaluation method, Process capability - Feature tolerances- Geometric tolerances-Assembly limits- Datum features- Tolerance stacks.

## Unit II Factors influencing form Design

## Unit III Component Design – Machining Consideration

## Unit IV Robust Design and Taguchi Method
Robust design - Design of experiments – Robust design process- Orthogonal arrays: Two level orthogonal arrays, three level orthogonal arrays, combined inner and outer arrays.

## Unit V Redesign for Manufacture and case studies
Design for economy, Identification of uneconomical design – Modifying the design – Computer Applications for DFMA – Case Studies.

**Text Books**

**References**

**Mode of Evaluation**
Quiz/Assignment/ Seminar/Written Examination

**Recommended by the Board of Studies on** 12.05.2012

**Date of Approval by the Academic Council** 18.05.2012
MEE552  |  OPTIMIZATION METHODS
---|---
Version No. | 1.00
Prerequisite | Nil

**Objectives:**
- To understand the role of optimization in Engineering design and its importance
- To introduce the different optimization algorithms in linear programming and non-linear programming
- To introduce the non-traditional optimization algorithm in Solving non-linear problems.

**Expected Outcome:**
Upon completion of this course, the student shall be able to:
- Formulate the design problem in mathematical form which can be solved by suitable optimization algorithm
- Solve the design problem which involves non-linear constraints.
- Compare the efficiency of different algorithms.

**Contents**
- Introduction to Optimization
- Integer Programming, Dynamic Programming and Network Analysis
- Non-Linear Programming
- Non-Linear Programming and Geometric Programming
- Optimization Design of Machine Elements

**Unit I**  | Linear Optimization

**Unit II**  | Unconstrained Non-linear Optimization

**Unit III**  | Constrained Non-linear Optimization

**Unit IV**  | Advanced Non-linear Optimization

**Unit V**  | Optimization Design of Machine Elements
Functional requirements- desirable and undesirable effects – functional requirements and material and geometrical parameters – adequate designs, Optimum design – primary design equation, subsidiary design equations, limit equations – basic procedural steps for methods of optimum design – constrained parameters and free variables – normal, redundant and incompatible specifications general planning.

**Text Books**

**References**
- Quiz/Assignment/ Seminar/Written Examination

**Mode of Evaluation**
- Recommended by the Board of Studies on 14 July 2011
- Date of Approval by the Academic Council 30 Aug 2011
<table>
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<th>MEE604</th>
<th>DESIGN AND ANALYSIS OF EXPERIMENTS</th>
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<td>Prerequisite</td>
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**Objectives:** The objective of this course is to introduce experimental design techniques and familiarize with all of the best design techniques and study the objectives, similarities, differences, advantages, and disadvantages of each.

**Expected Outcome:**
- On completion of this course, students will be able to:
- Setup Full and Fraction Factorial Experiment Design.
- Perform ANOVA and Hypothesis testing.
- Learn Loss function approach to Quality Control.
- Setup and analyse Robust Design.

**Unit I**  
**Introduction**
Basic principle of DOEs, Guide lines for Designing Experiments, Terminology, ANOVA, Computation of sum of squares and Basics of quality by design, Experiments with single factor, Model Adequacy checking, Test on means

**Unit II**  
**Single Factor Experiments**
Randomized complete block design, Latin square design, Graeco-Latin square design, Balanced Incomplete block design

**Unit III**  
**Factorial Design**
Two-Factor factorial design, General factorial design, $2^k$ Factorial design, $3^k$ Factorial design, Blocking and confounding, Fractional replication and Factors with mixed levels.

**Unit IV**  
**Robust Design Process**
Comparison of classical and Taguchi’s approach, variability due to noise factors, principle or robustization, classification of quality characteristics and parameters, objective functions in robust design, S/N ratios.

**Unit V**  
**Orthogonal Experiments**
Selection and application of orthogonal arrays for design, Conduct of experiments, collection of data and analysis of simple experiments, Modifying orthogonal arrays, Inner and outer OA experiments, Optimization using S/N ratios, attribute data analysis, a critique of robust design.

**Text Books**

**Mode of Evaluation**  
Quiz/Assignment/ Seminar/ Written Examination

**Recommended by the Board of Studies on**  
14 July 2011

**Date of Approval by the Academic Council**  
30 Aug 2011
Prerequisite: Nil

Objectives: To provide the student with an understanding of the importance of process planning role in manufacturing and the application of Computer Aided Process Planning tool in the present manufacturing scenario

Expected Outcome: Upon completion of this course, the student shall be able to:

Unit I Introduction


Unit II Part Design Representation


Unit III Process Engineering and Process Planning

Experienced based planning – Decision table and Decision trees – Process capability analysis – Process planning – Variant process planning – Generative approach – Forward and backward planning, Input format, A1

Unit IV Computer Aided Process Planning Systems

Logical Design of process planning – Implementation considerations- Manufacturing system components, Production Volume, No. of production families- CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

Unit V An Integrated Process Planning Systems


Text Books

References


Mode of Evaluation

Recommended by the Board of Studies on 14 July 2011

Date of Approval by the Academic Council 30 Aug 2011
Recommended by the Board of Studies on Design

Objectives:
- The main objective of the course is to give students the basic concepts of tool engineering.
- The student is guided to use these concepts in the design of jigs, fixtures and various types of dies used in production industry through assigned projects and factory visits.

Expected Outcome:
- The student will be able to:
  - Become aware of the materials used to make different types of tooling components including tool steels, low carbon steels, cast iron, aluminum, plastics and cutting tool materials.
  - Integrate CAD techniques into the design of production tooling to help understand the advantages and disadvantages for productive tool design.
  - Develop an understanding of the factors involved in the design of special production inspection gages.
  - Become acquainted with the development of cutting tool design for production machines and the selection of tool geometries for metal cutting methods.
  - Develop an understanding of the principles involved in the design of jigs and fixtures concentrating on locating methods, clamping and use of drill bushings. Standard jig and fixture designs will be reviewed.
  - Develop an understanding of the principles used in the design and plastic injection mold tooling and Composite tooling. To include cavity layout, sprue and runner design, gate design, venting, cooling, and selection of tooling components.

Unit I
Introduction and basic tool design principles. Broad Classification of Tools-Cutting tools, Dies, Holding and measuring tools, Tool manufacturing and Introduction to Computer aided die design applications.

Unit II
Design of Cutting Tools: Single Point and multipoint cutting tools; Single Point Cutting Tools: Classification, Nomenclature, geometry, design of single point tools for lathes, shapers, planers etc. Chip breakers and their design; Multipoint Cutting Tools: Classification and specification, nomenclature, Design of drills, milling cutters, broaches, taps etc.; Design of Form Tools: Flat and circular form tools, their design and application.

Unit III

Unit IV
Design of Jigs, Fixtures and Gauges: Classification of Jigs and Fixtures, Fundamental Principles of design of Jigs and Fixtures, Location and Clamping in Jigs and fixtures, Simple design for drilling Jigs, Milling fixtures etc. Indexing Jigs and fixtures.

Unit V

Text Books

References
5. John G. Nee, Fundamentals of Tool Design, Author - Society of Manufacturing Engineers

Mode of Evaluation
Quiz/Assignment/ Seminar/Written Examination

Recommended by the Board of Studies on 14 July 2011
Date of Approval by the Academic Council 30 Aug 2011
## Version No. 1.00

### Prerequisite Nil

#### Objectives
- To equip the students to analyze reliability data.
- To introduce the concepts of reliability and useful life availability of products.
- To impart knowledge on maintainability and availability analysis of products.

#### Expected Outcome
On completion of this course, the student shall be able to acquire good knowledge on reliability of products through the failure concepts, failure distributions, Serial & parallel systems and their risk assessment.

### Unit I Reliability Concept
Reliability function - failure rate - Mean Time between Failures (MTBF) - Mean Time to Failure (MTTF) - a priori and a posteriori concept - mortality curve - useful life availability - maintainability - system effectiveness.

### Unit II Reliability Data Analysis
Time-to-failure distributions - Exponential, normal, Gamma, Weibull, ranking of data - probability plotting techniques - Hazard plotting.

### Unit III Reliability Prediction Models

### Unit IV Reliability Management
Reliability testing - Reliability growth monitoring - Non parametric methods - Reliability and life cycle costs - Reliability allocation - Replacement model.

### Unit V Risk Assessment
Definition and measurement of risk - risk analysis techniques - risk reduction resources - industrial safety and risk assessment.

### Text Books

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### Mode of Evaluation
Quiz/Assignment/ Seminar/Written Examination

### Recommended by the Board of Studies on 14 July 2011

### Date of Approval by the Academic Council 30 Aug 2011
<table>
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<tr>
<th>MEE571</th>
<th>VIRTUAL MANUFACTURING</th>
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<td>Version No.</td>
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<td>Prerequisite</td>
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<tr>
<td>Objectives:</td>
<td>This subject will provide students with:</td>
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<td>• an understanding of the enterprise networking technologies and web-based tools that support modern manufacturing systems</td>
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<td>• the knowledge to apply the Information Technology (IT) in dispersed network manufacturing, virtual manufacturing, virtual organizations (VO)/virtual enterprises (VE), work flow management, web services.</td>
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<td>• a working knowledge and sound skills to plan, develop and implement customized IT solution for enterprise integration as well as to address industrial problems in manufacturing environment.</td>
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<td>Expected Outcome:</td>
<td>Upon completion of this course, the student shall be able to:</td>
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<td>• Have good amount of knowledge on paradigms of virtual manufacturing, Sterio vision.</td>
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<tr>
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<td>• Bridges gap between virtual reality and computer vision in managatuidys</td>
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<tr>
<td></td>
<td>• Have good amount of knowledge of manufacturing process simulation</td>
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<td>• Have good amount of knowledge on dispersed network manufacturing Send application of virtual manufacturing</td>
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**Unit I**

Paradigms of VM:  Design-centered VM, Production-centered VM and Control-centered VM. Generic VM Issues - relationships between VM, Virtual Prototyping, the Virtual Enterprise. Role of object oriented technology in VM.

**Unit II**

Promising areas of VM and manufacturability analysis, validation and evaluation of process plans, partnering in agile enterprises, process design, and optimization of production plans and schedules. Tools for manufacturability analysis. Case study.

**Unit III**

Virtual Manufacturing over the Internet. Transmitting VM Information over the Internet. Manufacturing resource models for distributed manufacturing. Case study.

**Unit IV**


**Unit V**

Dispersed Network Manufacturing - Virtual factory, enterprise collaborative modeling system, virtual manufacturing (VM) system, Web-based work flow management, collaborative product commerce, applications of multi-agent technology, e-supply chain management and tele-manufacturing

**Text Books**


**References**


**Mode of Evaluation**

| Quiz/Assignment/ Seminar/Written Examination |

**Recommended by the Board of Studies on**

| 14 July 2011 |

**Date of Approval by the Academic Council**

| 30 Aug 2011 |
Version No. 1.00  
Prerequisite Nil  
Objectives:  
1. To understand the basic principles of Metal Forming Theory  
2. To know the various types of forming processes  
3. To know about advanced metal forming methods  
Expected Outcome:  
1. Choose forming techniques for various applications  
2. Estimate power requirement for forming processes  
3. Calculate the forming limit for various processes  

Unit I Theory of Plasticity  

Unit II Plastic Forming of Metals – Forging  

Unit III Plastic Forming of Metals – Rolling and Extrusion  

Unit IV Plastic Forming of Metals – Drawing and Sheet metal Forming  

Unit V Unconventional Forming Methods  
Electro hydraulic forming – magnetic pulse forming – super plastic forming – electro forming – fine blanking – P/M forging-Isothermal forging – HERF.  

Text Books  
References  

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination  
Recommended by the Board of Studies on 14 July 2011  
Date of Approval by the Academic Council 30 Aug 2011
Objectives:

1. To introduce students the basics of rapid prototyping/manufacturing technologies and systems and its applications in various fields, reverse engineering techniques, CAD modeling techniques such as surface and solid models, and their use in rapid prototyping applications.
2. To familiarize students how commercial rapid prototyping systems use these models to perform activities such as part building, materials used etc.
3. To teach students about mechanical properties and geometric issues relating to specific rapid prototyping applications.

Expected Outcome:

1. Demonstrate the knowledge of Rapid Prototyping/Manufacturing technologies.
2. Get exposed to commercial Rapid Prototyping systems.
3. Possess the knowledge of Rapid Prototyping software.

Unit I


Unit II

Classification of different RP techniques – based on raw materials, layering technique (2-D or 3-D) and energy sources: Process technology and comparative study of: Stereo-lithography (SL) with photopolymerisation, SL with liquid thermal polymerisation, Solid foil polymerisation,

Unit III

Selective laser sintering, Selective powder binding, ballistic particle manufacturing – both 2-D and 3-D, Fused deposition modelling, Shape melting, Laminated object manufacturing, Solid ground curing, Repetitive masking and deposition, Beam interference solidification, Holographic interference solidification.

Unit IV


Unit V


Text Books


References


Mode of Evaluation

Quiz/Assignment/ Seminar/Written Examination

Recommended by the Board of Studies on 14 July 2011

Date of Approval by the Academic Council 30 Aug 2011
OBJECTIVES:

- To understand the fundamentals of composite materials.
- Understand the manufacturing of various composites.
- To understand and analyze the reinforced composite design and performance for different combinations and orientations of reinforcements.
- To understand the properties and Hygro-Thermo-Mechanical degradation of composite materials and conduct application oriented case studies.

EXPECTED OUTCOME: Students would be able to understand, analyse and select suitable manufacturing methods.

UNIT I: INTRODUCTION AND MATERIALS

Definition – Need – General Characteristics, Reinforcements and Matrices – Polymer, Ceramic, Metal Matrix and Carbon/Carbon composites – Nano composites. Superiority of composites to conventional materials, Applications in automotive, mechanical, civil and aerospace sectors.

UNIT II: RAW MATERIALS

Introduction, Reinforcements manufacturing, Matrix materials manufacturing, Fabric constructions, 3D Braided performs, Pepregs, Moulding compounds-SMC, BMC, DM.

UNIT III: COMPOSITES MANUFACTURING

Manufacture of PMCs, RRIM, VARTEM and SCRIMP, Manufacture of MMCs C/C and CMCs, Solid State Fabrication Techniques - Diffusion Bonding - Powder Metallurgy Techniques - Plasma Spray, Chemical and Physical Vapour Deposition of Matrix on Fibres - Liquid State Fabrication Methods - Infiltration - Squeeze Casting - Rheo Casting – Compocasting, stir casting, sol-gel method - Interdiffusion, electrostatic, chemical, mechanical. Fabrication of FRP reinforced concrete, CAD/CAM.

UNIT IV: SECONDARY MANUFACTURING OF COMPOSITES

Fundamentals of design for manufacturing, Implementation, Design evaluation method, Design for assembly, Joining and jointing of composites, Welding of thermoplastics and MMCs, Bonding of ceramic matrix composites, Machining and cutting of composites, conventional and unconventional methods of machining.

UNIT V: COMPOSITE PERFORMANCE

Mechanical behaviour of laminated plates. Composite beams in tension, compression, shear and Flexure, Composite beam in Torsion, Different mode of failure of the composite structures, Failure of lamina and laminated structures, Failure of sandwich composite, Long term environmental effect, Inter-laminar failure, Failure due to fracture and fatigue, Damage due to impact loads, Creep, Health monitoring of composite structures, Interface damage.

TEXT BOOKS


REFERENCES


MODE OF EVALUATION: Quiz/Assignment/ Seminar/Written Examination

Recommended by the Board of Studies on: 12.05.2012
Date of Approval by the Academic Council: 18.05.2012
### MEE576: Surface Engineered Materials Technology

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**Objectives:**

1. To teach students the basic concepts of surface engineering and its development
2. To provide students the knowledge of coatings and the formation of technological surface layers
3. To enable the students understand the basic principles of Laser Technology and Plasma Coating Technology

**Expected Outcome:**

1. Student will be able to develop and apply various surface modifications technologies
2. Find applications of coating processes in industries

### Unit I: Development of Surface Engineering


### Unit II: Concepts of Coating


### Unit III: Formation of Technological Surface Layers

Formation of technological surface layers – Techniques – Physical vapor deposition – Chemical vapor deposition - electron beam technology – Principles underlying the electron beam impingement – Acceleration of electrons – Electron guns – Interaction of electron beam with treated material – Applications of electron beam coating in surface engineering

### Unit IV: Laser Technology


### Unit V: Plasma Coating Technology


**Text Books**

Plasma surface engineering, (2004), Proce DAE-BRNS workshop

**References**

1. D.Setas, A.Tacton, Mercel –Dekker, (2001), Coatings technology handbook I Editors:

**Mode of Evaluation**

Quiz/Assignment/ Seminar/Written Examination

**Recommended by the Board of Studies on:** 14 July 2011

**Date of approval by the Academic Council:** 30 Aug 2011
Objectives:
Having successfully completed the course, the student will be able to:

1. Understand ERP systems and its modules and its application to industries
2. Understand ERP related technologies and its module design
3. Understand the effect of supply chain on business operations
4. Be able to formulate basic supply network distribution models

Unit I
Introduction To ERP, Evolution of ERP, Reasons for the growth of ERP, Scenario and Justification of ERP in India, Evaluation of ERP, Various Modules of ERP, Advantage of ERP.

Unit II

Unit III
ERP and Related Technologies, Business Process Reengineering (BPR), Management Information System (MIS), Executive Information System (EIS), Decision support System (DSS), ERP Modules: Quality Management, Materials Management

Unit IV
Understanding the Supply Chain, Objectives of Supply chain, Importance of Supply chain decision, Decision phases in a supply chain, Supply chain performance,

Unit V
Drivers of Supply Chain Performance, Framework for structuring drivers, Role of distribution in the supply chain, Design options for a distribution network, Role of network design in supply chain, Case studies and related problems, Role of IT in supply chain

Text Books

References

Mode of Evaluation
Seminar
Quiz/Assignment/
Examination
Seminar/Written

Recommended by the Board of Studies on 14 July 2011
Date of Approval by the Academic Council 30 Aug 2011
### MEE515

<table>
<thead>
<tr>
<th>Version No.</th>
<th>1.00</th>
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<tbody>
<tr>
<td>Prerequisite</td>
<td>Nil</td>
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**Objectives:**
- Machine design, Manufacturing Technology, Work Study. Objectives To make the student to familiar with
  - The new product management process
  - Product lifecycle management stages
  - The DFx concepts from the conception to recovery or disposal
  - Applying analytic methods for all stages of product planning, development, launch, and control

**Expected Outcome:**
- Upon completion the course, student will be familiar with
  - The new product management process
  - Product lifecycle management stages
  - The DFx concepts from the conception to recovery or disposal
  - Applying analytic methods for all stages of product planning, development, launch, and control
  - Development and implementation of product development and management strategies within a simulated environment, including product platform, branding, pricing, distribution and promotion decisions.
  - Performing the decision analysis on new product development
  - Assessing and improving product development and management performance in the context of a case study

**Unit I**
**Introduction**

**Unit II**
**Product Development Life cycle – I**

**Unit III**
**Product Development Life cycle – II**

**Unit IV**
**Product Development Life cycle – III**

**Unit V**
**Productivity and Reliability**

**Text Books**

**References**

**Mode of Evaluation**
- Quiz/Assignment
- Seminar/Written Examination

**Recommended by the Board of Studies on**
14 July 2011

**Date of Approval by the Academic Council**
30 Aug 2011
**MEE578** | Manufacturing System And Simulation
---|---
Version No. | 1.00
Prerequisite | Nil
Objectives: | • Ability to understand the underlying features of discrete event simulation and how it is applicable for analyses and development of manufacturing systems.
• To understand the concept of simulation and to learn the simulation language.
• To enable application of simulation to manufacturing systems and to gain hands on experiences from how discrete event simulation is applied based on an industrial needs.

Expected Outcome: | Upon completion of this course the student shall be able to:
• Identify and formulate advance problems and apply knowledge of mathematics and simulation packages to solve manufacturing problems.
• Use the techniques, skills, and modern packages, necessary for professional practices.

**Unit I** | Computer modeling and simulation system
Introduction to simulation- steps in simulation-nature of computer modeling and simulation- types of models- Monte Carlo simulation, limitation of simulation, areas of application, examples. Components of a system- discrete and continuous systems- Examples, Model of a system-variety of modeling approaches.

**Unit II** | Random number generation
Properties of random numbers, Random number generation techniques-the mid product method- constant multiplier technique- additive congruential method- linear congruential method, Test for random numbers- frequency tests- test for autocorrelation.

**Unit III** | Random variable generation

**Unit IV** | Distribution and evaluation of experiments
Discrete uniform distribution- Poisson distribution- geometric distribution- acceptance and rejection technique for poisson, gamma distribution. Variance reduction techniques- antithetic variables- Validation of simulation models- Verification of simulation models.

**Unit V** | Discrete event simulation

**Text Books**

**References**

**Mode of Evaluation** | Quiz/Assignment/ Seminar/Written Examination
**Recommended by the Board of Studies on** | 14 July 2011
**Date of Approval by the Academic Council** | 30 Aug 2011
Recommended by the Board of Studies on
Mode of Evaluation

Version No. 1.00
Prerequisite Nil
Objectives: Reliability, Quality Management.

To introduce Maintenance Engineering and Engineering Management as a specialized discipline for high operational efficiency and minimized downtime.

• To acquaint with the principles of Condition Based Maintenance as the most cost effective and reliable maintenance policy involving various condition monitoring techniques for effective diagnosis.

Expected Outcome: Upon completion of this course, the student shall be able to:

• Familiarize the general maintenance procedures followed in practice regarding preventive schedules, network and queuing policies, spares management and replacement policies.

Contents

• Introduction
• Reliability Engineering
• Maintenance Planning and Organization
• Quantitative Techniques and Network Analysis
• Integrated logistics support – ILS concept, Life-cycle costs, maintenance engineering analysis, support requirements.

Unit I
Introduction to maintenance engineering and management, profitability, function, objectives, planning and control. Failure statistics – probability theories and functions, decision making, weibull distribution, application and limitations of failure statistics to maintenance management.

Unit II
Reliability engineering and maintenance – reliability prediction of series and parallel connected components, reliability testing and preventive maintenance, maintainability prediction and testing equipment availability.

Unit III
Maintenance planning – policies, preventive and corrective, condition based, opportunity and design-out maintenance, determination of maintenance plan, maintenance organization, Computer Aided Maintenance Management. Organization of maintenance resources – resources structure, administrative structure, work planning and scheduling.

Unit IV

Unit V
Management techniques in maintenance management-job reform, motivation and reorganization of maintenance trade force

Text Books

References

Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination
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References:


Text Books:

Unit I: Introduction
- Extensive definition of CE - CE design methodologies - Organizing for CE - CE tool box collaborative product development.

Unit II: Use of Information Technology
- IT support - Solid modeling - Product data management - Collaborative product commerce – Artificial Intelligence - Expert systems - Software hardware co-design.

Unit III: Design Stage
- Life-cycle design of products - opportunity for manufacturing enterprises - modality of CE Design - Automated analysis idealization control - Concurrent engineering in optimal structural design - Real time constraints.

Unit IV: Manufacturing Concepts and Analysis
- Manufacturing competitiveness - Checking the design process - conceptual design mechanism – Qualitative physical approach - An intelligent design for manufacturing system - JIT system - low inventory - modular - Modeling and reasoning for computer based assembly planning - Design of Automated manufacturing.

Unit V: Project Management
**MEE581**

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<thead>
<tr>
<th>Manufacturing Information Systems</th>
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<tbody>
<tr>
<td>Version No.</td>
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<tr>
<td>Prerequisite</td>
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<tr>
<td>Objectives:</td>
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<tr>
<td>To familiarize with designing data base.</td>
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<td>To introduce the concepts of information systems for manufacturing</td>
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<td>Expected Outcome</td>
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<tr>
<td>On completion of this course, the student will be able to acquire knowledge of manufacturing information systems, production control systems, database models and shop floor control models.</td>
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<tr>
<td>Unit I</td>
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<tr>
<td>The evolution of order policies, from MRP to MRPII, the role of Production organization, Operations control.</td>
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<tr>
<td>Unit II</td>
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<tr>
<td>Terminologies - Entities and attributes - Data models, schema and subschema - Data Independence - ER Diagram - Trends in database.</td>
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<tr>
<td>Unit III</td>
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<tr>
<td>Hierarchical model - Network approach - Relational Data model - concepts, principles, keys, relational operations - functional dependence - Normalisation, types - Query languages.</td>
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<tr>
<td>Unit IV</td>
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<tr>
<td>Product and its structure, Inventory and process flow - Shop floor control - Data structure and procedure - various models - order scheduling module, input / output analysis module stock status database - complete IOM database.</td>
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<tr>
<td>Unit V</td>
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<tr>
<td>Parts oriented production information system - concepts and structure - computerised production scheduling, online production control systems, computer based production management system, computerised manufacturing information system - case study.</td>
</tr>
</tbody>
</table>

**Text Books**


**Mode of Evaluation**

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**Recommended by the Board of Studies on**

14 July 2011

**Date of Approval by the Academic Council**

30 Aug 2011
<table>
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<tr>
<th><strong>MEE617</strong></th>
<th><strong>Laser Materials Processing</strong></th>
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<td><strong>Objectives:</strong></td>
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<tr>
<td>• To make student familiar with use of laser for industrial application</td>
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<tr>
<td>• To train students on the material processing applications of laser for automotive, aerospace and shipbuilding applications</td>
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<td><strong>Expected Outcome:</strong></td>
<td>At the end of the course, student will be familiar with all material processing capabilities of LASER and its implications in the production processes.</td>
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<td><strong>Unit II</strong></td>
<td>Laser processing fundamentals: Laser beam interaction with metal, semiconductor and insulator, Ultra-short laser pulse interaction, heat flow theory and metallurgical considerations.</td>
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<td><strong>Unit III</strong></td>
<td>Laser Material Processing Applications: Laser cutting and drilling: Process characteristics, material removal modes, practical performances. Laser welding: Process mechanisms like keyhole and plasma effect, operating characteristics and process variation. Laser surface modifications: Heat treatment, surface remelting, surface alloying and cladding, surface texturing, LCVD and LPVD.</td>
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<tr>
<td>MEE618</td>
<td>Electronic Manufacturing Assembly And Packaging</td>
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| Objectives: | • To educate the manufacturing engineering students the importance of electronic materials and manufacturing  
• To enable the students to learn about electronic materials characterization  
• To teach the students the elements of electronic packaging, assembly and reliability |
| Expected Outcome: | • At the end of the course the student should be able to master the manufacturing techniques of electronic materials.  
• The student should be able to characterize the electronic materials  
• Understand and be able to work on projects involving electronic packaging, assembly and reliability. |
<p>| Unit I | <strong>Electronic materials and Manufacturing</strong> |
|  | Introduction to electronic materials, Silicon and compound semiconductors, Single polycrystalline and amorphous semiconductors and manufacturing, Czochralski, Bridgeman and Float zone techniques, Neutron Transmutation Doping, Thick film and Thin films, Vapour deposition and Solution based processes to grow semiconductors, Equipment details for manufacturing. |
| Unit II | <strong>Wafer Manufacturing and Characterization</strong> |
|  | Wafer production, Slicing, Lapping, Polishing, Photolithography, Screen printing, Diffusion processes, Wafers for semiconductor devices and Photovoltaic applications, Semiconductor characterization techniques- Thermal, Sonic, Microscopic, Spectroscopic and Optical methods, X ray characterization, Etching and etch pit dislocations, Equipment for wafering and characterization, Quality control. |
| Unit III | <strong>Fundamentals of Electronic Packaging</strong> |
|  | Micro and Nanosystems packaging, The need, characteristics and packaging road map, Types of electronic packaging, Metal, ceramic and plastic packaging, ICs and IC packaging, Dual and quad packaging, BGAs, Wafer Level, Flip-chip and Multichip packaging, Role of these packages in automotive, computer, telecom, medical, consumer electronics and MEMS applications. |
| Unit IV | <strong>Electronic Assembly</strong> |
|  | Different stages of IC manufacture, Finished wafer dicing, Die attach to lead frames, Wire bonding, Packaging-encapsulation and sealing, Singulation, Instruments, Equipment and Stations used for IC assembly, PCB and PWB manufacturing, Solder materials and soldering, Interconnects, Microvia boards, Surface mount technology, Through hole assembly, Applications, Statistical fundamentals in manufacturing and assembly. |
| Unit V | <strong>Design, Failure and Reliability in Electronic Packaging</strong> |
|  | Design factors in microsystem packaging, CAD tools for electronic packaging and assembly, Thermal management of Devices, Boards and Electronic equipment, Fundamentals of failures-Electrical, Chemical and Thermo-mechanically induced Failures, Reliability and Durability ( environmental attack and protection), Reliability qualification tests, Fatigue, Design for environment in electronics, toxicity free manufacturing, Life cycle assessment and management. |
| Mode of Evaluation | Quiz/Assignment/Seminar/Written Examination |
| Recommended by the Board of Studies on | 14 July 2011 |
| Date of Approval by the Academic Council | 30 Aug 2011 |</p>
<table>
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<tr>
<th>MEE 619</th>
<th>Computer Graphics and Geometric Modeling</th>
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<tr>
<td>Prerequisite</td>
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**Objectives:**
This course provides a comprehensive introduction to computer applications including geometric modeling and computer graphics.

**Expected Outcome:**
On completion of this course, the students will be able to acquire knowledge of the applications of computers in design and manufacturing activity.

**Unit I: Introduction to Computer Graphics and Database**
Definition, product cycle & CAD/CAM, automation & CAD/CAM introduction, software configuration of a graphic system, functions of a graphics package, data base structure and content, CAD applications, line, circle and ellipse drawing algorithms, windowing and clipping, lighting and shading, hidden surface/solid removal, color models, two-dimensional transformations, three-dimensional transformations, linear transformations.

**Unit II: Geometric Modeling**

**Unit III: Surface Modeling**

**Unit IV: Assembly Modeling**

**Unit V: Recent Developments**
Data exchange standards, multi-resolution models, heterogenous modeling. Meshing algorithms, surface reconstruction from point cloud data, computational geometry applications in CAD, collaborative design, product data modeling.

**Text Books**

**References**

**Mode of Evaluation**
Quiz/Assignment / Seminar/Written Examination

**Recommended by the Board of Studies on** 12.05.2012

**Date of Approval by the Academic Council** 18.05.2012