SYLLABUS

For

Master of Engineering Programmes
(M.Tech. Manufacturing Science & Engineering)

(For admission in 2022-23 and onwards)
## Course Structure and Scheme of Examination for M. Tech. - 2 Year Program
### Manufacturing Science and Engineering

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Type/Code</th>
<th>Course Name</th>
<th>Teaching Scheme</th>
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<th>Internal Marks</th>
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### Semester IV (M. Tech. - 2 Year Program: Manufacturing Science & Engineering)

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**Abbreviations:** L-No. of Lecture hours per week, T-No. of Tutorial hours per week, P-No. of Practical hours per week, CT-Class Test Marks, TA-Marks of teacher’s assessment including student’s class performance and attendance.
## Course Structure and Scheme of Examination for B.Tech.-M. Tech. Dual 1 Year Program

### Manufacturing Science and Engineering

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Type/Code</th>
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### Semester IV (B.Tech.-M. Tech. Dual 1 Year Program: Manufacturing Science & Engineering)

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### Abbreviations:
- L- No. of Lecture hours per week, T- No. of Tutorial hours per week, P- No. of Practical hours per week, CT- Class Test Marks, TA- Marks of teacher’s assessment including student’s class performance and attendance,
- 1 Hr Lecture | 1 Hr Tutorial | 2 or 3 Hr Practical | 1 Credit | 1 Credit | 1 Credit
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### List of Open Electives

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Syllabus

Advanced Mathematics (AHT-301)

Course objectives:
From this course, students will be able to:
1. learn distinct methods of solving simultaneous equations.
2. well-versed with partial differential equations and their solutions and applications.
3. acquire the knowledge of transformation to ease the complex problems.
4. acquaintance with basics of random variables and their distribution for dealing with events by chance.
5. study different mathematical domains to deal with real-time engineering problems.

Learning outcomes:

1. Comprehend with engineering problems in different mathematical realm.
2. Learn analytical and numerical methods to deal with mathematical problems.
3. Understand how to model the engineering problems and their solutions.
4. Implement the solutions to real-time complex engineering problems.
5. Apprehend with mathematical methodology.

Course content:

Unit I: Solution of linear simultaneous equations: (8 hours)
Consistency, Iterative method, Convergence, Cholesky’s (Crout’s) method, Gauss-Jordan method, Gauss-Seidel iteration and relaxation methods, Solution of Eigenvalue problems, Smallest, largest, and intermediate Eigen values

Computer based algorithm and programme for these methods (non-evaluative)

Unit II: Partial differential equation and its applications: (10 hours)
Introduction and classification of partial differential equation, Four standard forms of non-linear partial differential equations and their solutions, linear equations with constant coefficients. Applications of partial differential equations one and two-dimensional wave equation, one and two-dimensional heat equation, Two-dimensional Laplace’s equation.
Unit III: Transform calculus-I: (8 hours)

Laplace transform, Properties of Laplace transform, Inverse Laplace transform, Applications of Laplace transform, Fourier integral theorem, Fourier transforms, Application of Fourier transform

Unit IV: Transform calculus-II: (8 hours)

Z-transform, Properties of Z-transform, Shifting theorems, Initial and final value theorem, Convolution theorems, Inverse Z-transform, Application of Z-transform

Unit V: Basic probability theory: (8 hours)

Concept and laws of probability, Discrete and continuous random variable and their distributions; Some special distributions such as Binomial, Poisson, Negative Binomial, Geometric, Continuous uniform, Normal, Exponential, Weibull, Moments, Moment generating functions, Expectation and variance

Practical demo with statistical software like R, SPSS, SAS, etc. (non-evaluative)

Text Books / References:
S. Ross, A First Course in Probability, Pearson Education, 8th edition
Syllabus

Metal Forming Techniques (MST – 301)

Course Objective:

- To understand the behavior of materials during forming
- To learn the various metal forming process and their applications
- To study about powder metallurgy and modern forming process
- To learn various surface treatment processes

UNIT I: THEORY OF PLASTICITY

Theory of plastic deformation - Yield criteria - Teresa and Von-misses - Distortion energy - Stress-strain relation - Mohr's circle representation of a state of stress - cylindrical and spherical co-ordinate system - upper and lower bound solution methods - Overview of FEM applications in Metal Forming analysis.

UNIT II THEORY AND PRACTICE OF BULK FORMING PROCESSES

Analysis of plastic deformation in Forging, Rolling, Extrusion, rod/wire drawing and tube drawing - Effect of friction - calculation of forces, work done - Process parameters, equipment used - Defects - applications - Recent advances in Forging, Rolling, Extrusion and Drawing processes - Design consideration in forming.

UNIT III SHEET METAL FORMING

Formability studies - Conventional processes - H E R F techniques – Super plastic forming techniques - Hydro forming - Stretch forming - Water hammer forming - Principles and process parameters - Advantages, Limitations and applications

UNIT IV POWDER METALLURGY AND SPECIAL FORMING PROCESSES

Overview of Powder Metallurgy technique - Advantages - applications - Powder perform forging - powder rolling - Tooling, process parameters and applications. - Orbital forging - Isothermal forging - Hot and cold isostatic pressing - High speed extrusion - Rubber pad forming - Fine blanking - LASER beam forming
UNIT V SURFACE TREATMENT AND METAL FORMING APPLICATIONS

Experiment techniques of evaluation of friction in metal forming selection - influence of temperature and gliding velocity - Friction heat generation - Friction between metallic layers - Lubrication carrier layer - Surface treatment for drawing, sheet metal forming, Extrusion and hot and cold forging.

Processing of thin Al tapes - Cladding of Al alloys - Duplex and triplex steel rolling - Thermo mechanical regimes of Ti and Al alloys during deformation - Formability of welded blank laser structured steel sheet Formability of laminated sheet.

References

1. An Introduction to the Principles of Metal Working by Rowe Arnold.
2. Metal Forming Analysis by Avitzur, McGraw Hill
4. Plasticity for Mechanical Engineers by Johnson &Mellore Van Nostrand
5. High Velocity Working of Metals, ASTME EEE
6. Manufacturing Science by Ghosh & Mallik, Affiliated East-West
7. Technology of Metal Forming Processes by S. Kumar, Prentice Hall of India

Course Outcomes

CO1: Able to understand the concept of theory of plasticity.
CO2: Able to understand and analyse the concept of yield criteria applicable to different material deformation processes.
CO3: Able to apply theoretical and experimental techniques for measurement of important outcomes of metal forming processes.
CO4: Able to understand the different powder metallurgy techniques.
CO5: Able to understand the different experimental techniques of evaluation of friction in metal forming selection.
Syllabus

Manufacturing Management (MST – 302)

L T P: 3 1 0

Credits-4

Course objectives:
To understand the concepts of manufacturing management and its various functions

Unit I: Plant engineering

Unit II: Work study
Principles of motion economy - steps in method study - tool and techniques - work measurement - purpose - stop watch time study - production studies - work sampling - ergonomics - value analysis.

Unit III: Process planning and forecasting
Process planning - aims of process planning - steps to prepare the detailed work sheets for manufacturing a given component - break even analysis - forecasting - purpose of forecasting - methods of forecasting - time series - regression and correlation - exponential smoothing - forecast errors.

Unit IV Scheduling and project management

Unit V Personnel and marketing management

References:
1. R-panneerselvam “production and operation management” prentice hall of india.
3. Thomas e mortan “production and operation management” vikash publication.

Course Outcomes

CO1: Able to understand the plant engineering.
CO2: Able to understand and work study problems.
CO3: Able to understand process planning and forecasting.
CO4: Able to understand and analyse PERT and CPM techniques.
CO5: Able to understand the marketing management.
Research Methodology and IPR (AHT-302)

L:T:P:: 2:0:0

Course Objectives: Students will be able to:
1. To understand the fundamentals of research in today’s world controlled by technology, ideas, concept, and creativity.
2. To understand different methods of research designing and data collections.
3. To understand the methods of report writing and its different methods of interpretations.
4. To understand research ethics and methods of research publications
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Course Outcomes:
1. To understand research problem formulation.
2. To study research design and method of data collections.
3. To study methods of report writing.
4. To follow research ethics.
5. To enhance student’s competence to discover new inventions.

Syllabus Contents:

UNIT I: FUNDAMENTAL OF RESEARCH
Meaning of research; objectives of research; basic steps of research; criteria of good research; Research methods vs. Methodology. Types of research – criteria of good research; Meaning of research problem; selection of research problem; Approaches of investigation of solutions for research problem, Errors in selecting a research problem, Scope and objectives of research problem, Review of related literature- Meaning, necessity and sources.

UNIT 2: RESEARCH DESIGN AND DATA COLLECTION
Research design: Types of research design- exploratory, descriptive, diagnostic and experimental; Variables- Meaning and types; Hypothesis- Meaning, function and types of hypothesis; Null/Alternative hypothesis; Sampling- Meaning and types of sampling; Probability and Non-Probability; Tools and techniques of data collection- questionnaire, schedule, interview, observation, case study, survey etc.

UNIT 3: REPORT WRITING AND ITS INTERPRETATION

UNIT 4: RESEARCH ETHICS AND SCHOLARLY PUBLISHING
Ethics-ethical issues, ethical committees (human & animal); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism and its concept and importance for scholar.

UNIT 5: INTELLECTUAL PROPERTY RIGHT (IPR)

Reference Books:

2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
Syllabus

Advanced Manufacturing Laboratory I (MSP – 301)

L T P: 0 0 3
Credits-1

List of Experiments:

1. Study of the morphology of chips produced from different materials and machining processes.
2. Effect of tool geometry on chip flow direction in simulated orthogonal cutting conditions.
3. Study of cutting ratio/chip thickness ratio in simulated orthogonal cutting with different materials and tool geometry.
4. Evaluations of tool face temperature with thermocouple method.
5. Roughness of machined surface. Influence of tool geometry and feed rate.
6. Extrusion of cylindrical billets through dies of different included angles and exit diameters and their effect on extrusion pressure.
7. Practice and study of blanking and punching process and their characteristic features mechanical press with existing dies.
8. Study of operation of tool and cutter grinder, twist drill grinder, Centreless grinder
9. Determination of cutting forces in turning
10. Inspection of parts using tool makers microscope, roughness and form tester
Syllabus
Manufacturing Simulation Lab(MSP – 302)

L T P: 0 0 3 Credits-1

A. MANUFACTURING SIMULATION

The students will be given training on the use and application of the following software to manufacturing problems:

1. Auto MOD Software.
2. PROMODEL
3. SLAM-II
4. CAFIMS
5. Flexsim

They also learn how to write sub routines in C-language and interlinking with the above packages.

Problems for modelling and simulation experiments:

1. AGV planning
2. ASRS simulation and performance evaluation
3. Machines, AGVs and AS/RS integrated problems
4. JIT system
5. Kanban flow
6. Material handling systems
7. M.R.P. Problems
8. Shop floor scheduling etc.

B. PRECISION ENGINEERING

1. Hydraulic and Pneumatic circuits
2. Closed loop control systems
3. Study of the chip formation in turning process
4. Study of operation of tool and cutter grinder, twist drill grinder, Centreless grinder
5. Determination of cutting forces in turning
6. Experiments in unconventional manufacturing processes-AJM and study of USM, EDM, Laser Machining and Plasma spraying
7. Inspection of parts using tool makers microscope, roughness and form tester
8. Study of micro-controllers, programming on various CNC machine tools and also controllers
9. Studies on PLC programming
10. Study and programming of robots
Syllabus

Applied Material Engineering (MST – 305)

L T P: 3 0 0 Credits-3

Course objective

- To study the elastic, plastic and fracture behavior of engineering materials.
- To study the various modern materials, properties and their applications
- To understand the selection of metallic and non-metallic materials for various engineering applications.

Particulars

Unit I Elastic and plastic behavior

Elasticity in metals and polymers - An elastic and visco-elastic behavior - Mechanism of plastic deformation and non metallic shear strength of perfect and real crystals - Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fiber and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behavior - Super plasticity - Deformation of non crystalline materials.

Unit II Fracture behaviour

Griffith's theory, stress intensity factor and fracture toughness - Toughening mechanisms - Ductile, brittle transition in steel - High temperature fracture, creep - Larson Miller parameter - Deformation and fracture mechanism maps - Fatigue, low and high cycle fatigue test, cracks initiation and propagation mechanisms and Paris law. Effect of surface and metallurgical parameters on fatigue - Fracture of non metallic materials - Failure analysis, sources of failure, procedure of failure analysis.

Unit III Selection of materials

Motivation for selection, cost basis and service requirements - Selection for mechanical properties, strength, toughness, fatigue and creep - Selection for surface durability corrosion and wear resistance - Relationship between materials selection and processing - Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications - Computer aided materials selection.

Unit IV Modern metallic materials


Unit V Non metallic materials

Polymeric materials - Formation of polymer structure - Production techniques of fibers, foams, adhesives and coating - structure, properties and applications of engineering polymers.
- Advanced structural ceramics, WC, TIC, Tac, Al₂O₃, Sic, Si₃N₄ CBN and diamond - properties, processing and applications.

References

4. GEORGE E, DIETER, Mechanical METALLURGY, MC Graw HILL, 1998
5. THOMAS H COURTNEY, mechanical behavior of materials (2 EDITION) Me Graw HILL, 1998

Course Outcomes

At the end of this course, the student is able to

CO1: Differentiate between elastic and plastic behaviour of materials.
CO2: Understand the fracture mechanism.
CO3: Suggest materials for low and high temperature applications.
CO4: Integrate knowledge of different types of advanced engineering materials.
CO5: Analyse problem and find appropriate solution for use of non-metallic materials.
Course objective
To impart knowledge regarding various Fusion welding practices in industries. Moreover, this course also provides knowledge about the heat flow and chemical reactions and their influence on weld properties. The aspects about the metallurgical changes and weldability of different materials and their effects on weld properties also covered in this course.

Particulars
Unit 1
**Fusion Welding Processes:** Principle, Working and Application of fusion welding processes such as Gas welding, Gas Tungsten Arc welding, Gas Metal Arc Welding, Submerged Arc Welding, Resistance welding. Electroslag Welding, Electron beam welding, Plasma arc welding, Laser welding.

Unit 2
**Non-Fusion Welding Processes:** Principle, Working and Application of non-fusion welding processes such as such as Forge Welding, Friction Stir welding, Explosive welding, Diffusion welding, Ultrasonic welding,

Unit 3
**Heat flow and Chemical Reactions in welding**
Gas-Metal Reactions, Slag-metal Reactions,

Unit 4
**Welding Metallurgy and Weldability:**

Unit 5
**Weld Design:** Residual stresses (Causes, effects and remedies), Distortion (causes, effects and remedies), Fatigue (Mechanism, Fractography, S-N curve, Remedies), Non-destructive Testing of weldments, Weld design for static loading and fatigue loading.
References:
1. Welding Engineering and Technology-R. S. Parmer, Khanna Publishers
2. Welding Processes and Technology- R. S. Parmer, Khanna Publishers
5. ASM Handbook vol.6, welding Brazing & Soldering

Course Outcomes
CO1: Students are introduced to various fusion and non-fusion welding techniques which make them interested to choose a career in the field of welding.
CO2: Students will be familiar with various welding process parameters and techniques and capable to select most suitable welding procedure and consumables for a product/process.
CO3: Students will understand the advanced welding practices in Industries and their comparative merits and demerits.
CO5: Students are demonstrated to develop the knowledge and skills in advanced welding processes, weld design using the various thermal and metallurgical considerations against various defects and final quality testing of weldments to secure employments.
CO5: Students will be able to choose the appropriate welding processes, right kind of welding techniques, weld design to minimize the occurrence of various weld defects or distortion with the aim of maximizing process efficiency and weld quality.
Syllabus

Micro and Nano Manufacturing (MST – 307)

L T P: 3 0 0  Credits-3

Course objective
The objective of this course is to give awareness of different techniques used in micro and nano manufacturing and to introduce other processing routes. Moreover, different techniques used in micro joining and the metrology tools in micro and nano manufacturing also covered in this course.

Particulars

Unit 1: Introduction to Micro and Nano Engineering


Unit 2: Conventional Micro Manufacturing Techniques

Unit 3: Unconventional Micro Nano Manufacturing Techniques

Unit 4: Micro and Nano Finishing Processes

Unit 5: Micro Joining and Metrology Tools

References

Course Outcomes
CO1: Get an awareness of different techniques used in micro and nano manufacturing.
CO2: get in-depth idea of the conventional techniques used in micro manufacturing.
CO3: Become aware about non-conventional micro-nano manufacturing and finishing approaches.
CO4: Get awareness on micro and nano finishing processes.
CO5: Know about different techniques used in micro joining and the metrology tools in micro and nano manufacturing.
Syllabus

Modern Machining Processes (MST – 308)

L T P: 3 0 0

Course Objective

To impart clear knowledge about modern machining processes and its latest developments to the students.

Particulars

Unit I

MECHANICAL ADVANCED MACHINING PROCESSES ABRASIVE JET MACHINING ( AJM )
Introduction - Abrasive Jet Machining Setup - Gas Propulsion System - Abrasive Feeder Machining Chamber - AJM Nozzle - Abrasives.

PARAMETRIC ANALYSIS - Stand-off-Distance Abrasive Flow Rate - Nozzle Pressure - Mixing Ratio.

PROCESS CAPABILITIES APPLICATIONS PROBLEMS

ULTRASONIC MACHINING ( USM ) INTRODUCTION ULTRASONIC MACHINING SYSTEM MACHINING SYSTEM MECHANICS OF CUTTING PARAMETRIC ANALYSIS PROCESS CAPABILITIES APPLICATIONS PROBLEMS

ABRASIVE FLOW FINISHING ABRASIVE FLOW FINISHING WORKING PRINCIPLE ABRASIVE FLOW MACHINING SYSTEM Machine - Tooling - Media. PROCESS VARIABLES PROCESS PERFORMANCE ANALYSIS AND MODELING OF ABRASIVE FLOW MACHINED SURFACES - Number of Active Grains - Wear of Abrasive Grains. APPLICATIONS - Aerospace - Dies and Molds.

Unit II

MAGNETIC ABRASIVE FINISHING (MAF) INTRODUCTION WORKING PRINCIPLE OF MAF MATERIAL REMOVAL (OR STOCK REMOVAL) AND SURFACE FINISH - Bonded and Unbonded Magnetic Abrasives - Machining Fluid- Magnetic Flux Density. ANALYSIS
WATER JET CUTTING (WJC) INTRODUCTION

WJM MACHINE PROCESS CHARACTERISTICS

PROCESS PERFORMANCE APPLICATIONS

BIBLIOGRAPHY

SELF TEST QUESTIONS

REVIEW QUESTIONS

ABRASIVE WATER JET MACHINING (AWJM) WORKING PRINCIPLE

AWJM MACHINE -

Pumping System – Abrasive Feed System - Abrasive Jet Nozzle - Catcher. PROCESS CHARACTERISTICS

WATER - Water Jet Pressure During Slotting Water Flow Rate.

ABRASIVES - Abrasive Flow Rate - Abrasive Particle Size - Abrasive Material.

CUTTING PARAMETERS - Traverse Speed Number of Passes - Stand-off-Distance - Visual Examination. PROCESS CAPABILITIES

APPLICATIONS

Unit III

THERMOELECTRIC ADVANCED MACHINING PROCESSES

ELECTRIC DISCHARGE MACHINING (EDM) INTRODUCTION

WORKING PRINCIPLE OF EDM R-C PULSE GENERATOR


PROCESS CHARACTERISTICS - Gap Cleaning. APPLICATIONS

ELECTRIC DISCHARGE GRINDING (EDG) AND ELECTRIC DISCHARGE DIAMOND GRINDING (EDDG)

ELECTRIC DISCHARGE GRINDING (EDDG) ELECTRICAL DISCHARGE DIAMOND GRINDING - Working Principle - Capabilities and Applications.

WIRE ELECTRIC DISCHARGE MACHINING WORKING PRINCIPLE

WIRE EDM MACHINE - Power Supply System Dielectric System - Positioning System - Wire Drive System. ADVANCES IN WIRECUT STRATIFIED WIREPROCESS VARIABLES

PROCESS CHARACTERISTICS APPLICATIONS PROBLEMS

Unit IV

LASER BEAM MACHINING PRODUCTION OF LASERS WORKING PRINCIPLE OF LASER BEAM MACHINING TYPES OF LASERS - Solid Lasers - Gas Lasers.

PROCESS CHARACTERISTICS APPLICATIONS - Drilling - Cutting - Marking Miscellaneous Applications.

PLASMA ARC MACHINING WORKING PRINCIPLE PLASMA ARC CUTTING SYSTEM ELEMENTS OF A PLASMA ARC CUTTING SYSTEM PROCESS PERFORMANCE APPLICATIONS

REVIEW QUESTIONS
ELECTRON BEAM MACHINING WORKING PRINCIPLE

SYSTEM Electron Beam Gun - Power Supply - Vacuum System and Machining Chamber.

PROCESS PARAMETERS CHARACTERISTICS OF THE PROCESS APPLICATIONS


ELECTROCHEMICAL AND CHEMICAL ADVANCED MACHINING PROCESSES

ELECTROCHEMICAL MACHINING

Unit V


ELECTROCHEMICAL GRINDING INTRODUCTION ECG MACHINE TOOL PROCESS CHARACTERISTICS APPLICATIONS

ELECTROCHEMICAL DEBURRING INTRODUCTION - Definition of Burr - Types of Burrs - Basic Approach on Deburring. CLASSIFICATION OF DEBURRING PROCESSES ELECTROCHEMICAL DEBURRING (ECDe) Principle of Working. APPLICATIONS SPECIFIC FEATURES OF ECDe MACHINE

CHEMICAL MACHINING (ChM) INTRODUCTION MASKANTS - Cut And Peel - Screen Printing Photo-resist Mask-ant. ETCHANT ADVANTAGES AND LIMITATIONS

References

3. Unconventional Machining Processes by P.K.Mishra
4. Advanced Machining Methods by JAMcGeough, Chapman and Halls, UK.
Course Outcomes

At the end of course, students will

CO1: Able to understand as well as demonstrate the knowledge and the basic techniques of ultrasonic machining processes.

CO2: Able to understand the abrasive jet machining.

CO3: Able to understand the applications of EDM & EDG.

CO4: Able to understand the applications of electrochemical and chemical advanced machining methods.

CO5: Able to understand the importance and criteria to apply ECM and chemical machining.
Syllabus

Modern Manufacturing Processes (MST – 309)

L T P: 3 0 0 Credits-3

Course objective
This course familiarizes students with the advanced manufacturing processes which includes surface treatment, non-traditional machining, laser beam, plasma arc, electron beam and electron chemical machining. This course also covers the processing of composites and fabrication of microelectronic devices.

Particulars
Unit 1
Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

Unit 2

Unit 3

Unit 4
Processing of ceramics: Applications, characteristics, classification. Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics.
Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.
Unit 5

Fabrication of Microelectronic devices: Crystal growth and wafer preparation, FilmDeposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuitboards, computer aided design in microelectronics, surface mount technology, Integratedcircuit economics. E-Manufacturing, nanotechnology, and micromachining, High speed Machining.

References


Course Outcomes

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

CO1: Understand the methodology of surface treatment
CO2: Understand the working principle of non-traditional machining
CO3: Understand the working of Electron beam, laser beam and laser hybrid welding processes.
CO4: Understand different types of composite material characteristics, types ofmicro & macro machining processes
CO5: Understand the e-manufacturing & nano materials.
Syllabus

Lean Manufacturing System and Implementation (MST – 310)

L T P: 3 0 0 Credits-3

Course objective

- To introduce the concepts of lean manufacturing system
- To study the various tools for lean manufacturing and case studies

Unit I- Introduction to lean manufacturing


Unit II- Cellular manufacturing, JIT, TPM

Cellular Manufacturing - Types of Layout, Principles of Cell layout, Implementation. JIT - Principles of JIT and Implementation of Kanban. TPM - Pillars of TPM, Principles and implementation of TPM.

Unit III Set up time reduction, TQM, 5S, VSM

Set up time reduction - Definition, philosophies and reduction approaches. TQM - Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

Unit IV Six sigma

Six Sigma - Definition, statistical considerations, variability reduction, design of experiments - Six Sigma implementation

Unit V Case studies

Various case studies of implementation of lean manufacturing in industries.

References

1. Ronald g. askin&jeffrey b gold berg design and analysis of lean production system john wiley& sons.2003

Course outcomes

CO1: Able to understand the concept and principle of lean manufacturing system.

CO2: Able to define the principles of JIT & TPM.

CO3: Able to apply the principles of TQM, 5S.

CO4: Able to identify the principles of six sigma.

CO5: Able to apply case studies using quality tools.
Syllabus

Robotics and Automation (MST – 311)

L T P: 3 0 0 Credit-3

Course objective

To impart knowledge about the engineering aspects of Robots and their applications.

Particulars

Unit 1

Introduction: Brief history, robot terminology, classification, characteristic, physical configuration, structure of industrial robot. Robot and Effectors: Types, mechanical grippers, other types of gripper, tools as end effectors, Robot/end effector interface, design consideration.

Robot Motion Analysis & Control: Introduction to manipulator kinematics, robot dynamics, manipulator dynamics, robot control, task planning.

Unit 2

Sensors: Transducers and sensors, sensors in robotics, tactile sensors, proximity and range sensors, miscellaneous sensors and sensor-based systems, use of sensors in robotics, touch sensors, force-torque sensors.

Machine Vision: Introduction, sensing and digitizing function in machine vision, image processing and analysis, vision system robotic applications.

Unit 3

Programming: Basics of robot programming, languages, commands, communications and data processing. Applications: Welding, electro-plating, painting, spraying, assembling, material handling, inspection, Future applications. Introduction to design of robot in specific applications.

Unit 4


Automated Material Handling: components, operation, types, design of automated guided vehicles and applications. Automated storage / retrieval systems - types, basic components and applications.

Unit 5

Automated Inspection and Testing: Automated inspection principles and methods sensors techniques for automated inspection-techniques for automated inspection-contact and noncontact inspection methods-in process gauging, CMM’s, construction, types, inspection probes, types, and applications. Machine vision, LASER Micro meter and optical inspection methods.

References


Course Outcomes

At the end of course, student will able to

CO1: demonstrate the knowledge of relationship between mechanical structures of industrial robots and their operational workspace characteristics.
CO2: demonstrate an ability to apply spatial transformation to obtain forward kinematics equation of robot manipulators.
CO3: demonstrate an ability to solve inverse kinematics of simple robot manipulators.
CO4: apply localization and mapping aspects of mobile robotics.
CO5: demonstrate the self-learning capability.
Syllabus

Micro Electro Mechanical Systems (MST – 312)

L T P: 3 0 0 Credits-3

Course objective
To educate on the rudiments of micro fabrication techniques and to introduce different types of sensors and actuators. Moreover, the micro systems design are also explored.

Particulars

Unit 1

Unit 2
Materials for MEMS and Microsystems: substrates and wafers, active substrate materials, silicon as a substrate material- the ideal substrate for MEMS, single crystal silicon and wafers, crystal structure, the miller indices, mechanical properties of silicon. Silicon compounds- silicon dioxide, silicon carbide, silicon nitride, polycrystalline silicon piezo resistors, Gallium arsenide, polymers for MEMS and Microsystems, conductive polymer, the Langmuir-Blodgett film, packaging materials.

Unit 3
Microsystems Fabrication Processes: Photolithography-photo resists and application, light sources, photo resist development, photo resist removal and post baking. Ion implantation, diffusion, oxidation-thermal oxidation, silicon dioxide, thermal oxidation rates, oxide thickness by color; Chemical vapor deposition- working principle of CVD, chemical reaction s in CVD, rate of deposition, enhanced deposition; physical vapor deposition- sputtering; Deposition by epitaxy; Etching- Chemical etching, plasma etching.

Unit 4
Unit 5

**Microsystems Design:** Design Considerations- Design constraints, selection of materials, selection of manufacturing processes, selection of signal transduction, electromechanical system and packaging

Process design- photolithography, thin film fabrications, geometry shaping, Mechanical design- thermo mechanical loading, thermo mechanical stress analysis, dynamic analysis, interfacial fracture analysis. Design of micro fluidic network systems- fluid resistance in microchannels, capillary electrophoresis network systems, mathematical modeling of capillary electrophoresis network systems

**References**

1. MEMS & Microsystems Design and Manufacture by Tai-Ran Hsu Tata McGraw-Hill

**Course outcomes**

At the end of course, student will able to

**CO1:** describe new applications and directions of modern engineering.

**CO2:** illustrate the techniques for building microdevices in silicon, polymer, metal and other materials.

**CO3:** demonstrate the physical, chemical, biological, and engineering principles involved in the design and operation of current and future microdevices.

**CO4:** critically analyze microsystems technology for technical feasibility as well as practicality.

**CO5:** outline the limitations and current challenges in microsystems technology.
Syllabus
Automated & Computer Integrated Manufacturing (MST – 303)

L T P: 3 1 0
Credits-4

Course Objective
- To understand basic concepts of CIM system
- To learn the various concepts of automated manufacturing system.
- To study the computer aided process planning and control and techniques.

UNIT INTRODUCTION


UNIT II AUTOMATED MANUFACTURING SYSTEMS

Automated production line -system configurations, work part transfer mechanisms - Fundamentals of Automated assembly system-System configuration, Part delivery at workstations - Design for automated assembly - Overview of material handling equipments -Consideration in material handling system design. Automated Guided Vehicle system - Automated storage/Retrieval system and Carousel storage system

UNIT III GROUP TECHNOLOGY AND FMS

Part families - Visual - Parts classification and coding - Production flow analysis - Grouping of parts and Machines by rank order clustering method - Benefits of GT - Case studies.

FMS -Components -workstations-FMS layout configurations - FMS planning and implementation issues - Architecture of FMS - flow chart showing various operations in FMS -FMS applications Benefits.

UNIT IV PROCESS PLANNING

UNIT V  TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE


References:

7. Automation, Production systems and computer integrated manufacturing by Mikel P. Groover, Pearson Education.

Course Outcomes

CO1: Able to understand the introduction of CAD/CAM
CO2: Able to understand the automated manufacturing system.
CO3: Able to understand the concepts of group technology and flexible manufacturing system.
CO4: Able to understand the concepts of process planning.
CO5: Able to understand the different types of process controls.
Syllabus

Finite Elements Methods (MST – 304)

L T P: 3 1 0  Credits-4

Course objective
To equip students with fundamentals of finite element principles. Moreover, physical and engineering
problems with emphasis on structural and thermal engineering applications also covered in this course.

Particulars

Unit 1: Introduction to Finite Element Analysis and Finite Element Formulation Techniques
Introduction, Basic Concepts of Finite Element Analysis, Introduction to Elasticity, Steps in Finite
Element Analysis.
Virtual Work and Variational Principle, Galerkin Method, Finite Element Method: Displacement
Approach, Stiffness Matrix and Boundary Conditions.

Unit 2: Element Properties
Natural Coordinates, Triangular Elements, Rectangular Elements, Lagrange and Serendipity
Elements, Solid Elements, Isoparametric Formulation, Stiffness Matrix of Isoparametric Elements,
Numerical Integration: One Dimensional, Numerical Integration: Two and Three Dimensional,
Worked out Examples.

Unit 3: Analysis of Frame Structures
Stiffness of Truss Members, Analysis of Truss, Stiffness of Beam Members, Finite Element Analysis
of Continuous Beam, Plane Frame Analysis, Analysis of Grid and Space Frame.

Unit 4: FEM for Two- and Three-Dimensional Solids
Constant Strain Triangle, Linear Strain Triangle, Rectangular Elements, Numerical Evaluation of
Element Stiffness Computation of Stresses, Geometric Nonlinearity and Static Condensation,
Axisymmetric Element, Finite Element Formulation of Axisymmetric Element, Finite Element
Formulation for 3 Dimensional Elements Worked out Examples.

Unit 5: Additional Applications of FEM

References
1. Introduction to Finite Elements in Engineering by T. R. Chandrupatla and A. D. Belegundu,
   Pearson Education.
2. Finite Element Methods: Basic concepts and applications by Chennakesava R. Alavala, PHI
   publications.
7. Finite Element and Approximation by O.C. Zenkiewicy& Morgan

Course Outcomes

CO1: Students should be able to understand the basic Concepts of Finite Element Analysis.

CO2: Students will be able to understand the Finite Element Formulation Techniques.

CO3: Students should have the knowledge about the Finite Element Properties

CO4: Students will be able to understand the analysis of Frame Structures

CO5: Student should have a knowledge about the applications of FEM.
Syllabus

Automation Lab(MSP – 303)

L T P: 0 0 3 Credits-1

To simulate the various hydraulics and pneumatics circuits

2. Study of Temperature Transducer.
4. Exercises on Operational amplifier circuits.
5. Study of Fiber optic sensors.
7. Study of Hydraulic and Pneumatic components.
8. Exercise on Hydraulic circuits.
10. Study of Electro Pneumatic Sequencing circuits.
12. Exercise on Hydraulic and Pneumatic circuits using PLC.
Syllabus

Advanced Manufacturing Laboratory II (MSP – 304)

L T P: 0 0 3 

Credits-1

List of experiments

1. Experimental Study of MRR on EDM
2. Experimental Study of TWR on EDM
3. Experimental Study of Surface Roughness on EDM
4. Experimental Study on ECM
5. Experimental Study on 3D Printing
6. Study of wear characteristics of machine components.
7. To determine sliding wear rate of given sample.
8. To determine of abrasive wear rate of given sample
10. To determine the hardness of given sample.
11. Experiment on Metal Spraying and to study the tribological properties of coated film
12. Experiment on Metal Spraying and study the hardness of coated film
13. Dye-Penetrant Testing of weldments
Course objective
To expose the students to the different aspects of machining. Identify and use various methods and mechanism of metal cutting.

Particulars
Unit 1: Mechanics of metal cutting
Chip formation, Types of chips, tool geometry-effect of rake, lead and clearance angles; Mechanics of orthogonal and oblique cutting, Shear angle relations in orthogonal cutting, Shear angle and chip flow direction in oblique cutting, Chip control methods, Analysis of cutting process, Machining with rotary tools.

Unit 2: Thermal aspects in machining
Heat and temperature distribution, modelling of chip formation in metal cutting, machining characteristics in turning, milling, drilling, grinding, etc., measurement of cutting forces and cutting temperatures. Economics of metal machining.

Unit 3: Cutting tools
Tools materials analysis of plastic failure (from stability criterion), Analysis failure by brittle fracture, wear of cutting tools, criterion, flank and crater wear analysis, optimum tool life, tool life equations, machining optimization, predominant types of wear; abrasive, adhesive, diffusion wear models, wear measurements and techniques, theory of tool wear, test of machinability and influence of metallurgy on machinability.

Unit 4: Abrasive machining
Mechanics of grinding, cutting action of grit, maximum grit chip thickness, energy and grit force temperature during grinding, Theory of wheel wear, High speed grinding theory, Grinding of drills, form cutters etc., testing of grinding wheels, mechanics of lapping and honing, free body abrasion.

Unit 5: Micro milling

References
11. Introduction to Machining Science by GK Lal New Age International.

**Course Outcome**

**CO1**: To be able to understand the mechanism of metal cutting.

**CO2**: To be able to understand the thermal aspects in machining.

**CO3**: Understand the classification of various types of cutting tools and their geometry and design.

**CO4**: To be able to understand the concept of abrasive machining and free body abrasion.

**CO5**: Understand the importance of micro-milling and micro-drilling.
Supply Chain and Logistics Management (MST – 314)

L T P: 3 1 0

Course objective

This course aims to provide an introduction industry demand. Our Supply Chain Management program will prepare you to: Understand fundamental supply chain management concepts. Apply knowledge to evaluate and manage an effective supply chain.

Particulars

Unit 1
Introduction: Understanding supply chain, supply chain performance; supply chain drivers and obstacles.

Unit 2
Planning Demand and Supply in a Supply Chain: Demand forecasting in supply chain, aggregate planning in supply chain, planning supply and demand; managing predictable variability, Economic Order Quantity Models, Reorder Point Models, Multi-echelon Inventory Systems.

Unit 3
Planning and Managing inventories in a Supply Chain: Managing economies of supply chain, managing uncertainty in a supply chain, determining optimal levels of product availability.

Unit 4
Transportation, Network Design and Information Technology: Transportation aspects in a supply chain, facility Decision, Network design in a supply chain, Information technology and its use in supply chain.

Unit 5
Coordination in Supply Chain and effect of E- Business: Role of Coordination and E-business in a supply chain; financial evaluation in a supply chain.

References


Course Outcomes

At the end of this course, students will be

CO1: Able to apply metrics in supply chains.
CO2: Able to define the principles of scheduling and planning in supply chain management.
CO3: Able to apply the principles of Strategic/Master planning of resource in supply chains.
CO4: Able to identify the principles of customer and supplier relationship management in supply chains.
CO5: Able to define the principles of quality and lean manufacturing.


Syllabus

Machine Tool Design Techniques (MST – 315)

L T P: 3 1 0  

Credits-4

Course objective
To impart the clear knowledge about the machine tool design.

Particulars

Unit 1

Unit 2
Regulation of Speed and Feed Rates: Aim of speed feed regulation, stepped regulation of speed, design of speed box, Design of feed box, Special cases of gear box design, Set stopped regulation of speed and feed rates.

Unit 3

Unit 4

Design of Spindles and Spindle Supports: Materials for spindles, Design of spindles, Antifriction bearings, Sliding bearings.

Unit 5
Dynamics of Machines Tools: General procedure of assessing dynamic stability of EES, Cutting processing, closed loop system, Dynamic characteristics of cutting process, Stability analysis.

References

Course Outcomes

CO1: The students will be able to explain the Auxiliary motion, feed motion of different machine tool, layout of machine, and general requirement of machine tool.

CO2: The student will be able to design the speed box and feed box.

CO3: The student will be able to design various parts of machine tool like bed, column, housing, etc.

CO4: The student will be able to design guideways, spindle and spindles support of a machine tool.

CO5: The student will be able to assess dynamic stability of EES and Dynamic characteristics of cutting process, Stability analysis.
Syllabus

Precision Engineering (MST – 316)

Course objective

- Understand the principal application of different measuring instruments.
- Summarize the application of latest manufacturing techniques (Nano).

UNIT I: Concepts of Accuracy:


UNIT II: Datum Systems:

Design of freedom, Grouped Datum Systems – different types, two and three mutually perpendicular grouped datum planes; Grouped datum system with spigot and recess, pin and hole; Grouped Datum system with spigot and recess pair and tongue – slot pair – Computation of Transnational and rotational accuracy, Geometric analysis and application.

UNIT III: Tolerance Analysis:


UNIT IV: Surface finish,

Review of relationship between attainable tolerance grades and different machining process. Cumulative effect of tolerances sure fit law, normal law and truncated normal law.
UNIT V: Fundamentals of Nanotechnology:

System of nanometer accuracies – Mechanism of metal Processing – Nano physical processing of atomic bit units. Nanotechnology and Electrochemical atomic bit processing. MEASURING SYSTEMS PROCESSING: In processing or in-situ measurement of position of processing point-Post process and on-machine measurement of dimensional features and surface-mechanical and optical measuring systems.

Reference books:


Course Outcomes

At the end of course, students are able to

CO 1: describes the General concept of accuracy.
CO 2: Understand the datum system
CO 3: Understand the BIS code fits and tolerances for geometrical dimensioning and tolerance
CO 4: Understand the fundamental importance of surface finish and its measurement
CO 5: Explains Top down and bottom up approach, development of Nanotechnology, and precision.
Syllabus

Advanced Materials Characterization Techniques (MST – 317)

L T P: 3 0 0 Credits-3

Course objective

To introduce the students to the principles of optical and electron microscopy, X-ray diffraction and various spectroscopic techniques

Particulars

Unit I

Introduction: Need of materials characterization and available techniques. Optical Microscopy: Optical microscope - Basic principles and components, Different examination modes (Bright field illumination, Oblique illumination, Dark field illumination, Phase contrast, Polarised light, Hot stage, Interference techniques), Stereomicroscopy, Photomicroscopy, Colour metallography, Specimen preparation, Applications.

Unit II


Unit III


Unit IV


Unit V

Thermal Analysis: Thermo gravimetric analysis, Differential thermal analysis, Differential Scanning calorimetry, Thermo mechanical analysis and dilatometry.
References


Course Outcomes

Students will have achieved the ability to:

CO1: Apply appropriate characterization techniques for microstructure examination at different magnification level and use them to understand the microstructure of various materials

CO2: Choose and appropriate electron microscopy techniques to investigate microstructure of materials at high resolution

CO3: Determine crystal structure of specimen and estimate its crystallite size and stress

CO4: Use appropriate spectroscopic technique to measure vibrational / electronic transitions to estimate parameters like energy band gap, elemental concentration, etc.

CO5: Apply thermal analysis techniques to determine thermal stability of and thermodynamic transitions of the specimen.
Syllabus

Additive Manufacturing Technology (MST – 318)

L T P: 3 0 0 Credits-3

Course objectives:
• To analyze and determine material fabrication processes.
• To use laboratory instrument doing routine metrological measurements
• To operate regular machine shop equipment such as grinders, drill presses, lathes, milling machines, shapers and etc.
• To recognize engine machine tool requirements and be selective in the choice of tools.
• To setup and operate machines, index and determine machine speeds, feeds, and depth of cut requirements.
• To identify with numerical control machining and computer programming.
• To determine costs and establish basic programs in machine shop economics.

UNIT - I:
Surface treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT - II:

UNIT - III:

UNIT - IV:
Processing of ceramics: Applications, characteristics, classification. Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application.
Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

UNIT - V:
Fabrication of Microelectronic devices: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. E-Manufacturing, nanotechnology, and micromachining, High speed Machining

References:

Course Outcomes

At the end of course, students are able to

CO1: Understand the principle of vapour deposition

CO2: Understand the aspects of non-traditional machining

CO3: Understand the principle of laser beam and electron beam machining

CO4: Demonstrate the knowledge about processing ceramics

CO5: Demonstrate the knowledge for fabrication of microelectronic devices
Syllabus

Manufacturing System Simulation (MST – 319)

L T P: 3 0 0 Credits-3

Course objectives

To acquaint the student with the various methods of modelling and analysis of manufacturing systems.

Particulars

Unit I

Manufacturing Systems and Models

Introduction to manufacturing models- types and principles of manufacturing system, manufacturing models - types and uses- physical models, mathematical models, model uses, model building

Unit II

Assembly Lines, Scheduling

Introduction- line balancing algorithms- COMSOL Random sequence generation, Ranked positional weight heuristics, optimal solutions- practical issues - mixed models – sequencing- unpaced lines-

Shop scheduling with many products, Order release, flow shop sequencing – single and two machine flow shops- job shop scheduling- Dispatching rules and Schedule generation

Unit III

Flexible Manufacturing Systems

Introduction - Components of FMS – Machines, Part movement system, work stations, system controller. Planning and control hierarchy- System design, system set up, scheduling and control. Flexible assembly system.- Group technology – principles, coding schemes, assign machines to groups- production flow analysis, binary ordering algorithm. Assigning parts to machines

Unit IV

Material Handling and AGV systems

Introduction- types, principles of material handling – Equipment selection, conveyor analysis, closed loop conveyor- AGV systems – Design and operation of AGV, vehicle requirements analysis- pallet sizing and loading
Unit V

**Ware Housing – Storage and Retrieval Systems**

Introduction – ware house components – ware house design, stacking pattern, location in ware houses – dedicated storage, open storage, class base storage, storing complementary items- Order picking – forming pick list, pick sequencing

**References**


**Course outcomes**

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

CO1 Understand types and models of manufacturing systems

CO2 Apply line balancing algorithms

CO3 Design flexible manufacturing systems

CO4 Design of material handling systems

CO5 Design ware house systems
Syllabus

Modern Concepts of Engineering Design (MST – 320)

L T P: 3 0 0 Credits-3

Course Objectives

- Widen students’ knowledge on design process
- Enable Students to attain knowledge on tools used in Design Methods
- Create an understanding on the process of material selection and design
- Develop in depth knowledge on Engineering statistics and reliability
- Create awareness on legal and ethical issues in Design a Quality Engineering

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
property – Legal and ethical domains – Codes of ethics – Solving ethical conflicts – case studies
Total
Design – Failure Model Effect Analysis.

References
Edition
    Hill,  4. International Editions, Mechanical Engineering Series

Course Outcomes:
1. Get clear understanding on CAE / concurrent engineering and systems engineering
2. Attain problem solving skills through modeling/simulation and optimize design
3. Ability to do material selection based on economy and value analysis. Develop understanding on
    DFM/DFA
4. Have good understanding on DOE, Reliability theory and reliability centred maintenance
5. Exposed to laws, codes of ethics, Quality concepts and FMEA
Syllabus

Facility Planning and Value Engineering (MST – 331)

L T P: 3 0 0  Credits-3

Course objective
Provide students with the ability to apply plant layout design procedure to design a new facility and ability to select a suitable location for new facility with the use of different techniques.

Particulars
Unit 1
Plant layout, material handling and their interrelationship, objectives of a good plant layout, principles of a good layout, classical types of layouts, special types and practical layouts. Factors affecting plant layout: man, material, machine, movement, waiting, service, building and change, features and considerations of each factor, procedure of plant layout, data collection for layout design, layout visualization using templates and 3D models.

Unit 2
Various theories/models of site location like equal weights, variable weights, weight cum rating, composite model and Bridgemann’s model, Weber index, and various subjective techniques, evaluation of layout, computerized layout, flowcharts of various Programmes like CRAFT, ALDEP AND CORELAP.

Unit 3
Principles, factors affecting material handling, objectives, material handling equation, selection of material handling systems and equipments, cranes, conveyors, hoists and industrial trucks, installation of new facilities in the existing setup using median model and gravity model.

Unit 4
Methodology of value engineering, unnecessary costs, use and prestige value, estimation of product quality or performance. Types of functions functional cost and functional worth. Effect of value improvement on profitability, tests for poor value.

Unit 5
Aims and objectives of value engineering, systematic approach. Value engineering, job plan- study of various phases of the job plan. Selection of projects for value analysis. Primary and secondary functions work and sell functions, determining and evaluating functions, assigning equivalence, function-cost matrix evaluation. Function (FAST). Reporting, implementation & follow up.
References


Course Outcomes

At the end of this course, student is able

**CO1**: To select a suitable location amongst the available locations for setting up a new facility.

**CO2**: To decide about the particular production process flow strategy.

**CO3**: To design a layout for the new facility to suit the company’s production process structure.

**CO4**: To select proper type of equipment for storage and movement of material.

**CO5**: To create the value engineering team and discuss the value engineering case studies.
Course Objective
The objectives of this course is to introduce the main principles of business and social excellence, to generate knowledge and skills of students to use models and quality management methodology for the implementation of total quality management in any sphere of business and public sector.

Particulars
Unit 1
Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of prototype.
Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.
Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

Unit 2
Quality Management: Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program.
Human Factor in quality: Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.

Unit 3
Control Charts: Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.
Attributes of Control Chart: Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

Unit 4
Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

Unit 5
References


Course Outcomes

At the end of this course, student will demonstrate the ability to

CO1: Explain the different meanings of the quality concept and its influence.
CO2: Recognize the contributions of world’s leading experts on quality management and through this, develop the intellectual skills.
CO3: Understand the importance of control chart.
CO4: Understand the concept of reliability.
CO5: To apply the concept of Quality Management ISO 9000 series and Taguchi method.
Syllabus

Reliability and Maintenance Engineering (MST – 333)

L T P: 3 0 0  Credits-3

Course objective
To apply the concept to reliability, concept of maintainability, concept of replacement planning & to apply the concept of maintenance management.

Particulars

Unit 1

Unit 2

Unit 3
Maintenance Strategies: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency.

Unit 4
Replacement planning maintain or replace decision, replacement of items that deteriorate identical equipment, replacement of items that fail without deterioration individual, group replacement, replacement in anticipation of failure. Break down maintenance planning.

Unit 5
Maintenance Management, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management.
References

2. Introduction to Safety Engineering: David S Gloss & Miriam Gayle Wardle.

Course Outcomes

At the end of this course, the student is

CO1: Able to explain the concept to reliability.
CO2: Able to explain the concept of maintainability of a system.
CO3: Able to explain the concept of maintenance strategies.
CO4: Able to explain the concept of replacement planning.
CO5: Able to explain the concept of maintenance management.
Syllabus

Entrepreneurship Development (MST – 334)

L T P: 3 0 0 Credits-3

Course objective
To motivate the development of new entrepreneurs for new India.

Particulars

Unit 1
Foundation of Entrepreneurship Development: Concept and need of entrepreneurship; Characteristics and Types of Entrepreneurship; Entrepreneurship as a career; Entrepreneurship as a style of Management; The changing role of the entrepreneur; Entrepreneurial traits, factors affecting entrepreneur.

Unit 2
Theories of Entrepreneurship: Influences on entrepreneurship development; External influences on entrepreneurship development; Socio-cultural, Political, economical, personal entrepreneurial success and failure: reasons and remedies; Women entrepreneurs: Challenges and achievements of women entrepreneurs.

Unit 3
Business Planning Process: The business plan as an entrepreneurial tool; Elements of business planning; Objectives; Market analysis; development of Product/idea; Marketing, Finance, Organization and management; Ownership; Critical risk contingencies of the proposal; Scheduling and milestones.

Unit 4
Project Planning for Entrepreneurs: Technical, Financial, Marketing, Personnel, and management feasibility reports; Financial schemes offered by various financial institution, Like Commercial Banks, IDBI, ICICI, SIDBI, SFCs, Foreign currency, Financing; Estimation of Financial requirements.

Unit 5
References


Course Outcomes

At the end of course, students will able to understand

CO1: the basic requirements for entrepreneurship.
CO2: the influence of entrepreneurship on socio-cultural, political and economical regime.
CO3: the entrepreneurial tool.
CO4: the aspects of project planning for entrepreneurs.
CO5: the schemes raised by central and state Government for promoting entrepreneurship.
Syllabus

Product Engineering (MST – 335)

L T P: 3 0 0 Credits-3

Course Objectives: 1. Gain an understanding and appreciation of the breadth and depth of the field of Product design and manufacturing. 2. Understand the various basics of Product design phases, design morphology, considerations in different manufacturing processes and value engineering. 3. Learn how to apply optimization, ergonomics and anthropometry for product design and manufacturing. 4. Learn to design, develop and manufacturing of a product.

Unit 1

Introduction to Product Design


Unit 2

Product Design Practice and Industry


Unit 3

**Design for Production - Metal Parts**


Unit 4


Unit 5


Modern Approaches to Product Design

Concurrent Design, Quality Function Deployment (QFD) for design.

**Text Books:**

- A.C. Chitale and R.C. Gupta, Product Design and Manufacturing by PHI.
Reference Books:

- Boothroyod & Dewburst P., Design for Assembly, a Designer's Hand book, University of Massachusetts, Amherst, 1983.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Learn basics of product design process and morphology of design.

2. Students are exposed to Concept design, detail design, manufacturing, marketing, Introduction strategy of new product. Students learn about process of design for production of metal components.


4. To prepare a brief presentation on design morphology of at least one product as well as assignments is given to students to evaluate manufacturability and design for production.

5. At the end of course students should aware of different stages of product design
Syllabus
Six Sigma (MST – 336)

L T P: 3 0 0 Credits-3

Unit-I
Quality Perception: Quality in Manufacturing, Quality in Service Sector; Differences between Conventional and Six Sigma concept of quality; Six Sigma success stories. Statistical foundation and methods of quality improvement.

Descriptive statistics: Data Type, Mean, Median, Mode, Range, Variation, Standard Deviation, Skewness, Kurtosis.

Probability Distribution: Normal, Binomial, Poisson Distribution.

Unit-II
Basics of Six Sigma: Concept of Six Sigma, Defects, DPMO, DPU, Attacks on X’S, Customer focus, Six Sigma for manufacturing, Six Sigma for service. Z score, Understanding Six Sigma organization, Leadership council, Project sponsors and champions, Master Black Belt, Black Belt, Green Belts.

Unit-III
Methodology of Six Sigma, DMAIC, DFSS, Models of Implementation of Six Sigma, Selection of Six Sigma Projects.

Unit-IV

Unit-V
Sustenance of Six Sigma, Communication plan, Company culture, Reinforcement and control, Introduction to softwares for Six Sigma, Understanding Minitab, Graphical analysis of Minitab plots.

References:
1. Six Sigma: SPC and TQM in manufacturing and service, Geoff Tennant, Gower Publishing Co.
2. Six Sigma for managers, Greg Brue, TMH
3. What is Six Sigma, Pete Pande, TMH
4. The Six Sigma Way, Peter S. Pande, TMH Team Field book
5. The Six Sigma way, Peter S. Pande, TMH