PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. To impart knowledge to students in recent advances in the Computer Integrated Manufacturing Engineering to educate them to prosper in Manufacturing engineering and research related professions.

II. To enhance the mathematical, scientific and engineering fundamentals the provide students with a solid foundation in required to solve analytical problems.

III. To coach students with good design and engineering skills so as to comprehend, analyze, design, and produce novel materials, products and solutions for the contemporary manufacturing issues.

IV. To inculcate students with professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate Computer Integrated Manufacturing engineering issues to broader engineering and social context.

V. To provide student with an academic environment conscious of research excellence, organizing capabilities, written ethical codes, discipline and guidelines, and the life-long learning needed for a successful professional career.

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

1. Graduates will demonstrate knowledge of mathematics, science and engineering.
2. Graduates will demonstrate an ability to identify, formulate and solve engineering problems.
3. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.
4. Graduates will demonstrate an ability to design a system, component or process as per needs and specifications.
5. Graduates will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.
6. Graduate will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.
7. Graduates will demonstrate knowledge of professional and ethical responsibilities.
8. Graduate will be able to communicate effectively in both verbal and written form.
9. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
10. Graduate will develop confidence for self education and ability for life-long learning.
Mapping of PEOs with POs

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF DEGREE = 69**
ANNA UNIVERSITY, CHENNAI  
UNIVERSITY DEPARTMENTS  
REGULATIONS – 2015  
CHOICE BASED CREDIT SYSTEM  
CURRICULA AND SYLLABI  
M.E. COMPUTER INTEGRATED MANUFACTURING (PART TIME)

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### PROFESSIONAL CORE (PC)

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**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

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OBJECTIVE:

- To teach the students basic concepts in various methods of engineering measurement techniques and applications, understand the importance of measurement and inspection in manufacturing industries.
- To make the students capable of learning to operate and use advanced metrological devices with ease in industrial environments.

UNIT I  CONCEPTS OF METROLOGY: 8
Terminologies – Standards of measurement – Errors in measurement – Interchangeability and Selective assembly – Accuracy and Precision – Calibration of instruments – Basics of dimensional metrology and Form metrology - Clean room - behaviour - Maintenance and handling of equipments

UNIT II  MEASUREMENT OF SURFACE ROUGHNESS: 9

UNIT III  INTERFEROMETRY: 8

UNIT IV  COMPUTER AIDED AND LASER METROLOGY: 10

UNIT V  IMAGE PROCESSING FOR METROLOGY: 10
Overview, Computer imaging systems, Image Analysis, Preprocessing, Human vision system, Image model, Image enhancement, gray scale models, histogram models, Image Transforms - Examples-Major applications of image processing.

TOTAL: 45 PERIODS

OUTCOME:

Students will:
1. Understand the advanced measurement principles with ease.
2. Operate sophisticated measurement and inspection facilities.
3. Design and develop new measuring methods.

REFERENCES:

OBJECTIVE:
At the end of this course the students are expected to understand special machining processes, unconventional machining processes, micro machining process, nano fabrication processes and rapid prototyping.

UNIT I  UNCONVENTIONAL MACHINING  10
Introduction-Bulk processes - surface processes- Plasma Arc Machining- Laser Beam Machining-Electron Beam Machining-Electrical Discharge Machining – Electro chemical Machining-Ultrasonic Machining - Water Jet Machining-Electro Gel Machining- Anisotropic machining- Isotropic machining- Elastic Emission machining – Ion Beam Machining - Hybrid Machining.

UNIT II  PRECISION MACHINING  10

UNIT III  ADVANCES IN METAL FORMING  7
Orbital forging, Isothermal forging, Warm forging, Overview of Powder Metal techniques –Hot and Cold isostatic pressing - high speed extrusion, rubber pad forming, micro blanking –Powder rolling – Tooling and process parameters

UNIT IV  MICRO MACHINING AND NANO FABRICATION  10

UNIT V  RAPID PROTOTYPING AND SURFACE MODIFICATION TECHNIQUES  8

TOTAL: 45 PERIODS
OUTCOME:
At the end of this course the students are expected
1. to produce useful research output in machining of various materials
2. use this knowledge to develop hybrid machining techniques
3. Application of this knowledge to manage shop floor problems

REFERENCES:

CI7103 APPLIED MATERIALS ENGINEERING  L T P C
3 0 0 3

OBJECTIVE:
- This course provides knowledge in the areas of Industrial metallurgy, advanced materials and selection of materials for industrial applications.

UNIT I ELASTIC AND PLASTIC BEHAVIOUR
8

UNIT II FRACTURE BEHAVIOUR
8

UNIT III SELECTION OF MATERIALS
8
Motivation, 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.
UNIT IV MATERIAL PROCESSING
Processing of engineering materials – Primary and Secondary processes – astability, Weldability, forgeability and malleability Criteria – Process induced defects – Monitoring and control.

UNIT V MODERN MATERIALS AND TREATMENT
Dual phase steels, high strength low alloy steel, transformation included plasticity steel, maraging steel, smart materials, properties and applications of engineering plastics and composites materials - advanced structural ceramics – WC, TiC, TaC, Al₂O₃, SiC, Si₃N₄, CBN, diamond – Plasma, PVD, CVD- thick and thin film deposition – Functionally Gradient Materials , Nano materials

OUTCOME:
• At the end of this course the student will be able to select the materials for Engineering applications by understanding basic mechanical properties of materials, the relation of the microstructure and mechanical properties, processing techniques for controlling shape and properties in the final product and able to work in R&D activity in the field of materials science.

REFERENCES:

WEB REFERENCES:
1. www.astm.org/labs/pages/131350.htm
2. www.appliedmaterials.com/carrers/agu-ei.html

ED7151 COMPUTER APPLICATIONS IN DESIGN L T P C 3 0 0 3

OBJECTIVE:
• To impart knowledge on computer graphics which are used routinely in diverse areas as science, engineering, medicine, etc.

UNIT I INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS
Output primitives (points, lines, curves etc.), 2-D & 3-D transformation (Translation, scaling, rotators) windowing - view ports - clipping transformation.
UNIT II CURVES AND SURFACES MODELLING 9

UNIT III NURBS AND SOLID MODELING 9

UNIT IV VISUAL REALISM 9
Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric and variational geometry based software’s and their principles creation of prismatic and lofted parts using these packages.

UNIT V ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE 9

OUTCOME:
- It helps the students to get familiarized with the computer graphics application in design. This understanding reinforces the knowledge being learned and shortens the overall learning curve which is necessary to solve CAE problems that arise in engineering.

REFERENCES:

MA7160 STATISTICAL METHODS FOR ENGINEERS

OBJECTIVE:
- This course aims at providing the necessary basic concepts of a few statistical methods and apply them to various engineering problems.

UNIT I ESTIMATION THEORY 12
UNIT II TESTING OF HYPOTHESIS
Tests based on Normal, t, $\chi^2$ and F distributions for testing of means, variance and proportions - Analysis of $r \times c$ tables – Goodness of fit.

UNIT III CORRELATION AND REGRESSION
Multiple and Partial Correlation - Method of Least Squares - Plane of Regression - Properties of Residuals - Coefficient of Multiple Correlation - Coefficient of Partial Correlation - Multiple Correlation with total and partial correlations - Regression and Partial correlations in terms of lower order coefficients.

UNIT IV DESIGN OF EXPERIMENTS
Analysis of variance - One-way and two-way classifications - Completely randomized design - Randomized block design - Latin square design.

UNIT V MULTIVARIATE ANALYSIS

TOTAL: 60 PERIODS

OUTCOME:
- It helps the students to have a clear perception of the power of statistical ideas, tools and would be able to demonstrate the applications of statistical techniques to problems drawn from industry, management and other engineering fields.

REFERENCES:

CI7111 CAD AND CAE LABORATORY

OBJECTIVE:
- At the end of the course, the student should be able to: sketch, model, assemble and analyze mechanical components using CAD and CAE software package.

LIST OF EXPERIMENTS:
1. Sketching and Part modeling (Solid modeling, Surface modeling, Feature manipulation) of mechanical components using CAD software package.
2. Assembly (Constraints, Exploded Views, Interference check) and Drafting (Layouts, GD & T Standard, Sectional Views, & Detailing) of mechanical components using CAD software package
3. Sheet Metal Design and Mould Design using CAD Software Package
4. Working with CAD Data Exchange formats: IGES, PDES, PARASOLID, DXF and STL
5. Finite Element Analysis (FEA) using Pre-processing (solid modeling, meshing, analysis setup) and post processing (graphical display and report) with CAE software package
6. Finite Element Analysis (FEA) for plastic deformation using nonlinear material models with CAE software package

TOTAL: 60 PERIODS

OUTCOME:
- With laboratory classes, it helps the students to get familiarized with the computer applications in design, Finite Element Analysis and to prepare drawings for components used industries.

LIST OF EQUIPMENTS REQUIRED:
1. Computers 25
2. CAD software Package- Unigraphics/CATIA/Solid Works/ PTC Creo
3. CAE Software package- ABAQUS/ LS-DYNA/ ANSYS/DEFORM/PATRAN/NASTRAN/MARC/ Hypermesh

CI7201 COMPUTER AIDED MANUFACTURING L T P C
3 0 0 3

OBJECTIVE:
- On completion of the course the students are expected to be knowledgeable in Engineering product specification, CAD/CAM integration, CNC machine tool building, CNC programming using manual method, generation of CNC codes using CAM software, Tooling and work holding devices.

UNIT I INTRODUCTION TO CAM

UNIT II CAD/CAM INTEGRATION

UNIT III CONSTRUCTIONAL FEATURES OF CNC MACHINES
CNC Machine building, structural details, guide ways –Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion.

UNIT IV PART PROGRAMMING FOR CNC MACHINES
Structure of CNC program, Coordinate system, G & M codes, cutter radius compensation, tool nose radius compensation, tool wear compensation, canned cycles, sub routines, do loop, mirroring features, Manual part programming for CNC turning and machining centre for popular controllers like Fanuc, Siemens, Generation of CNC program using CAM software.

UNIT V TOOLING AND WORK HOLDING DEVICES

OUTCOME:
- At the end of this course the student will be able to apply knowledge in various fields of Computer Aided Manufacturing.

REFERENCES:

CI7202 COMPUTER INTEGRATED PRODUCTION AND INVENTORY SYSTEMS

OBJECTIVES:
- To familiarize the student with current trend in production management activities.
- To impress and prepare them to use modern technologies in future management systems.
UNIT I  PRODUCTION PLANNING AND CONTROL AND FORECASTING: 9

UNIT II  AGGREGATE PLANNING: 8
Planning hierarchy - Aggregate production planning (APP) - Need - Alternatives for managing supply and demand - Basic strategies - Numerical problems - APP methods - Master Production Scheduling

UNIT III  RESOURCE PLANNING: 10
Inventory Management - Inventory types and general control procedures - Order point systems - The inventory management module - Material Requirements Planning - Basic MRP Concepts - Capacity requirements planning - Distribution requirements planning - Independent versus dependent demand - Lumpy demand - Lead times - Common use items - Inputs to MRP - Numerical problems - Manufacturing Resource planning - Enterprise planning

UNIT IV  SHOP FLOOR CONTROL: 9
Shop Floor Control - Functions of Shop Floor Control - Priority control and assignment of shop orders - Maintaining information on work-in-progress - Monitor shop order status - Production output data for capacity control - The Shop Floor Control System - Order release - Order scheduling - Order progress - Operation Scheduling - An overview of the scheduling problem - Priority rules for job sequencing - The Factory Data Collection System - Job traveler - Employee time sheet - Operation tear strips - Centralized shop terminal - Individual work center terminals - Voice data input

UNIT V  COMPUTER PROCESS MONITORING AND CONTROL: 9

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course the students are expected
- To manage efficiently various activities of production with the help of technology
- Expected to use modern technologies in future management systems

REFERENCES:
OBJECTIVE:

- To emphasize the knowledge on the quality improvement, automation, and advanced manufacturing techniques to create the highest-caliber products quickly, efficiently, inexpensively, and in synchronization with the marketing, sales, and customer service of the company.

UNIT I MANUFACTURING IN A COMPETITIVE ENVIRONMENT


UNIT II GROUP TECHNOLOGY & FLEXIBLE MANUFACTURING SYSTEMS


UNIT III COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS


UNIT IV LEAN MANUFACTURING


UNIT V JUST IN TIME:


TOTAL: 45 PERIODS

OUTCOME:

- At the end of this course the student will be able to apply the knowledge to implement and work in competitive manufacturing systems. Student will be able to practice the principles of flexible manufacturing, Kaizen, 5S, Jidoka, Poka Yoke and Lean manufacturing.
REFERENCES:

QE7251 DISCRETE SYSTEM SIMULATION

OBJECTIVES:
- To understand the importance and advantages of applying simulation techniques for solving various problems on discrete event systems.
- To teach various random number generation techniques, its use in simulation, tests and validity of random numbers etc. development of simulation models, verification, validation and analysis.
- To understand the applications of random probability distributions in real time environments.
- Train students to solve discrete event problems through hand simulation and to develop simulation models using Extend simulation software.

UNIT I INTRODUCTION: 3
Systems, modeling, general systems theory, concept of simulation, simulation as a decision making tool, types of simulation.

UNIT II RANDOM NUMBERS: 5
Methods of generating random numbers, Pseudo random numbers and random variates, discrete and continuous random probability distributions, tests for random numbers.

UNIT III DESIGN OF SIMULATION: 8
Problem formulation, data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation, validation.

UNIT IV SIMULATION SOFTWARE: 14
Study and selection of simulation languages, Use of simulation software such as GPSS, Extend, Matlab, Simulink, LabView etc., for simulation.

UNIT V CASE STUDIES IN SIMULATION: 15
Development of simulation models for queuing systems, production systems, inventory systems, Industrial scheduling problems.

TOTAL: 45 Periods
OUTCOMES:

Students will:
- Learn to simulate models matching real life scenarios and obtain superior results
- Develop capabilities of taking up consultancy projects.

REFERENCES:

OBJECTIVES:
- Concepts of CNC programming and simulation on CNC turning center, Machining center and CNC Wire EDM
- Robot, PLC programming and Database Management Methods

LIST OF EXPERIMENTS
1. Study of different control systems and CNC codes.
2. Programming and simulation for turning, taper turning, circular interpolation, thread Cutting and facing operation.
3. Programming and simulation using Do-Loop and Sub-routine for CNC turning centre.
4. Programming and simulation for machining of internal surfaces in CNC turning centre
5. Programming and simulation for profile milling operation, circular interpolation
6. Programming and simulation for circular and rectangular pocket milling
7. Programming using canned cycles
8. CNC code generation using CAM software packages – Turning centre
9. CNC code generation using CAM software packages – Machining centre
10. Programming for CNC Wire cut EDM
11. Dimensional and geometric measurement of machined features using VMS and CMM
12. Robot programming for Material handling applications
13. PLC ladder logic programming.
14. Study on RDBMS and its application in problems like inventory control MRP etc

TOTAL: 60 PERIODS

OUTCOME:
At the end of this course
- The student will be able to use CNC machines for production
- Use this knowledge to program CNC machines
- Use this knowledge for Robot, PLC programming and Database Management method
LIST OF EQUIPMENTS REQUIRED:
1. Computers 25
2. CAM Software for 3 axis machining or more
3. CNC Production type turning or Machining center
4. CNC Wire Cut - EDM
5. Video Measuring System
6. Coordinate Measuring Machine
7. Surface Roughness tester
8. 5-axis Robot
9. Programmable Logic Controller with ladder logic programming software
10. RDMBS Package with relevant modules like Inventory Control and MRP

CI7212 TECHNICAL SEMINAR

OBJECTIVE:
To enrich the communication skills of the student through presentation of topics in recent advances in engineering/technology

OUTCOMES:
Students will develop skills to read, write, comprehend and present research papers.
Students shall give presentations on recent areas of research in manufacturing engineering in two cycles. Depth of understanding, coverage, quality of presentation material (PPT/OHP) and communication skill of the student will be taken as measures for evaluation.

TOTAL: 30 PERIODS

CI7311 PROJECT WORK PHASE I

OBJECTIVES
- A research project topic may be selected either from published lists or from the creative ideas of the students themselves in consultation with their project supervisor.
- To improve the student research and development activities.

EVALUATION
Project work evaluation is based on Regulations of Credit system University Departments - Post graduate programmes of Anna University

TOTAL : 90 PERIODS

OUTCOME
The students’ would apply the knowledge gained from theoretical and practical courses in solving problems, so as to give confidence to the students to be creative, well planned, organized, coordinated in their project work phase – II.
PROJECT WORK PHASE II

OBJECTIVES

- The objective of the research project work is to produce factual results of their applied research idea in the Thermal Engineering, from phase – I.
- The progress of the project is evaluated based on a minimum of three reviews.
- The review committee may be constituted by the Head of the Division.
- A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Division based on oral presentation and the project report.
- To improve the student research and development activities.

EVALUATION

- Project work evaluation is based on Regulations of Credit system University Departments - Post graduate programmes of Anna University

TOTAL = 180 PERIODS

OUTCOME

The students would apply the knowledge gained from theoretical and practical courses in solving problems, so as to give confidence to the students to be creative, well planned, organized, coordinated project outcome of the aimed work.

CI7001 ADVANCES IN WELDING AND CASTING TECHNOLOGY

OBJECTIVE:

- To impart knowledge on advances in welding and casting technology, cast design and advanced welding and casting processes.

UNIT I WELDING DESIGN AND METALLURGY:

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Weld joint design- Heat Affected Zone (HAZ) - Weldability of steels - Cast iron - Stainless steels, aluminum, copper and titanium alloys - Hydrogen embrittlement - Pre and Post weld heat treatments - Weld defects.

UNIT II SPECIAL WELDING PROCESSES:

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UNIT III CASTING DESIGN AND METALLURGY:

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UNIT IV SPECIAL CASTING PROCESSES:

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Evaporative Pattern Casting Process and full mould process –Vacuum sealed moulding-vacuum casting-Magnetic Moulding -Squeeze Casting-types- Plaster mould casting-Ceramic mould casting-Thixoforming or semi solid forming-Single crystal growing.
UNIT V AUTOMATION OF WELDING AND FOUNDRY: 9
Use of robots in welding - weld positioner and manipulators - weld seam tracking - arc sensing - vision system - automation of foundry - use of robots - moulding machines - Automation of sand plant, moulding and fettling sections of foundry - Dust and fume control.

TOTAL: 45 PERIODS

OUTCOME:
At the end of this course the students are expected
• To produce useful research output in welding and casting.
• Use this knowledge in advancing the welding and casting process.
• Application of design knowledge to understand and to overcome defects in welding and casting.

REFERENCES:

CI7002 COMPOSITE MATERIALS L T P C
3 0 0 3

OBJECTIVE:
• To impart knowledge of various manufacturing methods of different composite materials, their properties, machining characteristics and their applications.

UNIT I INTRODUCTION: 9

UNIT II POLYMER MATRIX COMPOSITES: 9
UNIT III METAL MATRIX COMPOSITES:
9
Introduction – Types, Metallic matrices: Aluminium, Titanium, Magnesium, copper Alloys –
Processing of MMCs: Solid state, Liquid state, Vapour state, In-situ – Interface/Interphase in
MMCs – Interfacial bonding in MMCs – Mechanical properties, coefficient of thermal
expansion, environmental effects, moisture effects – Applications of MMCs – Recycling of
MMCs.

UNIT IV CERAMIC MATRIX COMPOSITES:
9
Introduction – Types – Toughening Mechanism- Processing of CMCs: Cold pressing,
sintering, reaction bonding, liquid infiltration, lanxide process – In-situ chemical reaction
techniques: Chemical vapour deposition, Chemical vapour impregnation, Sol-gel, C-C
Composites. Interface in CMCs. Mechanical Properties and Applications of CMCs – Fatigue
behaviors and S-N curves of particle and whisker reinforced CMCs – Hybrid composites –
Thermal fatigue – Creep.

UNIT V MACHINING OF COMPOSITES
9
Traditional (turning, milling, drilling, abrasive machining) and non-traditional (abrasive
waterjet machining, electric discharge machining, ultrasonic, laser–assisted) machining of
Composites – Characterisation and surface integrity studies on the machined surface.

OUTCOME:
• At the end of this course the student will be able to select appropriate composite
materials for specific applications.

REFERENCES:
35539-9, 2009.
Elsevier Ltd., New Delhi, 2011.

CI7003 CORROSION AND SURFACE ENGINEERING L T P C
3 0 0 3
OBJECTIVES:
• To impart knowledge on the scientific principles and methods that underlie the cause,
detection, measurement and prevention of corrosion problems in engineering practices.
• To impart knowledge on the hands-on approaches for matching surface treatments with
design and performance requirements.
UNIT I
MECHANISMS AND TYPES OF CORROSION:

UNIT II
TESTING AND PREVENTION OF CORROSION:
Planning and preparation of corrosion tests – In-service monitoring, simulated service, laboratory testing – Evaluation of corrosion - Prevention of Corrosion, suitable designing and modifications of corrosive environment, corrosion inhibitors -Cathodic Protection - Anodic protection - Protective surface coatings.

UNIT III
CORROSION BEHAVIOR OF MATERIALS:
Selection of material for various corrosive environments - Corrosion of Steels, Stainless Steel, Aluminum alloys, Copper alloys, Nickel and Titanium alloys –Corrosion of Polymers, Ceramics and Composite materials.

UNIT IV
SURFACE COATINGS:
Solid surface significance, surface properties, superficial layer – changing surface metallurgy, chemistry and adding a surface layer or coating - Diffusion coatings- Electro and Electro less Plating-Hot dip coating-Hard facing-Metal spraying, Plasma spraying

UNIT V
THIN LAYER ENGINEERING PROCESSES:
Laser and Electron Beam hardening- Thermal evaporation, Arc Vaporization, Sputtering, Ion plating-Vapor deposition processes, Implantation technique – Coating of tools, TiC, TiN, Al2O3 and Diamond coating – Properties and applications of thin coating

TOTAL: 45 PERIODS

OUTCOMES:
- Students can able to provide solution for the typical Industrial corrosion problem.
- Students can able to provide solution for different types of Surface Engineering problem.

REFERENCES:
6. ASM Metals Hand Book – Volume 13 , Corrosion, 1999

CI7004
DESIGN FOR MANUFACTURING

OBJECTIVE:
- At the end of this course the student should be able to apply the design for manufacturing principles in casting, welding, forming, machining and assembly, by considering various manufacturing constraints.
UNIT I  INTRODUCTION:  6
Economics of Process selection – General design principles of manufacturability – Proper material selection – Strength and Mechanical factors- Application of form design.

UNIT II  CASTING DESIGN AND WELDMENT DESIGN:  10
Factors affecting casting design- Strength aspects – Sand casting and die casting design- Factors affecting weldment design-Gas and arc welding design.

UNIT III  FORMED METAL COMPONENTS AND NON METALLIC PARTS DESIGN:  10
Design considerations for the manufacture of extruded, cold headed metal parts – Tube and section bends – Powder metal parts-Thermo setting plastic parts-Reinforced – Plastic/Composite parts.

UNIT IV  MACHINED COMPONENTS DESIGN:  10
Design considerations for the manufacture of turned parts-drilled parts-milled parts, planned, shaped and slotted parts-Ground parts-parts produced by EDM.

UNIT V  DESIGN FOR ASSEMBLY:  9

OUTCOME:
• At the end of this course the student will be able to design castings, weldings, formed and machined components. He / She will be able to practice design for assembly principles.

REFERENCES:
UNIT III IMPLEMENTATION OF GT/CMS:
Inter and Intra cell layout, cost and non-cost based models, establishing a team approach, Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS.

UNIT IV PERFORMANCE MEASUREMENT AND CONTROL:
Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP - framework.

UNIT V ECONOMICS OF GT/CMS:
Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS - cases.

TOTAL: 45 PERIODS

OUTCOME:
- At the end of this course the student should be able to plan and implement Cellular manufacturing systems, distinguish between traditional and non-traditional approaches of Problem solving, involve in performance measurement and determine human and economical aspects of CMS.

REFERENCES:

CI7006 ELECTRONICS MANUFACTURING TECHNOLOGY L T P C
OBJECTIVE:
- To impart the knowledge in electronic packaging technology

UNIT I INTRODUCTION TO ELECTRONICS MANUFACTURING
History, definition, wafer preparation by growing, machining, and polishing, diffusion, microlithography, etching and cleaning, Printed Circuit Boards, types - single sided, double sided, multi layer and flexible printed circuit board, design, materials, manufacturing, inspection. Electronic packaging – Through Hole Technology (THT) and Surface Mount Technology (SMT).

UNIT II COMPONENTS AND PACKAGING
Through-hole components – axial, radial, multi leaded, odd form. Surface mount components - active, passive. Interconnections - chip to lead interconnection, die bonding, wire bonding, TAB, Flip chip, chip on board, multi chip module, direct chip array module, leaded, leadless, area array and embedded packaging, miniaturization and trends.
UNIT III  SOLDERING AND CLEANING

UNIT IV  SURFACE MOUNT TECHNOLOGY:
SMT Equipment and Material Handling Systems, Handling of Components and Assemblies - Moisture Sensitivity and ESD, Safety and Precautions Needed, IPC and Other Standards, Stencil Printing Process, solder paste storage and handling, stencils and squeegees, process parameters, quality control - Component Placement, Equipment Type, Chip shooter, IC placer, Flexibility, Accuracy of Placement, Throughput, reflow soldering, adhesive, underfill and encapsulation process, applications, storage and handling, process & parameters.

UNIT V  INSPECTION, TEST AND REWORK FOR PCB:

TOTAL: 45 PERIODS

OUTCOME:
• At the end of this course the student will be able to apply knowledge in various steps in electronics packaging technology

REFERENCES:
OBJECTIVE:
• The objective is to equip students with fundamentals of finite element principles so as to enable them to understand the behavior of various finite elements and to be able to select appropriate elements to solve physical and engineering problems with emphasis on structural and thermal engineering applications.

UNIT I  GENERAL INTRODUCTION

UNIT II  PROBLEM IN 2D:

UNIT III  APPLICATIONS TO FIELD PROBLEMS
Higher Order Elements. Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One, two and three dimensions – Serendipity elements – Numerical integration and application to plane stress problems transformation in, and coordinates- Jacobian of transformation-order of convergence- numerical integration –example problems- shape functions in natural coordinates- rectangular elements - Lagrange family-Serendipity family - rectangular prisms- tetrahedral elements-

UNIT IV  NON-LINEAR ANALYSIS
Introduction to Non-linear problems - some solution techniques- computational procedure- simple material nonlinearity- Plasticity and viscoplasticity, stress stiffening, contact interfaces-problems of gaps and contact- geometric non-linearity- modeling considerations- Impact analysis.

UNIT V  ANALYSIS OF PRODUCTION PROCESSES
Application to Bulk forming, sheet metal forming, casting, metal cutting, welding- Features of software packages

OUTCOME:
• At the end of this course the students would have developed a thorough understanding of the basic principles of the finite element analysis techniques with an ability to effectively use the tools of the analysis for solving problems in Manufacturing Engineering
REFERENCES:

CI7008 INTELLIGENT PRODUCT DESIGN AND MANUFACTURING L T P C
3 0 0 3

OBJECTIVE:
- To teach the student the principles and practices of intelligent product design and manufacturing

UNIT I INTRODUCTION TO INTELLIGENT DESIGN AND MANUFACTURING: 9
Need - Internet technology and Manufacturing Industry - Digital enterprises - Manufacturing portals – Benefits.

UNIT II TECHNIQUES OF KNOWLEDGE REPRESENTATION 9

UNIT III INTELLIGENT PRODUCT MODELING TECHNIQUES: 9
Intelligent CAD systems, integrating product and process design, manufacturing analysis and CAD/CAM integration, design methodology for automated manufacture, the impacts of intelligent process control on product design, and fuzzy knowledge-based controller design.

UNIT IV APPLICATION OF NEURAL NETWORKS: 9
Neural Networks for Intelligent Process Monitoring and Control : Applications to CNC machining, Metal Forming - Intelligent Manufacturing Planning, Scheduling and Control - Intelligent Assembly and Layout Planning.

UNIT V INTERNET BASED COLLABORATIVE CAD/CAM: 9
Applications to web based CAD, CAPP, CNC, Assembly planning, and Rapid Prototyping - Challenging issues of Collaborative CAD/CAM.

TOTAL: 45 PERIODS

OUTCOME:
- At the end of this course the student will be able to apply Internet technology in manufacturing industry and use techniques of Knowledge Representation.

REFERENCES:
LEON MANUFACTURING

OBJECTIVE:

- At the end of this course the students should be able to implement lean manufacturing concepts in the factories.

UNIT I INTRODUCTION:

The mass production system – Origin of lean production system – Necessity – Lean revolution in Toyota – Systems and systems thinking – Basic image of lean production – Customer focus – Muda (waste).

UNIT II STABILITY OF LEAN SYSTEM:

Standards in the lean system – 5S system – Total Productive Maintenance – standardized work – Elements of standardized work – Charts to define standardized work – Man power reduction – Overall efficiency - standardized work and Kaizen – Common layouts.

UNIT III JUST IN TIME:


UNIT IV JIDOKA (AUTOMATION WITH A HUMAN TOUCH):


UNIT V WORKER INVOLVEMENT AND SYSTEMATIC PLANNING METHODOLOGY

Involvement – Activities to support involvement – Quality circle activity – Kaizen training - Suggestion Programmes – Hoshin Planning System (systematic planning methodology) – Phases of Hoshin Planning – Lean culture

TOTAL: 45 PERIODS

OUTCOME:

- The student will be able to practice the principles of lean manufacturing like customer focus, reduction of MUDA, just in time, Jidoka and Hoshin planning.

REFERENCES:

CI7010 MICRO AND NANO MANUFACTURING

OBJECTIVE:

- The purpose of this subject is to understand the principles of various micro and nano manufacturing methods.

UNIT I INTRODUCTION

Introduction to Meso, Micro and Nano manufacturing, Miniaturization and applications, classification-subtractive, additive, micro forming, micro moulding, micro casting, micro joining. Applications of Micro and Nano products in IT and telecommunications, Automotives, Medicine

UNIT II MANUFACTURING METHODS

Material deposition – PVD, CVD, LIGA, Micro stereo lithography, Traditional micromachining- Theory of micromachining-Chip formation-size effect in micromachining, micro turning, micro drilling, micro milling, micro grinding, Diamond turn machining-types of DTM, components of DTM, materail removal mechanisms, tool geometry, applications

UNIT III ADVANCED MACHINING / FINISHING PROCESSES


UNIT IV SYNTHESIS OF NANOMATERIALS


UNIT V CHARACTERISATION TECHNIQUES

Metrology for micro machined components-Optical Microscopy, White Light Interferrometry, Molecular Measuring Machine, Micro CMM

TOTAL: 45 PERIODS

OUTCOME:

- At the end of this course the student will be able to apply knowledge in micro and nano manufacturing methods, synthesis of nano materials and characterization techniques

REFERENCES:


CI7011 PRECISION ENGINEERING

OBJECTIVES:
The student will be able to understand the striving need for precision and application.
• Motivate the students to learn about the advanced concepts of precision and ultra precision Machining methods
• In addition, the student will enhance his/her knowledge in Precision Engineering and its applications.

UNIT I INTRODUCTION:

UNIT II MATERIALS FOR PRECISION ENGINEERING:

UNIT III PRECISION MACHINING:

UNIT IV ERRORS: CAUSES AND REMEDIES:
Static stiffness - influence on machining accuracy – over all stiffness in a machine/instrument – errors due to variation of cutting forces – clamping forces – errors due to compliance while machining. Inaccuracy due to thermal effects: Heat sources and dissipation – Geometry of thermal deformation-influence of forced isstratics dimensional wear of elements – instruments; Machining tools and their influence on accuracy- error due to clamping and setting location.

UNIT V PRECISION MACHINE ELEMENTS:

TOTAL: 45 PERIODS
OUTCOME:
Students will:
- Operate high precision machineries with ease.
- Research and explore new areas of cutting tools.

REFERENCES:

CI7012 PRODUCTION PLANNING AND MANAGEMENT

OBJECTIVE:
- To provide the student with the knowledge of how to manage different aspects of manufacturing including design, facilities, jobs, inventory, MRP and reengineering.

UNIT I INTRODUCTION:
Elements – Manufacturing Strategies and competitiveness - Meeting the competitive Project management.

UNIT II DESIGNING OF PRODUCTS:

UNIT III DESIGN OF FACILITIES AND JOBS:
Capacity planning – Strategies – Planning service capacity - JIT – Facility location and layout - Job Design and Work measurement.

UNIT IV INVENTORY SYSTEMS AND MRP:
Definition-Purposes of Inventory-Inventory models-Fixed order Quantity models and Fixed-time period models.MRP Systems-MRP system structures- Improvements for MRP system-Advanced MRP-type systems.

UNIT V REVISING THE SYSTEM:

OUTCOME:
At the end of this course the student should be able to design products, facilities, jobs, inventory systems and embark on business process reengineering.

REFERENCES:

CI7013 RELIABILITY AND TOTAL PRODUCTIVE MAINTENANCE L T P C
3 0 0 3

OBJECTIVE:
- To provide the student with the knowledge of reliability, failure analysis, reliability prediction, management and also the principles and practices of TPM.

UNIT I INTRODUCTION
Reliability function - MTBF - MTTF - mortality curve - availability - Maintainability.

UNIT II FAILURE DATA ANALYSIS:
Repair time distributions - exponential, normal, log normal, gamma, and Weibull - reliability data requirements - Graphical evaluation.

UNIT III RELIABILITY PREDICTION:

UNIT IV RELIABILITY MANAGEMENT:
Reliability demonstration testing - Reliability growth testing - Duane curve - Risk assessment - FMEA, Fault tree.

UNIT V TOTAL PRODUCTIVE MAINTENANCE:

TOTAL: 45 PERIODS

OUTCOME:
At the end of this course the student should be able to do all calculations relating to reliability of a product or a system. The student should be able to predict reliability and implement total productive maintenance in factories.

REFERENCES:
OBJECTIVE:

- To impart knowledge of sensor technologies used in the manufacturing industry for monitoring workpieces, machine tools, machining processes and advanced sensors.

UNIT I INTRODUCTION TO SENSORS

Role of sensors in manufacturing and condition monitoring – Principles – Classification Applications – Basic requirements of sensor – Signal processing and decision making.

UNIT II SENSORS FOR WORKPIECE MONITORING

Mechanical, Electrical, Electro-mechanical, Opto-electrical, Optical, Pneumatic, Capacitance, Eddy- current and Magnetic sensors.

UNIT III SENSORS FOR MACHINE TOOL MONITORING

Position measurements: Linear, angular and velocity sensors – Calibration of machine tools – Collision detection measurements.

UNIT IV SENSORS FOR MACHINING PROCESSES


UNIT V ADVANCED SENSORS


TOTAL: 45 PERIODS

OUTCOME:

- At the end of this course the student will be able to apply appropriate sensors for monitoring work pieces, machine tools, machining processes and advanced sensors in manufacturing industries.

REFERENCES:

OBJECTIVE:
To provide the student with the knowledge of sustainability in manufacturing, its evaluation, strategy to achieve sustainability, supply chain management and sustainable operations.

UNIT I ENVIRONMENTAL VALUATION:
Introduction to the environmental issues pertaining to the manufacturing sector - pressure to reduce costs - processes that minimize negative environmental impacts - environmental legislation and energy costs - acceptable practice in society - adoption of low carbon technologies - need to reduce the carbon footprint of manufacturing operations. Techniques for non-market valuation: cost and income based approaches, demand estimation methods - expressed and revealed preference, choice modeling - Multi-criteria analysis - Stakeholder analysis - Environmental accounting at sector and national levels.

UNIT II EVALUATING SUSTAINABILITY:
Sustainability performance evaluators - Frameworks and techniques - environmental management systems - life cycle assessment - strategic and environmental impact assessments - carbon and water foot-printing.

UNIT III MANUFACTURING STRATEGY FOR SUSTAINABILITY:

UNIT IV SUPPLY CHAIN MANAGEMENT:
Challenges in logistics and supply chain - developing the right supply chain strategy for the products - need to align the supply network around the strategy - Tools that can be used systematically to identify areas for improvement in supply chains - Specific challenges and new thinking in the plan, source and delivering of sub-processes.

UNIT V SUSTAINABLE OPERATIONS:

OUTCOME:
On completion of the course the students will be able to apply techniques of environmental valuation, formulate strategy for sustainable manufacturing and plan sustainable operations and supply chain management.

REFERENCES:
OBJECTIVE:
- On completion of the course the students are expected to be knowledgeable in microstructure evaluation, crystal structure analysis, electron microscopy, Chemical, Thermal analysis and mechanical testing methods.

UNIT I MICRO STRUCTURAL EVALUATION: 9

UNIT II CRYSTAL STRUCTURE ANALYSIS: 9

UNIT III ELECTRON MICROSCOPY: 9

UNIT IV CHEMICAL AND THERMAL ANALYSIS: 9
Basic principles, practice and applications of X-ray spectrometry, Wave dispersive X-ray spectrometry, Auger spectroscopy, Secondary ion mass spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR) – proton induced X-ray Emission spectroscopy, Differential thermal analysis, Differential Scanning Calorimetry (DSC) and Thermo Gravimetric Analysis (TGA)

UNIT V MECHANICAL TESTING: 9

OUTCOME:
At the end of this course the student will be able to apply various material characterization techniques for research and analysis.

REFERENCES:

TOTAL: 45 PERIODS

CI7017 TOOL ENGINEERING

OBJECTIVE:
- This course provides knowledge in the areas of design of single point and multi point cutting tools, dies, jigs, fixtures and limit gauges and toll design for CNC machines.

UNIT I INTRODUCTION:
Broad Classification of Tools-Cutting tools, Dies, Holding and Measuring tools, Tool materials and heat treatment- Ferrous, Non-ferrous and Non metallic materials, tool making practices.

UNIT II DESIGN OF 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 applications.

UNIT III DESIGN OF DIES:

UNIT IV DESIGN OF JIGS AND FIXTURES:
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 DESIGN OF LIMIT GAUGES AND TOOL DESIGN FOR CNC MACHINES:
Fixed gauges, gauge tolerances, indicating gauges, automatic gauges, selection of materials, tool design for CNC machines- fixture design, cutting tools, tool holding, tool pre-setter, automatic tool changers and positioners.

TOTAL: 45 PERIODS

OUTCOME:
At the end of this course
- This domain knowledge will increase their employability skills
- Use this knowledge to develop innovative ideas work holding methods
- Encourages to involve in research in the area of machining
## REFERENCES:

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**CI7018**  TOTAL QUALITY SYSTEMS AND ENGINEERING  

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**OBJECTIVE:**
- This course provides knowledge in the areas of quality management, its pioneers, practices and techniques. It also provides knowledge in quality by design and product liability.

**UNIT I**  INTRODUCTION:  

**UNIT II**  PRACTICES OF TQM:  

**UNIT III**  TECHNIQUES OF TQM:  

**UNIT IV**  QUALITY BY DESIGN:  

**UNIT V**  PRODUCTS LIABILITY:  

**OUTCOME:**
- At the end of this course the student should be able to apply the principles, practices and techniques of quality systems and engineering in factories.

**REFERENCES:**
OBJECTIVE:

- Students will learn various part feeding methods, optimum design of feeding routes and feeding methods and develop knowledge on warehouse management systems, safety requirements of warehouse planning.

UNIT I  LAYOUT PLANNING:


UNIT II  RACKING SYSTEMS FOR WAREHOUSE:


UNIT III  MATERIAL HANDLING SYSTEMS FOR WAREHOUSE:

Material Handling System - Material Flow Path - Selection Criteria to Determine Equipment - Material Handling Equipment Classification – MHE Manufacturer’s Worldwide Ranking - Comparison of Fork Lift, Reach Truck and Narrow Aisle Truck - MHE Service and Battery Charging - Crane Design Requirements.

UNIT IV  PART FEEDING:

Part feeding - Number of Tow Truck Requirements - Calculations - Kitting Trolley Route Map - Kitting Time Estimation - Kitting Trolley Feeding Man Power Calculation - Kitting Trolley Design Methodology - Assumptions in Kitting Design - Kit Trolley Design - Key Warehouse Planning Issues to be Considered during Warehouse Planning - Check List for Warehouse Layout Planning - Return on Assets.

UNIT V  WAREHOUSE MANAGEMENT SYSTEMS, SAFETY AND STAFFING


TOTAL: 45 PERIODS

Company Ltd., 1997.
OUTCOME:
Students will be able to:
- Design and plan warehouse layouts
- Plan racking systems and Material handling systems for warehouse requirements

REFERENCES:
1. Bartholdi, J.J. and Hackman, S.T., "Warehouse & Distribution science", Release 0.89, The Supply chain and logistics Institute, School of Industrial and systems Engineering, Georgia Institute of technology, Atlanta, GA 30332-0205 USA, Revised August 20, 2008.
3. Hanson, R., "In-plant materials supply: Supporting the choice between kitting and continuous supply", Department of Technology Management and Economics, Chalmers University of Technology, Gothenburg, Sweden 2012. (http://publications.lib.chalmers.se/records/fulltext/155418.pdf)

CI7071 COMPUTER AIDED PROCESS PLANNING

OBJECTIVE:
- To familiarize the students with process planning in the manufacturing cycle, design, drafting, geometric modeling, systems in CAPP and report generation.

UNIT I INTRODUCTION:
Production Planning and Process Planning -The role of Process Planning in the Manufacturing cycle - Experience based planning -Need for computer aided process planning. –Process Planning and Concurrent Engineering, Group Technology

UNIT II PART DESIGN REPRESENTATION:
Basic part representation methods: CAD models-Feature based design-Design interface: syntactic pattern recognition-State transition diagram-Decomposition approach-Logic approach-Graph based approach.

UNIT III KNOWLEDGE REPRESENTATION:
UNIT IV  SYSTEM FORMULATION:  10

UNIT V  COMPUTER AIDED PROCESS PLANNING SYSTEMS:  10

OUTCOMES:
At the end of this course the students are expected to use
- Application of computers in the documentation
- Creating database for the future use
- Use of commercially available CAPP system in Industries

REFERENCES:

WEB REFERENCES:

CI7072  INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS  L T P C  3 0 0 3

OBJECTIVE:
- To teach students the basics of robotics, construction features, sensor applications, robot cell design, robot programming and application of artificial intelligence and expert systems in robotics.

UNIT I  INTRODUCTION AND ROBOT KINEMATICS  10
UNIT II  ROBOT DRIVES AND CONTROL  9

UNIT III  ROBOT SENSORS  9

UNIT IV  ROBOT CELL DESIGN AND APPLICATION  9

UNIT V  ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS  8

OUTCOME:
The student will be able to design robots and robotic work cells and write program for controlling the robots. The student will be able to apply artificial intelligence and expert systems in robotics.

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- The purpose of the course is to provide an importance of databases and its application in manufacturing systems that prepare students for their engineering practice by organization by conversant with order policies, data base terminologies, designing, manufacturing considerations

UNIT I INTRODUCTION:
The Evolution of order policies, from mrp to MRP II to ERP – Agile Manufacturing Information Systems, Manufacturing Database Integration.

UNIT II DATABASE:

UNIT III DESIGNING DATABASE
Hierarchical model – Network approach- Relational Database concepts, principles, keys,– functional dependency – Normalization types – relational operations- Query Languages-Case studies.

UNIT IV MANUFACTURING CONSIDERATION:
The product and its structure, inventory and process flow – Shop floor control Data structure and procedure – various models – the order scheduling module, Input/output analysis module, and stock status database – the complete IOM database.

UNIT V INFORMATION SYSTEM FOR MANUFACTURING:
Parts oriented production information system – concepts and structure – Computerized production scheduling, online production control systems, Computer based production management system, computerized manufacturing information system -RFID-Telecommunication– case study.

TOTAL: 45 PERIODS

OUTCOME:
- On completion of this course, the students are expected to create simple to moderately complex manufacturing information system for manufacturing industry.

REFERENCES:
2. Date, C.J., ”An Introduction to Database Systems” Addison Wesley”, 8th Edn., 2003

WEB REFERENCES:
1. www.ist.psu.edu
2. www.cse.wustl.edu(UML Notation Guide)
OBJECTIVE:
- To provide the student with the knowledge of sensors, transducers, various types of actuators used in mechatronics systems and also the use of PLCs and mechatronics design.

UNIT I  INTRODUCTION :

UNIT II  SENSORS AND TRANSDUCERS:

UNIT III  ACTUATORS:

UNIT IV  PROGRAMMABLE LOGIC CONTROLLERS
Introduction - Basic structure - Input and output processing - Programming - Mnemonics - Timers, counters and internal relays - Data handling - Selection of PLC.

UNIT V  DESIGN AND MECHATRONICS CASE STUDIES:
Steps in mechatronics design - Possible design solutions-Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot - Conveyor based material handling system - PC based CNC drilling machine – Mechatronics Control in automated Manufacturing – Data Acquisition - Case studies.

OUTCOME:
- At the end of this course the student should be able to apply Mechatronics in design and practical requirements.

REFERENCES:
OBJECTIVE:
- To impart knowledge of design, fabrication and characterization of Micro Electro Mechanical systems.

UNIT I  INTRODUCTION

UNIT II  MECHANICS, SCALING AND DESIGN

UNIT III  MICRO SYSTEM FABRICATION PROCESSES
Introduction- Photolithography- Ion implantation- Chemical Vapor Deposition-Physical Vapor Deposition - clean room- Bulk micromachining:etching, isotropic and anisotropic etching, wet and dry etching- Surface micro machining :process, mechanical problems associated with surface micro machining- LIGA process :general description, materials for substrates and photo resists-SLIGA process-Abrasive jet micro machining-Laser beam micro machining- Micro Electrical Discharge Micro Machining –Ultrasonic Micro Machining- Electro chemical spark micro machining-Electron beam micro machining-Focused Ion Beam machining

UNIT IV  MICROSYSTEMS PACKAGING
Introduction - Microsystems Packaging-Interfaces in Microsystems Packaging-Essential Packaging Technologies- Die preparation, surface bonding, wire bonding, sealing- Three dimensional Packaging-Assembly of Microsystems, Signal Mapping and Transduction

UNIT V  MICROMETROLOGY AND CHARACTERIZATION

OUTCOME:
- At the end of this course the student will be able to apply the knowledge in mechanics, scaling, design, fabrication and characterization of micro systems.

REFERENCES:
CI7076 SUPPLY CHAIN MANAGEMENT L T P C 3 0 0 3

OBJECTIVE:

- The objective of this module is to provide the participants with a good knowledge on logistics and supply chain management and how these topics can be related with the organization and their business needs.

UNIT I INTRODUCTION TO SUPPLY CHAIN MANAGEMENT 8

UNIT II DESIGNING THE SUPPLY CHAIN NETWORK 9

UNIT III SOURCING, TRANSPORTATION AND PRICING 10

UNIT IV COORDINATION AND TECHNOLOGY 10
OUTCOMES:

- The objective of this module is to provide the participants with a good knowledge on logistics and supply chain management and how these topics can be related with the organization and their business needs.

REFERENCES


OBJECTIVE:

- To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology and the associated Aerospace, Architecture, Art, Medical and industrial applications.

UNIT I INTRODUCTION:


UNIT II REVERSE ENGINEERING AND CAD MODELING:


UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS

materials, advantages, limitations and applications - Case studies.

**UNIT IV**  
**POWDER BASED ADDITIVE MANUFACTURING SYSTEMS:**  

**UNIT V**  
**OTHER ADDITIVE MANUFACTURING SYSTEMS:**  
Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.  
TOTAL: 45 PERIODS

**OUTCOME:**
- On completion of this course, they will learn about a variety of Additive Manufacturing (AM) technologies, their potential to support design and manufacturing, case studies relevant to mass customized manufacturing, and some of the important research challenges associated with AM and its data processing tools.

**REFERENCES:**