PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

i. To train students with good scientific and engineering knowledge so as to comprehend, analyze, design, and create novel products and solutions for the real life problems

ii. 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.

iii. 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.

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

v. To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career

PROGRAMME OUTCOMES:
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.
## PEO / PO Mapping

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- PEO: Programme Educational Objectives
- PO: Programme Outcomes
- ✓: Indicators of achievement
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### List of Electives

#### MAPPING OF POS WITH SUBJECTS

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# M.E. COMPUTER INTEGRATED MANUFACTURING

## CHOICE BASED CREDIT SYSTEM

### I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 70**
# FOUNDATION COURSES (FC)

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# LIST OF ELECTIVES FOR M.E. COMPUTER INTEGRATED MANUFACTURING

## SEMESTER I (Elective I)

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## EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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OBJECTIVES:
This course is designed to enrich the knowledge in various advanced mathematical techniques such as matrix theory, calculus of variations, probability and random variables, Laplace transforms and Fourier transforms. The fundamental concepts in these areas will be more useful for the students to model the engineering problems and solving them by applying these methods.

UNIT I
MATRIX THEORY
The Cholesky decomposition - Generalized Eigenvectors - Canonical basis - QR factorization - Least squares method - Singular value decomposition.

UNIT II
CALCULUS OF VARIATIONS
Concept of variation and its properties – Euler’s equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems - Direct methods : Ritz and Kantorovich methods.

UNIT III
PROBABILITY AND RANDOM VARIABLES

UNIT IV
LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS

UNIT V
FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS

TOTAL : 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following skills:

- Apply various methods in matrix theory to solve system of linear equations.
- Maximizing and minimizing the functional that occur in various branches of engineering disciplines.
- Computation of probability and moments, standard distributions of discrete and continuous random variables and functions of a random variable.
- Application of Laplace and Fourier transforms to initial value, initial–boundary value and boundary value problems in Partial Differential Equations.

REFERENCES:
OBJECTIVE:
- 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  8

UNIT II  CAD/CAM INTEGRATION  9

UNIT III  CONSTRUCTIONAL FEATURES OF CNC MACHINES  10

UNIT IV  PART PROGRAMMING FOR CNC MACHINES  9
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  9

TOTAL: 45 PERIODS

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

ED5151 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 9
Output primitives (points, lines, curves etc.), 2-D & 3-D transformation (Translation, scaling, rotation) windowing - view ports - clipping transformation.

UNIT II CURVES AND SURFACES MODELING 9
Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations.

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

TOTAL : 45 PERIODS

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:

CM5102 ADVANCES IN MANUFACTURING TECHNOLOGY

OBJECTIVES:
- 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
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.

UNIT II PRECISION MACHINING:

UNIT III ADVANCES IN METAL FORMING
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

UNIT V RAPID PROTOTYPING AND SURFACE MODIFICATION TECHNIQUES

TOTAL: 45 PERIODS

OUTCOMES:
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

MR5391 INDUSTRIAL ROBOTICS 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

TOTAL: 45 PERIODS

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.
REFERENCES

CM5111 CIM LABORATORY I

OBJECTIVE:
- To impart knowledge in CAD software package for modeling, assembly, FEA of mechanical components and CNC programming for Milling/Turning.

OUTCOME:
At the end of this course the student will be able to model, assemble, FEA of mechanical components using CAD software and CNC programming for Milling/Turning.

1. Assembly of mechanical components using CAD software SolidWorks/CATIA/Pro-E.
2. Finite Element Analysis (FEA) using Pre-processing (solid modeling, meshing, analysis setup) and post processing (graphical display and report) with software PATRAN/ NASTRAN/ MARC/ ABAQUS/ LS-DYNA/ ANSYS/PAM-CRASH (Exercises include Simple Beam, Plane Stress, Strain, axi-symmetric, 3D Solids).
3. CNC code generation for CNC Milling.
4. CNC code generation for CNC Turning.
5. Demonstration of CNC Router Machine/ CNC Lathe/ CNC Milling (Students have to submit detailed reports on each demonstrations).

LIST OF EQUIPMENTS REQUIRED:
1. Computers 20
2. CAD software Solid Works/CATIA/Pro-E.
3. FEA Software PATRAN/NASTRAN/ MARC/ ABAQUS/ LS-DYNA/ ANSYS.
4. CAM Software for CNC machining/simulation (CAPS Mill, CAPS Turn and Edge CAM).

TOTAL: 60 PERIODS
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 9

UNIT II GROUP TECHNOLOGY & FLEXIBLE MANUFACTURING SYSTEMS 9

UNIT III COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS 9

UNIT IV LEAN MANUFACTURING: 9

UNIT V JUST IN TIME 9

OUTCOME:
OM Completion of this course the students are aware of the pace of changes in the manufacturing technology like FMS, Simulator, JIT etc.

REFERENCES:
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

UNIT II FRACTURE BEHAVIOUR

UNIT III SELECTION OF MATERIALS
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

TOTAL: 45 PERIODS

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:
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 - Maintain information on work-in-process - 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
1. To manage efficiently various activities of production with the help of technology
2. Expected to use modern technologies in future management systems

REFERENCES:
OBJECTIVES:

- 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

UNIT II  MEASUREMENT OF SURFACE ROUGHNESS:  9

UNIT III  INTERFEROMETRY:  8

UNIT IV  MEASURING MACHINES 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.

TOTAL: 45 PERIODS

OUTCOMES:

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
CM5211  CIM LABORATORY II  L T P C  0 0 4 2

OBJECTIVES:
- To impart knowledge in Programmable Logic Control, Robot, Matlab programming and inspection of mechanical components using Video Measurement System and Coordinate Measuring Machine.

OUTCOME:
At the end of this course the student will be able to programme in PLC, Robot, Matlab environment and they can also inspect mechanical components using VMS and CMM.
1. Programmable Logic Control (PLC) using PLC software Keyence ladder builder and working of PLC trainer kit.
2. Robot Programming.
3. Matlab Programming. (Matrix manipulations, plotting of functions and data, implementation of algorithms and creation of user interfaces).
4. Inspection of mechanical components using Video Measuring System (VMS).

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS REQUIRED:
1. Computers 20
2. PLC trainer kit
3. Video Measuring System (VMS)
4. Digital Height Gauge
5. Coordinate Measuring Machine (CMM)
6. Robot

CM5212  TECHNICAL SEMINAR  L T P C  0 0 2 1

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

OUTCOME:
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 and as report.

TOTAL: 30 PERIODS

CM5091  ADDITIVE MANUFACTURING  L T P C  3 0 0 3

OBJECTIVES:
- 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 

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

UNIT I INTRODUCTION: 8
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: 10
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: 7

UNIT IV SYSTEM FORMULATION: 10

UNIT V COMPUTER AIDED PROCESS PLANNING SYSTEMS: 10
Computer aided Process Planning – Variant process planning – Generative process planning – Forward and Backward planning, input format - Totally Integrated process planning systems – Expert process planning - Commercial systems: CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP-

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

REFERENCES
OBJECTIVE:
• To apply the design for manufacturing principles in casting, welding, forming, machining and assembly, by considering various manufacturing constraints.

UNIT I INTRODUCTION:
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:
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:
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:
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:

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

OBJECTIVE:
• To impart knowledge on group technology, optimization algorithms, implementation of GT/CMS, Performance measurements and economical aspects of CMS.

UNIT I INTRODUCTION:
Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.
UNIT II CMS PLANNING AND DESIGN: 10

UNIT III IMPLEMENTATION OF GT/CMS: 10
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: 8
Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP - framework.

UNIT V ECONOMICS OF GT/CMS: 5
Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS - cases.

TOTAL: 45 PERIODS

OUTCOMES:
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

CM5004 FINITE ELEMENT ANALYSIS IN MANUFACTURING ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
- 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 10

UNIT II PROBLEM IN 2D: 9
Application to Field Problems in Manufacturing Engineering - Quadrilateral elements. Introduction to elasticity equations – stress strain relations – plane problems of elasticity – element equations Plane stress, plane strain and axisymmetric problems – stress-strain-time or constitutive equations- Introduction to flow problems- solution of problems in fluid mechanics- numerical examples -plates and shell

UNIT III APPLICATIONS TO FIELD PROBLEMS 9
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 \( \xi, \eta \) and \( \zeta \) – 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 9
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 8
Application to Bulk forming, sheet metal forming, casting, metal cutting, welding- Features of software packages

TOTAL: 45 PERIODS

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

CM5005 ELECTRONICS MANUFACTURING TECHNOLOGY L T P C 3 0 0 3

OBJECTIVE:
• To impart the knowledge in electronic packaging technology

UNIT I INTRODUCTION TO ELECTRONICS MANUFACTURING 9
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 8
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  9

UNIT IV  SURFACE MOUNT TECHNOLOGY:  11
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:  8

TOTAL: 45 PERIODS

OUTCOME:
At the end of this course the student will be able to apply knowledge in various steps in electronics manufacturing and testings.

REFERENCES

CM5092  ENVIRONMENT CONSCIOUS MANUFACTURING  L T P C
3 0 0 3

OBJECTIVE:
- To impart the knowledge in sustainable manufacturing, ISO 14000 series standards, green manufacturing, recycling and life cycle assessment.
UNIT I  SUSTAINABLE MANUFACTURING AND EMS:  9

UNIT II  GREEN MANUFACTURING:  9
Green Design and Quality Initiatives - Environmental Cost Accounting and Business Strategy - Accounting for an Environmentally Conscious Setting - The Development of Eco labelling Schemes

UNIT III  RECYCLING:  9
Recycling as Universal Resource Policy - Innovation Towards Environmental Sustainability In Industry - A Systematic Framework for Environmentally Conscious Design

UNIT IV  ENVIRONMENTAL ATTRIBUTES OF MANUFACTURING:  10
Environmental Attributes of Manufacturing Processes - Environmental Decision Support Systems - Decision Models for Reverse Production System Design - Environmentally Sound Supply Chain Management

UNIT V  LIFE CYCLE ASSESSMENT  8
Life Cycle Assessment - Multipath way and Cumulative Risk Assessment - Reclamation And Recycling of Waste

TOTAL: 45 PERIODS

OUTCOME:
On completion of the course the students will be able to follow the guidelines of ISO 14000, implement green design, follow environmental norms in manufacturing and do lifecycle assessment of products and processes.

REFERENCES

CM5006  EVOLUTIONARY COMPUTATION  L T P C
3 0 0 3

OBJECTIVES:
- To impart the knowledge in optimization, multi objective optimization, evolutionary algorithms, Multi-Objective Evolutionary Algorithms and programming.

UNIT I  INTRODUCTION TO OPTIMIZATION:  9
Introduction to optimization - single and multi objective optimization - Evolutionary algorithms - principles of multi objective optimization.

UNIT II  MULTI OBJECTIVE OPTIMIZATION:  9
Convex programming, Karush-Kuhn-Tucker conditions, Direct functional evaluation and derivative based optimization techniques;
UNIT III  EVOLUTIONARY ALGORITHMS:  9
Simulated annealing, Tabu search; NFL theorem; Biological principles of evolution, General scheme of EAs, Representation, Selection schemes, Population evaluation, Variation operators; Constraint handling; Schema theorem; Binary coded genetic algorithm, Real coded genetic algorithm.

UNIT IV  EVOLUTIONARY STRATEGIES AND EVOLUTIONARY PROGRAMMING  9
Evolutionary strategies, Evolutionary programming, genetic programming, Differential evolution, Particle swarm optimization;

UNIT V  APPLICATIONS OF MULTI-OBJECTIVE EVOLUTIONARY ALGORITHMS:  9
Pareto-optimality, Multi-objective evolutionary algorithms; Statistical analysis of EC techniques; Customization in EAs; Applications of multi-objective evolutionary algorithms - Mechanical component design - Truss-structure design - Other applications.

TOTAL:  45 PERIODS

OUTCOME:
On completion of the course the students will be able to apply optimization using techniques like evolutionary strategies and evolutionary programming.

REFERENCES

CM5071 INTELLIGENT PRODUCT DESIGN AND MANUFACTURING

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:
Applications to web based CAD, CAPP, CNC, Assembly planning, and Rapid Prototyping - Challenging issues of Collaborative CAD/CAM.

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

CM5007 INTELLIGENT MANUFACTURING SYSTEMS L T P C
3 0 0 3

OBJECTIVES:
To know the concepts of Artificial Intelligence
To Practice the methods of solving problems using Artificial Intelligence
To build components of intelligent decision support system for Manufacturing

UNIT I INTRODUCTION

UNIT II ARTIFICIAL INTELLIGENCE LANGUAGES
Heuristic search-logic programming and reasoning-automatic programming-scope of AI-in manufacturing components of intelligent manufacturing Aspects of intelligence and AI Requirements of AI languages, LISP & PROLOG – Simple programs

UNIT III BUILDING OF KNOWLEDGE BASED SYSTEMS
Knowledge engineering-protocol analysis -fuzzy logic -Semantic networks, Learning systems Knowledge Engineering Knowledge representation – Knowledge acquisition and optimization - Knowledge based approaches to design mechanical parts and mechanisms and design for automated assembly.

UNIT IV INTELLIGENT SYSTEMS
Knowledge based system for material selection – Intelligent process planning system. Intelligent system for equipment selection -Intelligent system for project management & factory monitoring. Inference engine Vision programmes-factory vision systems -machine learning

UNIT V FACTORIES OF FUTURE
The role of Artificial Intelligence in the factory of the future Features of Experts systems -applications in manufacturing planning and control – Intelligent systems. Scheduling in manufacturing – scheduling the shop floor – Diagnosis & trouble shooting.

TOTAL 45 PERIODS
OUTCOMES:
- Apply various knowledge based techniques
- Practice building of intelligent systems
- Adopt intelligent system for Manufacturing

REFERENCES

MF5071 LEAN MANUFACTURING L T P C
3 0 0 3

OBJECTIVE:
- 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

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**CM5008 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 casting, micro forming, micro joining.
Micro and Nano products

**UNIT II MANUFACTURING METHODS**
Material deposition – PVD, CVD, LIGA, Micro stereo lithography, Electro discharge deposition, Traditional micromachining- Theory of micromachining-Chip formation-size effect in micromachining, micro turning, micro drilling, micro milling, micro grinding, Diamond turn machining

**UNIT III ADVANCED MACHINING / FINISHING PROCESSES**

**UNIT IV SYNTHESIS OF NANOMATERIALS**

**UNIT V CHARACTERISATION TECHNIQUES**
Metrology for micro machined components-Optical Microscopy, White Light Interferometry, Molecular Measuring Machine, Micro CMM

**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**

CM5072 MICRO ELECTRO MECHANICAL SYSTEMS L T P C
3 0 0 3

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

TOTAL: 45 PERIODS

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

PD5091 PRODUCT LIFECYCLE MANAGEMENT

OBJECTIVES:
To understand history, concepts and terminology of PLM
To understand functions and features of PLM/PDM
To understand different modules offered in commercial PLM/PDM tools
To understand PLM/PDM implementation approaches
To understand integration of PLM/PDM with other applications

UNIT I HISTORY, CONCEPTS AND TERMINOLOGY OF PLM
Introduction to PLM, Need for PLM, opportunities of PLM, Different views of PLM - Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (cPDm), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM), PLM/PDM Infrastructure – Network and Communications, Data Management, Heterogeneous data sources and applications.

UNIT II PLM/PDM FUNCTIONS AND FEATURES

UNIT III DETAILS OF MODULES IN A PDM/PLM SOFTWARE
Case studies based on top few commercial PLM/PDM tools

UNIT IV ROLE OF PLM IN INDUSTRIES
Case studies on PLM selection and implementation (like auto, aero, electronic) - other possible sectors, PLM visioning, PLM strategy, PLM feasibility study, change management for PLM, financial justification of PLM, barriers to PLM implementation, ten step approach to PLM, benefits of PLM for – business, organisation, users, product or service, process performance.

UNIT V BASICS ON CUSTOMISATION/INTEGRATION OF PDM/PLM SOFTWARE
PLM Customization, use of EAI technology (Middleware), Integration with legacy data base, CAD, SLM and ERP

OUTCOMES:
The students will be able to
1. Understand history, concepts and terminology of PLM.
2. Apply the functions and features of PLM/PDM.
3. Understand different modules offered in commercial PLM/PDM tools.
4. Understand PLM/PDM implementation approaches.
5. Integrate PLM/PDM with other applications.
6. Analyse the case studies.
REFERENCES

CM5093 MANUFACTURING SYSTEM SIMULATION

OBJECTIVE:
• To introduce computer simulation technologies and techniques
• To introduce concepts of modeling layers of society's critical infrastructure networks
• To build tools to view and control simulations and their results

UNIT I INTRODUCTION

UNIT II RANDOM NUMBERS

UNIT III RANDOM VARIATES

UNIT IV ANALYSIS OF SIMULATION DATA
Input modelling-Fitness tests – verification and validation of simulation models – output analysis for a single model, Comparison and evaluation of alternate system design, Optimization using simulation.

UNIT V SIMULATION LANGUAGES
Simulation languages and packages-Case studies in WITNESS; FLEXSIM, ARENA, SIMQUICK-Simulation based optimization-Modelling and Simulation with Petrinets -Case studies in manufacturing and material handling system.

OUTCOMES
• At the end of this course the students are expected to
• Develop Manufacturing Models of Discrete event systems
• Generation of Uncertainty using Random numbers and Random Variates
• Input, Output Analysis: Verification & Valediction of Models and Optimization

TOTAL: 45 PERIODS
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 systems for manufacturing industry.

REFERENCES

8. www.ist.psu.edu
CM5010  MANAGEMENT OF MANUFACTURING SYSTEMS    L T P C
                                                                 3 0 0 3

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: 6
Elements – Manufacturing Strategies and competitiveness-Meeting the competitive Project management.

UNIT II  DESIGNING OF PRODUCTS: 9

UNIT III  DESIGN OF FACILITIES AND JOBS: 10
Capacity planning – Strategies – Planning service capacity - JIT – Facility location and layout - Job Design and Work measurement.

UNIT IV  INVENTORY SYSTEMS AND MRP: 10
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: 10

TOTAL: 45 PERIODS

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:

CM5011  MECHATRONICS IN MANUFACTURING SYSTEMS    L T P C
                                                                 3 0 0 3

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 : 5
UNIT II SENSORS AND TRANSDUCERS: 12
Introduction - Performance Terminology – Potentiometers - LVDT - Capacitance sensors - Strain
gauges - Eddy current sensor - Hall effect sensor - Temperature sensors - Light sensors - Selection of
sensors - Signal processing.

UNIT III ACTUATORS: 10
Actuators – Mechanical - Electrical - Fluid Power - Piezoelectric – Magnetostrictive - Shape memory
alloy - applications - selection of actuators.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS 8
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: 10
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.

TOTAL: 45 PERIODS

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

REFERENCES:

CM5012 DESIGN OF FLUID POWER SYSTEMS L T P C 3 0 0 3

OBJECTIVE:
- To study the principles, practices and techniques of Design of Hydraulic and Pneumatic Systems.

UNIT I OIL HYDRAULIC SYSTEMS: 10
Hydraulic Power Generators - Selection and specification of pumps, pump characteristics - Linear and
Rotary Actuators - selection, specification and characteristics - Pressure - direction and flow control
valves - relief valves, non-return and safety valves - Hydraulic actuation systems.

UNIT II HYDRAULIC CIRCUIT DESIGN: 10
Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits - industrial circuits
– press circuits - hydraulic milling machine - grinding, planning, copying, forklift, earth mover circuits –
Design and methodology-Sequential circuits, cascade, circuits - Compound and combination circuit design - selection of components - safety and emergency mandrels.

UNIT III PNEUMATIC SYSTEMS AND CIRCUITS: 8
Pneumatic fundamentals - control elements, position and pressure sensing -logic circuits - switching circuits - fringe conditions - modules and their integration.

UNIT IV PNEUMATIC CIRCUIT DESIGN: 9
Sequential circuits - cascade methods - mapping methods – step counter method - compound circuit design - combination circuit design - hydro pneumatic circuits - Pneumatic equipments - selection of components - design calculations -application.

UNIT V COMPUTER CONTROL AND MAINTENANCE OF FLUID POWER CIRCUITS: 8
Fuzzy logic in fluid power circuits- PLC in fluid powers- PLC ladder diagram – Low cost automation - Robotic circuits - Installation -Fault finding in fluid power circuits.

TOTAL: 45 PERIODS

OUTCOME:
At the end of this course the student will be able to apply these innovations to design Hydraulic and Pneumatic Systems for industrial applications.

REFERENCES

CM5094 PROJECT MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
- To develop the skills that professionals need to become effective project managers. With a specific focus on developing practical project management skills for the students to apply proven methodologies to projects within their individual fields.

UNIT I PROJECT SELECTION AND PROJECT ORGANISATION: 9
Project selection and nature of selection, project portfolio process, Analysis under uncertainty, Project organisation, Matrix organisation, Mixed organisational systems.

UNIT II PROJECT PLANNING: 9
Project Co-ordination, sorting out the projects, Work breakdown structure, system integration, Interface co-ordination, Project life cycle, Conflict and negotiation.

UNIT III PROJECT IMPLEMENTATION: 12
Estimating project budgets, Process of cost estimation, Scheduling : Network techniques PERT and CPM, crashing a project, Resource loading and leveling, Multiproduct scheduling and resource allocation.
UNIT IV MONITORING AND INFORMATION SYSTEMS: 9
Planning-Monitoring-Controlling cycle, Information needs and the reporting process, Computerized PMIS, Earned value analysis, Types of project control processes, control as a function of management, control of change and scope.

UNIT V PROJECT TERMINATION: 6
Construction and use of audit report, Project audit life cycle, Essentials of audit and evaluation, Varieties of project termination, termination process, Final report – A project history.

TOTAL: 45 PERIODS

OUTCOME:
Students will gain a solid understanding of current Project Management methodologies and techniques that are being applied worldwide. They will also learn relevant management skills to ensure success in working with teams and entire organization

REFERENCES:

CM5013 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 9
Reliability function - MTBF - MTTF - mortality curve - availability -Maintainability.

UNIT II FAILURE DATA ANALYSIS: 9
Repair time distributions - exponential, normal, log normal, gamma, and Weibull - reliability data requirements - Graphical evaluation.

UNIT III RELIABILITY PREDICTION: 9

UNIT IV RELIABILITY MANAGEMENT: 9
Reliability demonstration testing - Reliability growth testing - Duane curve -Risk assessment - FMEA, Fault tree.

UNIT V TOTAL PRODUCTIVE MAINTENANCE: 9

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.
CM5014 SENSORS FOR MANUFACTURING AND CONDITION MONITORING

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
CM5015 SUPPLY CHAIN MANAGEMENT

OBJECTIVE:
- To provide the student with the knowledge of logistics management, network design, sourcing, pricing, coordination and technology in supply chain management.

UNIT I INTRODUCTION:
Definition of Logistics and SCM: Evaluation, Scope Importance & Decision phases – Drivers of SC performance and Obstacles.

UNIT II LOGISTICS MANAGEMENT:

UNIT III SUPPLY CHAIN NETWORK DESIGN:

UNIT IV SOURCING AND PRICING IN SUPPLY CHAIN:
Supplier Selection and contracts – design collaboration – Procurement process. Revenue management in supply chain.

UNIT V COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN:
Supply Chain Coordination – Bullwhip effect of lack of Coordination and obstacles – IT and SCM – supply Chain IT frame work. E Business & SCM. Metrics for SC performance – Case Analysis.

TOTAL: 45 PERIODS

OUTCOME:
At the end of this course the student should be able to manage logistics and supply chain of a factory or an organization.

REFERENCES

CM5073 GREEN MANUFACTURING

OBJECTIVE:
To introduce the concept of Green Manufacturing Design to the students

UNIT I INTRODUCTION
Environmental effects of design – Environmental damage – In efficient energy use – Design for recycling.
UNIT II ENVIRONMENTAL LIFE CYCLE ASSESSMENT

UNIT III GREEN DESIGN METHODS

UNIT IV DESIGN FOR ENVIRONMENT
Eco design – Industrial Ecology – Pollution prevention – Reduction of toxic emission.

UNIT V SUSTAINABLE ECONOMIC ENVIRONMENT

TOTAL: 45 PERIODS

OUTCOMES:
• Students will understand the concepts of Green Manufacturing Design
• It will impart green design methods and to assess the life cycle of the product

REFERENCES:

CM5016 MATERIAL CHARACTERIZATION TECHNIQUES

OBJECTIVE:
• To impart knowledge in microstructure evaluation, crystal structure analysis, electron microscopy, Chemical, Thermal analysis and mechanical testing methods.

UNIT I MICRO STRUCTURAL EVALUATION:

UNIT II CRYSTAL STRUCTURE ANALYSIS:

UNIT III ELECTRON MICROSCOPY:

UNIT IV CHEMICAL AND THERMAL ANALYSIS:
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:

TOTAL: 45 PERIODS

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

REFERENCES

CM5017  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:  8
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

OUTCOMES:
At the end of this course
1. This domain knowledge will increase their employability skills
2. Use this knowledge to develop innovative ideas work holding methods
3. Encourages to involve in research in the area of machining

REFERENCES

CM5018  TOTAL QUALITY SYSTEMS AND ENGINEERING  L T P C
3 0 0 3

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:  10
Principles of Quality Management - Pioneers of TQM - Quality costs - Customer Orientation -
Benchmarking - Re-engineering - Concurrent Engineering.

UNIT II  PRACTICES OF TQM:  10
Structure - Team Building - Information Systems and Documentation.

UNIT III  TECHNIQUES OF TQM:  10
Single Vendor Concept - JIT - Quality Function deployment - Quality Circles - KAIZEN - SGA - POKA
YOKE - Taguchi Methods.

UNIT IV  QUALITY BY DESIGN:  8
Introduction – Rationale for implementation – Benefits– Teams – Communication models –
Implementation – Tools – Misconceptions and Pitfalls.

UNIT V  PRODUCTS LIABILITY:  7

TOTAL: 45 PERIODS

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.

45
REFERENCES

CM5019 WAREHOUSE LAYOUT PLANNING AND PART FEEDING METHODS

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 panning

UNIT I LAYOUT PLANNING: 8
Layout Planning - Importance of Layout Planning - General Steps in Layout and Space Requirements Planning - Warehouse Activities - Determining Space Requirements – Develop realistic and Ideal Layout for Storage and Retrieval – Material storage methods for each part

UNIT II RACKING SYSTEMS FOR WAREHOUSE: 9

UNIT III MATERIAL HANDLING SYSTEMS FOR WAREHOUSE: 9
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: 10
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 Ware House Planning- Issues to be Considered during Ware Housing Planning - Check List for Warehouse Layout Planning - Return on Assets

UNIT V WAREHOUSE MANAGEMENT SYSTEMS, SAFETY AND STAFFING 9
WMS Support in Ware House Management - Benefits of a WMS - Components of a WMS - WMS Data - WMS Functions - WMS Reports - Ware House Safety Requirements, Warehouse Staffing - Personnel Requirements for a Typical Warehouse.

TOTAL: 45 PERIODS
OUTCOMES:
Students will be able to:
1. Design and plan warehouse layouts
2. 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)

MF5073    INTERNET OF THINGS FOR MANUFACTURING       L T P C
                      3 0 0 3

OBJECTIVES:
- To discover key IoT concepts including identification, sensors, localization, wireless protocols
- To explore IoT technologies, architectures, standards, and regulation
- To realize the value created by collecting, communicating, coordinating, and leveraging data
- To examine developments that will likely shape the industrial landscape in the future;

UNIT I     INTRODUCTION
9

UNIT II    DESIGN OF IoT
9
Design challenges in IoT -Standardization, Security and privacy, Infrastructure, Analytics. Design steps for implementing IoT.

UNIT III   PROTOTYPING OF IoT
9

UNIT IV    PREREQUISITES FOR IoT
9
IOT Technologies Wireless protocols low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications Data storage and analysis Localization algorithms Localization for mobile systems
UNIT V APPLICATION IN MANUFACTURING

Applications HCI and IoT world - Multilingual interactions Robotics and Autonomous Vehicles Sensing and data processing-Simultaneous mapping and localization-Levels of autonomy, Smart factories, Future research challenges

OUTCOME:
- Utilizing sensors to gain greater visibility and real-time situational awareness
- Vertical applications that provide a clear business case and a pressing opportunity
- Emerging technologies to address IoT challenges

REFERENCES:

IL5091 DATA ANALYTICS

OBJECTIVES:
The Student should be made to:
- Be exposed to big data
- Learn the different ways of Data Analysis
- Be familiar with data streams
- Learn the mining and clustering
- Be familiar with the visualization

UNIT I INTRODUCTION TO BIG DATA


UNIT II DATA ANALYSIS


UNIT III MINING DATA STREAMS

UNIT IV FREQUENT ITEMSETs AND CLUSTERING

UNIT V FRAMEWORKS AND VISUALIZATION
MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications:

TOTAL : 45 PERIODS

OUTCOMES:
The student should be made to:
- Apply the statistical analysis methods.
- Compare and contrast various soft computing frameworks.
- Design distributed file systems.
- Apply Stream data model.
- Use Visualisation techniques

REFERENCES: