## SEMESTER I

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**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 69**

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

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OBJECTIVES:
- To study and understand the concepts of Statistical methods and its applications in Engineering.
- To study the effect of estimation theory, testing of hypothesis, correlation and regression, randomized design, and multivariate analysis.

UNIT I  ESTIMATION THEORY  9+3

UNIT II  TESTING OF HYPOTHESIS  9+3
Tests based on Normal, t, $X^2$ and F distributions for testing of means, variance and proportions – Analysis of r x c tables – Goodness of fit.

UNIT III  CORRELATION AND REGRESSION  9+3
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 co-efficient.

UNIT IV  DESIGN OF EXPERIMENTS  9+3
Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT V  MULTIVARIATE ANALYSIS  9+3

OUTCOME:
- On completion of this course the students will be able to solve various problems in the field of engineering employing probability and statistical methods.

REFERENCES:
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

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.

TOTAL: 45 PERIODS
REFERENCES:

ED7102 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  
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  

UNIT IV VISUAL REALISM  
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  

TOTAL : 45 PERIODS

Laboratory session: Writing interactive programs generate graphics and to solve design problems - using any languages like Auto LISP/ C / FORTRAN etc. Each assessment should contain a component of Laboratory session.
OUTCOME:
- With laboratory classes in conjunction, 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 curves which are necessary to solve CAE problems that arise in engineering.

REFERENCES

CM7102 ADVANCES IN MANUFACTURING TECHNOLOGY

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
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


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

CM7103 ADVANCED METROLOGY AND COMPUTER AIDED INSPECTION

COURSE 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:
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:

UNIT III  INTERFEROMETRY:

UNIT IV  COMPUTER AIDED AND LASER METROLOGY:

UNIT V  IMAGE PROCESSING FOR METROLOGY:
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

COURSE 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

WEB REFERENCES:
1. www.metrologytooling.com
2. www.iuk’tu-harburg.de

CM7111  CIM LABORATORY I  L T P C
0 0 3 2

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/NASTRA/N/ MARC/ ABAQUS/ LS-DYNA/ ANSYS.
4. CAM Software for CNC machining/simulation (CAPS Mill, CAPS Turn and Edge CAM).

TOTAL: 45 PERIODS

CM7201 COMPETITIVE MANUFACTURING SYSTEMS L T P C
3 0 0 3

AIM:
To impart knowledge on the pace of changes in the manufacturing technology.

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
Involvement— Quality circle activity – Kaizen training - Suggestion Programmes – Hoshin Planning System (systematic planning methodology) – Lean culture.

UNIT V      JUST IN TIME

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

CM7202 APPLIED MATERIALS ENGINEERING  

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:

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

CM7203  DISCRETE SYSTEM SIMULATION

OBJECTIVE:
• 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:
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 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, Dispatch rules, Metaheuristics

TOTAL: 45 PERIODS

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

REFERENCES

CM7204 COMPUTER INTEGRATED PRODUCTION AND INVENTORY SYSTEMS L T P C
3 0 0 3

OBJECTIVE:
- 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:
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:
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:

OUTCOME:
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:

CM7211  TECHNICAL SEMINAR

OBJECTIVE:
• 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.

TOTAL: 30 PERIODS
CM7212  
CIM LABORATORY II  
L T P C  
0 0 3 2

OBJECTIVE:
• 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).
6. Demonstration of various facilities (Students have to submit detailed reports on each demonstrations) such as Non-Contact Surface Roughness Tester, Contact Type Surface Roughness Tester, Tool Makers Microscope, Wire Electrical Discharge Machine, Pin-on-Disc apparatus, Multipurpose Micro-Machine Tool, Physical Vapor Deposition, Fiber Forming Chamber Machine, Abrasive Waterjet Machine, Machining Centre, etc which will help the students to aware about the facilities available for their project works).

TOTAL: 45 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

CM7001  
ADDITIVE MANUFACTURING  
L T P C  
3 0 0 3

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:  
8

UNIT II  
REVERSE ENGINEERING AND CAD MODELING:  
10
UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS 10

UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS: 10

UNIT V OTHER ADDITIVE MANUFACTURING SYSTEMS: 7
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:

CM7002 ADVANCES IN WELDING AND CASTING TECHNOLOGY L T P C
3 0 0 3

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: 10
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:  

UNIT III  CASTING DESIGN AND METALLURGY:  

UNIT IV  SPECIAL CASTING PROCESSES:  
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:  
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.

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

REFERENCES

CM7003  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:  
UNIT II  POLYMER MATRIX COMPOSITES:

UNIT III  METAL MATRIX COMPOSITES:
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:

UNIT V  MACHINING OF COMPOSITES
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.

TOTAL: 45 PERIODS

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

REFERENCES

CM7004  COMPUTER AIDED PROCESS PLANNING  L  T  P  C
            3  0  0  3

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:  

UNIT V  COMPUTER AIDED PROCESS PLANNING SYSTEMS:  
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 -

OUTCOME:
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

WEB REFERENCES:
CM7005  CORROSION AND SURFACE ENGINEERING  L T P C
3 0 0 3

OBJECTIVE:
- 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

OUTCOME:
1. Students can able to provide solution for the typical Industrial corrosion problem.
2. Students can able to provide solution for different types of Surface Engineering problem.

REFERENCES
6. ASM Metals Hand Book – Volume 13, Corrosion, 1999
CM7006 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:
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

CM7007 DESIGN OF CELLULAR MANUFACTURING SYSTEMS

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

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

CM7008 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
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

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 the knowledge to design Hydraulic and Pneumatic Systems for industrial applications.

REFERENCES

CM7009  FINITE ELEMENT ANALYSIS IN MANUFACTURING ENGINEERING  L T P C
3 0 0 3

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  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 \( \xi, \eta \text{ and } \zeta \) – 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  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

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

CM7010   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
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:

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

REFERENCES
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:

UNIT II GREEN MANUFACTURING:
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:
Recycling as Universal Resource Policy - Innovation Towards Environmental Sustainability In Industry - A Systematic Framework for Environmentally Conscious Design

UNIT IV ENVIRONMENTAL ATTRIBUTES OF MANUFACTURING:
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:
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

OBJECTIVE:
- 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

ED7071  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

UNIT III ROBOT SENSORS

UNIT IV ROBOT CELL DESIGN AND APPLICATION

UNIT V ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

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.

TEXT BOOK:

REFERENCES
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

OBJECTIVE:
- To introduce the student various types of artificial intelligence and its applications.

UNIT I  INTRODUCTION:
UNIT II SEARCHING TECHNIQUES:

UNIT III KNOWLEDGE REPRESENTATION:

UNIT IV LEARNING:

UNIT V APPLICATIONS:

TOTAL: 45 PERIODS

OUTCOME:
At the end of this course the student should be able to apply the AI techniques to create applications which involve perception, reasoning and learning.

REFERENCES

CM7015 LEAN CONCEPTS IN PRODUCTION SYSTEMS

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:  9
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:  9
Principles of JIT – JIT system – Kanban – Kanban rules – Expanded role of conveyance – Production
leveling – Pull systems – Value stream mapping.

UNIT IV  JIDOKA (AUTOMATION WITH A HUMAN TOUCH):  9
Jidoka concept – Poka-Yoke (mistake proofing) systems – Inspection systems and zone control –

UNIT V  WORKER INVOLVEMENT AND SYSTEMATIC PLANNING METHODOLOGY:  9
Involvement – Activities to support involvement – Quality circle activity – Kaizen training - Suggestion
Programmes – Hoshin Planning System (systematic planning methodology) – Phases of Hoshin
Planning – Lean culture

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
2. Rother, M., and Shook, J., 'Learning to See: Value Stream Mapping to Add Value and Eliminate
   MUDA", Lean Enterprise Institute, 1999.
4. Michael, L.G., "Lean Six SIGMA: Combining Six SIGMA Quality with Lean Production
5. Ohno, T.,"Toyota Production System: Beyond Large-Scale Production", Taylor & Francis, Inc.,

CM7016  MICRO AND NANO MANUFACTURING  L T P C
3 0 0 3

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

UNIT I  INTRODUCTION  9
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  9
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

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

CM7017  MICROELECTROMECHANICAL SYSTEMS

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

UNIT I  INTRODUCTION

UNIT II  MECHANICS, SCALING AND DESIGN
Engineering Mechanics for Microsystems design: Introduction, Static bending of Thin Plates, Mechanical Vibration, Thermomechanics, Thermofluid, Engineering and micro system 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-Absasive 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

CM7018 MANUFACTURING INFORMATION SYSTEMS

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

WEB REFERENCES:
1. www.ist.psu.edu
2. www.cse.wustl.edu(UML Notation Guide)

CM7019 MANAGEMENT OF MANUFACTURING SYSTEMS

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: 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

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:

CM7020 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 :

UNIT II SENSORS AND TRANSDUCERS:

UNIT III ACTUATORS:
Actuators – Mechanical - Electrical - Fluid Power - Piezoelectric – Magnetostrictive - Shape memory alloy - applications - selection of 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
OUTCOME:
At the end of this course the student should be able to apply Mechatronics in design and practical requirements.

REFERENCES:

CM7021 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  9

OUTCOME:
Students will:
1. Operate high precision machineries with ease.
2. Research and explore new areas of cutting tools.

REFERENCES

CM7022  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:
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:
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:
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:
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:
   and Sons, 2011
   2007

CM7023 RELIABILITY AND TOTAL PRODUCTIVE MAINTENANCE

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:
Failure rate estimates - Effect of environment and stress - Series and Parallel systems - RDB analysis
- Standby Systems - Complex Systems.

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

UNIT V TOTAL PRODUCTIVE MAINTENANCE:
Causes of Machine Failures - Downtime - Maintenance policies - Restorability predictions -
Replacement models - Spares provisioning - Maintenance management – Total Productive
Maintenance – Maximizing equipment effectiveness – Organizing for TPM implementation –
Implementation – TPM small group activities.

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
4. Kales, P., “ Reliability for technology Engineering and Management ”, Prentice Hall, New Jersey,
   1998.
   Hall of India, New Delhi, 1996.
CM7024  SENSORS FOR MANUFACTURING AND CONDITION MONITORING  L T P C
3 0 0 3

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

CM7025  SUPPLY CHAIN MANAGEMENT  L T P C
3 0 0 3

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

CM7026  SUSTAINABLE MANUFACTURING  L T P C
3 0 0 3

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: 9
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: 9

UNIT IV SUPPLY CHAIN MANAGEMENT: 9
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: 9

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

CM7027 MATERIAL CHARACTERIZATION TECHNIQUES

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:  

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

CM7028  
TOOL ENGINEERING  
L T P C
3 0 0 3

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 tool 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.

OUTCOME:
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

CM7029
TOTAL QUALITY SYSTEMS AND ENGINEERING

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:  

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.

REFERENCES

CM7030  WAREHOUSE LAYOUT PLANNING AND PART FEEDING METHODS  L T P C
3 0 0 3

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 ware house panning

UNIT I  LAYOUT PLANNING:  
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:
Selection of Ware House Equipments and Material Handling Systems - Racking and Shelving Systems - Rack Planning Considerations - General Categories of Rack Systems - Large Products Storage System - Pallet Storage Systems Selection - Selection of Racking Systems - Technical

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 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
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

OUTCOME:
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)