ANNA UNIVERSITY COIMBATORE

ME (Full Time) - Computer Integrated Manufacturing

REGULATIONS 2007

Semester No. 1					
Theory					
Course Code	**Course Title**	**L**	**T**	**P**	**M**
	Data Structures and Computing	3	1	-	100
	Computer Integrated Manufacturing Systems	3	-	-	100
	Computer Graphics and Geometric Modelling	3	-	-	100
	Computer Aided Manufacturing	3	-	-	100
	Automated Manufacturing	3	-	-	100
	Managerial Accounting and Finance	3	1	-	100
Practical					
Course Code	**Course Title**	**L**	**T**	**P**	**M**
	CIM Laboratory I	-	-	3	100
Seminar					
	Seminar I	-	-	2	100
				Total	800
Semester No. 2					
Theory					
Course Code	**Course Title**	**L**	**T**	**P**	**M**
	Metrology and Computer Aided Inspection	3	-	-	100
	Sensors for Intelligent Manufacturing and Condition Monitoring	3	-	-	100
	Production and Operations Management	3	-	-	100
	Elective I	3	-	-	100
	Elective II	3	-	-	100
	Elective III	3	-	-	100
Practical					
Course Code	**Course Title**	**L**	**T**	**P**	**M**
	CIM Laboratory II	-	-	3	100
Seminar					
	Seminar II	-	-	2	100
				Total	800
Semester No. 3					
Course Code	**Course Title**	**L**	**T**	**P**	**M**
	Elective IV	3	-	-	100
	Elective V	3	-	-	100
	Elective VI	3	-	-	100
	Project Work Phase I	-	-	12	200
				Total	500
Semester No. 4					
Course Code	**Course Title**	**L**	**T**	**P**	**M**
	Project Work Phase II	-	-	24	400

Total 400

Total Marks 2500

List of Electives

Course Code	Course Title	L	T	P	M
	Nano Technology	3	-	-	100
	Computer Networking and Standards in Computer Integrated Manufacturing	3	-	-	100
	Flexible Manufacturing Systems	3	-	-	100
	Quality Engineering	3	-	-	100
	Product Data Management	3	-	-	100
	Lean Manufacturing	3	-	-	100
	Mechatronics	3	-	-	100
	Machine Vision and its Applications	3	-	-	100
	Design for Manufacture and Assembly	3	-	-	100
	Rapid Prototyping, Tooling and Manufacture	3	-	-	100
	Digital Manufacturing	3	-	-	100
	Occupational Safety and Health Engineering	3	-	-	100
	Concurrent Engineering	3	-	-	100
	Management Information Systems	3	-	-	100
	Engineering Optimisation : Theory and its Applications	3	-	-	100
	Advanced Finite Element Analysis	3	-	-	100
	Cellular Manufacturing	3	-	-	100
	Logistics and Supply Chain Management	3	-	-	100
	Modelling and Simulation in Manufacturing	3	-	-	100
	Productivity Management	3	-	-	100
	Microprocessor and Microcontrollers	3	-	-	100
	Fuzzy Logic and Neural Network	3	-	-	100
	Advanced Materials and their Processing	3	-	-	100

ANNA UNIVERSITY - COIMBATORE
M.E (COMPUTER INTEGRATED MANUFACTURING)

0102 DATA STRUCTURES AND COMPUTING 3 0 0 3

UNIT I INTRODUCTION 8

Basic concepts of OOPs – Templates – Algorithm Analysis – ADT - List (Singly, Doubly and Circular) Implementation - Array, Pointer, Cursor Implementation

UNIT II BASIC DATA STRUCTURES 12

Data representation, Arrays and matrices, Stacks and Queues – ADT, Implementation and Applications - Trees – General, Binary, Binary Search, Expression Search, AVL, B-Trees – Implementations - Tree Traversals.

UNIT III ADVANCED DATA STRUCTURES 9

Set – Implementation – Basic operations on set – Priority Queue – Implementation - Graphs – Directed Graphs – Shortest Path Problem - Undirected Graph - Spanning Trees – Graph Traversals

UNIT IV SEARCHING, SORTING 7

Searching Techniques, Sorting – Internal Sorting – Bubble Sort, Insertion Sort, Quick Sort, Heap Sort, Bin Sort, Radix Sort – External Sorting – Merge Sort, Multi-way Merge Sort, Polyphase Sorting

UNIT V DESIGN TECHNIQUES 9

Divide and Conquer - Dynamic Programming - Greedy Algorithm – Backtracking - Local Search Algorithms

Total No. of Periods : 45

TEXTBOOKS

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Pearson Education, 2002.
2. Aho, Hopcroft, Ullman, “Data Structures and Algorithms”, Pearson Education, 2002.

REFERNCES

1. Satraj Sahni, “Data Structures , Algorithms, and Applications in C++”, McGraw –Hill International Edition ,2000.
2. Horowitz, Sahni, Rajasekaran, “Computer Algorithms”, Galgotia, 2000
3. Tanenbaum A.S., Langram Y, Augestien M.J., ”Data Structures using C & C++”, Prentice Hall of India, 2002

0101 COMPUTER INTEGRATED MANUFACTURING **3 0 0 3**

Unit I

INTRODUCTION TO FMS, RMS, CIM: Introduction to FMS, FMS equipment, tool management system, system layouts, reconfigurable machines and systems **,** challenges, enabling technologies for reconfiguration, system level design issues in RMS – reconfigurable machines, CIM , technology issues, CIM implementation, integration, benefits of CIM. (9)

Unit II

MATERIAL HANDLING STORAGE & DATA COLLECTION: Functions, types, analysis of material handling equipments. Design of conveyor and AGV systems, storage system performance, AS/RS, carousel storage system, WIP storage system, interfacing handling storage with manufacturing. Automatic data collection, bar code technology ,Radio Frequency Identification. (5)

NETWORKS: Computer networks, a perspective, goals, applications, switching techniques, circuit switching, message switching, packet switching, network components, existing network , ARPANET, concepts of network protocol, OSI reference model. (4)

Unit III

LAN & ACCESS TECHNIQUES: Topologies, star, ring, bus, ethernet, transmission media, protocols, polling, contention, ALOHA, CSMA, CSMA/CD, token ring protocols, delay throughput characteristics, token ring and CSMA/CD bus, performance comparisons. (5)

INTERNETWORKING DEVICES: Principles, repeaters, bridges, routing with bridges, routers, brouters, gateways, hubs and switches, TCP/IP, protocol structure, internet protocol , transmission protocol , applications. (4)

Unit IV

PROCESS PLANNING: Approaches to process planning, study of a typical process planning, manufacturing planning and control, overview of production control, ERP, dynamic enterprise modeling. (5)

FUNDAMENTALS OF NETWORKING: Networking concepts, LOSI, MAP, TOP, LAN and WAN, internet and related technologies, collaborative engineering. (4)

Unit V

ARCHITECTURE OF CIM: Integration and implementation issues in CIM. (9)

Total 45

REFERENCES:

Basandra S K, Jaiswal, “Local Area Networks”, Galgotia publications Pvt. Ltd, New Delhi, 2003.

Taylor E D, “Networking Handbook”, Tata McGraw Hill Co ltd, New Delhi, 2003.

Rao P N, “CAD/CAM, Principles and Applications”, Tata McGraw Hill Co ltd, New Delhi, 2004

Tien,chien Chang and Richard A Wysk, “An Introduction to Automated Process Planning Systems”, Prentice Hall Inc., Englewood cliffs, New Jersey,1985.

5. Radhakrishnan P and Subramanyan S, “CAD/CAM/CIM”, New Age International (P) Ltd, 2000.

0103 COMPUTER GRAPHICS AND GEOMETRIC MODELING 3 1 0 4

Unit I

OVERVIEW OF CAD SYSTEMS: Conventional and computer aided design processes - advantages and disadvantages - subsystems of CAD - CAD hardwares and softwares - analytical and graphics packages - CAD workstations - networking of CAD systems.

(5)

COMPUTER GRAPHICS AND GRAPHICS TRANSFORMATIONS: Generative, cognitive and image processing graphics - static and dynamic data graphics - transport of graphics data - graphic standards - generation of graphic primitives - display and viewing - transformations - customizing graphics softwares. (4)

Unit II

GEOMETRIC MODELING: Wireframe, surface and solid modeling - applications and advantages - creating primitive solids - sweeping solids - boolean operations - sculpting solids - sewing and unsewing solids - extracting entities from a solid - filleting of edges of solids - boundary representations (B-rep) - constructive solid geometry. (5)

PARAMETRIC DESIGN AND OBJECT REPRESENTATION: Types of co-ordinate system - parametric design - definition and advantages - parametric representation of analytic and synthetic curves - parametric representation of surfaces and solids - manipulations. (4)

Unit III

COMPUTER AIDED DRAFTING: Automated 2D drafting - basics, functions, attributes, layers, dimensioning, text styles - dragging and rubber banding - clipping - mechanical assembly - bill of materials generation - mass property calculations. (5)

PRINCIPLES OF FINITE ELEMENT MODELING AND ANALYSIS: General procedure of FEM - discretization - boundary conditions - element types - applications - convergence of finite element results - automatic mesh generation techniques - post-processing of FEA results. (4)

Unit V

MECHANISM ANALYSIS: Creation of kinematic models - imposement of constraints and forces - inertial data - static and dynamic analysis of kinematics systems - analysis of output data - animation - displacement, velocity and acceleration functions. (5)

OPTIMIZATION TECHNIQUES: Optimization - need - objective functions - constraints - mathematical modelling and analysis - finite element modelling and analysis - comparison - static and dynamic analyses. (4)

Total 45

REFERENCES:

Radhakrishnan P and Kothandaraman C P, "Computer Graphics and Design", Dhanpat Rai and Sons, 1997.

Radhakrishnan P and Subramanyan S, “CAD/CAM/CIM”, New Age International (P) Ltd., 1997.
Ibrahim Zeid, "CAD/CAM Theory and Practice", McGraw Hill Inc., 1991.
Vera B Anand, "Computer Graphics and Geometric Modeling for Engineers", John Wiley and Sons Inc., 1993.
Ramamurthi V, “ Computer Aided Mechanical Design & Analysis”, Tata McGraw Hill publishing Co. Ltd.,2000.
William M Newman and Robert Sproul, "Principles of Interactive Computer Graphics", McGraw Hill Inc., 1984.
Mikell P Groover, Emory W.Zimmer,Jr., "CAD/CAM- Computer Aided Design and Manufacturing",
Pearson Education, Inc., 2003

0104 COMPUTER AIDED MANUFACTURING 3 0 0 3

1. INTRODUCTION 5

Objectives of a manufacturing system-identifying business opportunities and problems classification production systems-linking manufacturing strategy and systems analysis of manufacturing operations.

2. GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10

Introduction-part families-parts classification and cooling - group technology machine cells-benefits of group technology. Process planning function CAPP - Computer generated time standards.

3. COMPUTER AIDED PLANNING AND CONTROL 10

Production planning and control-cost planning and control-inventory management-Material requirements planning
(MRP)-shop floor control-Factory data collection system-Automatic identification system-barcode technology- automated data collection system.

4. COMPUTER MONITORING 10

Types of production monitoring systems-structure model of manufacturing process-process control & strategies- direct digital control-supervisory computer control-computer in QC - contact inspection methods non-contact inspection method - computer-aided testing - integration of CAQC with CAD/CAM.

5. INTEGRATED MANUFACTURING SYSTEM 10

Definition - application - features - types of manufacturing systems-machine tools-materials handling system- computer control system - DNC systems manufacturing cell. Flexible manufacturing systems (FMS) - the FMS concept-transfer systems - head changing FMS - variable mission manufacturing system - CAD/CAM system - human labor in the manufacturing system-computer integrated manufacturing system benefits. Rapid prototyping - Artificial Intelligence and Expert system in CIM.

Total No of periods: 45

TEXT BOOKS:

Groover, M.P., "Automation, Production System and CIM", Prentice-Hall of India, 1998.

REFERENCES:

David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi, 1998.
Yorem Koren, "Computer Integrated Manufacturing Systems", McGraw Hill, 1983.
Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International 1986.
R.W. Yeomamas, A. Choudry and P.J.W. Ten Hagen, "Design rules for a CIM system", North Holland Amsterdam, 1985.

0105 AUTOMATED MANUFACTURING **3 1 0 4**

Unit I

COMPUTER NUMERICAL CONTROL

INTRODUCTION AND DESIGN FEATURES OF CNC MACHINES: Working principles of typical CNC lathes, turning centre, machining centre, CNC grinders, CNC gear cutting machines, wire cut EDM, turret punch press, CNC press brakes etc. Selection of CNC machine tools. Structure, drive kinematics, gear box, main drive, feed drive, selection of timing belts and pulleys, spindle bearings arrangement and installation. Re-circulating ball screws, linear motion guide ways, tool magazines, ATC, APC, chip conveyors, tool turrets, pneumatic and hydraulic control systems. (9)

Unit II

CONTROL SYSTEMS AND INTERFACING: Open loop and closed loop systems, microprocessor based CNC systems, block diagram of a typical CNC system, description of hardware and software interpolation systems, standard and optional features of a CNC control system, comparison of different control systems. Feedback devices with a CNC system, spindle encoder. (9)

Unit III

PART PROGRAMMING OF A CNC LATHE: Process planning, tooling, preset and qualified tools, typical tools for turning and machining centres. Axes definition, machine and workpiece datum, turret datum, absolute and incremental programming, tape codes , ISO and EIA codes, G and M functions, tool offset information, soft jaws, tool nose radius compensation, long turning cycle, facing cycle, constant cutting velocity, threading cycle, peck drilling cycle, part programming examples. (4)

MANUAL PART PROGRAMMING OF A MACHINING CENTRE: Co-ordinate systems, cutter diameter compensation, fixed cycles, drilling cycle, tapping cycle, boring cycle, fineboring cycle, back boring cycle, area clearance programs, macros, parametric programming, part programming examples. CAD/CAM based NC programming, features of typical CAM packages. (5)

Unit IV

ROBOTICS

FUNDAMENTAL CONCEPTS OF ROBOTICS: History, present status and future trends, robotics and automation, laws of robotics, robot definition, robotics systems and robot anatomy, specification of robots. Resolution, repeatability and accuracy of a manipulator.

(5)

ROBOT DRIVES: Power transmission systems and control robot drive mechanisms, mechanical transmission method , rotary-to-rotary motion conversion, rotary-to-linear motion conversion end effectors , types , gripping problem , remote-centered compliance devices , control of actuators in robotic mechanisms. Sensors for robotic applications.

(4)

Unit V

TRANSFORMATIONS AND KINEMATICS: Homogeneous co-ordinates, co-ordinate reference frames, homogeneous transformations for the manipulator, the forward and inverse problem of manipulator kinematics, motion generation, manipulator dynamics, Jacobian in terms of D.H.matrices controller architecture. Robot programming. (9)

Total 45

REFERENCES:

1. Radhakrishnan P, “Computer Numerical Control (CNC) Machines”, New Central Book Agency, 1992.
2. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotic Engineering , An Integrated Approach", Eastern Economy Edition Prentice Hall Pvt. Ltd., 1989.
3. Mikell P Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, “Industrial Robotics”, McGraw Hill Book Co, NY, 1986.
4. Yoram Koren, “Computer Control of Manufacturing Systems”, McGraw Hill Book Co, 1986.
5. Programming Instruction Manuals of CNC Lathes and Machining Centres, 2001.
6. Shuman Y.Nof, "Handbook of Industrial Robotics", John Wiley and Sons, New York, 1985.

MANAGERIAL ACCOUNTING AND FINANCE

3 0 0 100

FINANCIAL MANAGEMENT: Evolution, scope, objectives, functions, environment of corporate finance, Indian Financial system, Reserve Bank of India, Financial institutions, Financial markets, Merchant Banking Financial Services. (4)

SOURCES OF FINANCE: Long term - Retained earnings, equity, debenture, term loans, deferred credit, leasing, hire purchase; Short term - Accruals, trade-credit, short term bank finance, public deposit, commercial paper; Cost of capital, Leverage. (5)

CAPITAL BUDGETING : Process - cost/benefits, Investment appraisal criteria, time value of money, net present value, internal rate of return, profitability index, pay-back period, accounting rate of return, cash flows. (4)

WORKING CAPITAL MANAGEMENT : Overall considerations, influencing factors, working capital policy; Operating cycle analysis - procedure, problems; Cash management; Credit management - terms, credit-policy, credit-evaluation, control of accounts, receivable; Inventory Management - need, order quantity/point, pricing of raw material and valuation, monitoring and control of inventories.

(7)

CAPITAL STRUCTURE : Net income approach, Net operating income approach, Traditional position, Modigliani and Miller position; Planning the capital structure, EBIT - EPS analysis, ROI – ROE analysis, Assessment of dept capacity; (3)

BUDGETING AND BUDGETARY CONTROL - Budget - meaning, purpose, types of budgets- sales, production, purchasing, labou, cash; Flexible budgets. (3)

COST ACCOUNTING AND CONTROL : Nature - Historical and future costs; Cost classification - labour, material, overhead;, cost ladder, cost allocation, overhead absorption methods - DL, DM, number of pieces, LHR, MHR, Activity Based Costing; Accounting for service department expenses; Variance analysis for cost control - labour, material, overhead, variances, various types, illustrative problems. (8)

FINANCIAL STATEMENTS AND ANALYSIS: Double entry book keeping, journal, subsidiary books, bank reconciliation statement, ledger, trial balance, trading, profit and loss account, balance sheet; Financial statement analysis, types of financial ratios - liquidity, leverage, profitability, valuation ratios, time series analysis, common size analysis, Du-pont analysis. (8)

Total 42

TEXT BOOK:

1. Prasanna Chandra, "Fundamentals of Financial Management", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004.
2. Pandey I M “Management Accounitng”, Vikas Publishing House, 2000.

REFERENCES:

1. Pandey I M, "Financial Management ", Tata McGraw Hill, 2003.
2. Van Horne, “Financial Management”, McGraw Hill, 2002.
3. Ramachandra Aryasri A, Ramana Murthy V V, “Engineering Economics and Financial Management”, Tata McGraw Hill, New Delhi, 2004.

CIM Lab I 4 0 0 4

List of Experiments:

1) CAD Modeling and part program preparation using a CAD/CAM Software for turned and milled component.
2) Machining the products using the above part programs using CNC Lathe and machining centres
3) DNC Programming
4) Robot programming

Total No of periods: 60

Equipments required

Trainer Flexible Manufacturing System (FMS) with the following:

1) CNC Lathe
2) CNC Machining centre
3) Automatic conveyor
4) Robot for loading/unloading
5) CAD/CAM/DNC/CIM Softwares
6) Robot simulation softwares

0201 **METROLOGY AND COMPUTER AIDED INSPECTION 3 0 0 3**

Unit I
THE INTERNATIONAL STANDARD OF LENGTH AND LASER METROLOGY 9

Units of length – legal basis for length measurement – Traceability – Characteristics LASER light source – LASER interferometer – LASER alignment telescope – LASER micrometer – on-line and in-process measurements of diameter and surface roughness using LASER – Microholes and surface topography measurements – Straightness and flatness measurement.

Unit II
CO-ORDINATE MEASURING MACHINES 9

Evolution of measurement – coordinate measuring machines – Non Cartesian CMMS – Accessory elements – Application software – Performance evaluations – Temperature fundamentals – Environmental Control – Accuracy enhancement – Applications – Measurement integration.

Unit III
OPTO ELECTRONIC MEASURING SYSTEMS AND DEVELOPMENT IN METROLOGY 9

Opto electronic devices contact and non contact types – Applications in on-line and in-process monitoring systems – Tool wear measurement – Manufacturing metrology – 3D surface roughness – Pattern generation studies – Roundness measurement using LASER.

Unit IV
IMAGE PROCESSING AND ITS APPLICATION IN METROLOGY 9

Shape identification – Edge detection techniques – Normalization – Grey scale correlation – Template techniques – Surface roughness using vision system – Interfacing robot and image processing system – Measurement of length and diameters.

Unit V
COMPUTER INTEGRATED QUALITY ASSURANCE 9

Total quality control – Quality assurance Zero defects – POKE – YOKE Statistical evaluation of data using computer – data integration of CMM and Computers lagging in computers – TQM.

TOTAL = 45

REFERENCES:

WATSON.J., - Optoelectronics – Van Nostrand Reinhold (UK) Co Ltd., 1988.

ROBERT.G. SEIPPEL, - Optoelectronics for technology and Engineering, Prentice Hall New Jersey, 1989.
ULRICH-REMBOLD, ARMBRUSTER and ULZMANN – Interface technology for computer controlled manufacturing processes, Marcel Dekker, Pub New York, 1993.
International Journals on CIRP.
THOMAS G.G. -Engineering Metrology, Butterworh Pub. 1974.
TAGUCHI.G & SYED.L. Etal. Quality Engg in Production systems, McGraw Hill, 1980.
JOHN BANK, Essence of TQM, Prentice Hall of India Pvt Ltd., 1990.

0202 SENSORS FOR INTELLIGENT MANUFACTURING 4 0 0 4

Unit I

Science of Measurement (9)

Units and Standards – Calibration techniques – Classification of errors – Errors analysis – Statistical methods – Odds and uncertainty – static and dynamic characteristics of transducers – Response of transducers to different time varying inputs.

Unit II

Sensors & Transducers for measurements (9)

Classification of transducers – Direct digital transducers – Absolute and incremental transducers – Transducer with frequency output – potentiometer – Strain gauge- LVDT & RVDT – RTD – IC sensors – Thermistor – Thermocouples – Variable reluctance transducer – Capacitive transducer – Optoelectronic transducers – Piezo electric transducer – Fibre Optic transducer – Magnetostrictive transducer – Hall effect – Load Cells – Manufacturing of Semiconductor transducer.

Unit III

Signal Conditioning Methods (9)

Need for Signal Conditioning – Modulated and Unmodulated Signals – Resistance and Resistance Bridges – Amplification – Differentiation and Integration – Shielding and Grounding – Filters.

Unit IV

Mechanical Measurements (9)

Measurement of Mechanical Quantities – Force, Torque, Temperature, Flow, Pressure, Liquid level, Vibration and Displacement.

Unit V

Application in Manufacturing Automation (9)

Specific Case Studies related to Manufacturing Process and Automation – Automatic Gauging – CNC Machines and Robotics – Condition Monitoring – Lubrication systems and Tool Wear.

Total: 45 Hours

Text Books:

A.K. Sawhney, “A Course in Electrical and Electronic Measurements and Instrumentation”, Dhanpat Rai & Co., 2000.

S.Renganathan, “Transducers Engineering”, Allied Publishers Limited, 1999.

Reference Books:

E.O. Doeblin, “Measurement Systems, Application and Design” McGraw Hill, 4th Edition, 1990.
Beckwith, Marangoni & Lienhard, “Mechanical Measurements”, Addison – Wesley, 5th Edition, 2000.
C.S. Rangan, G.R.Sarma & V.S.V.Mani, “Instrumentation Devices and Systems”, TMH Publishing & Co. Ltd., 1990.
D.V.S. Murthy, “Transducers and Instrumentation”, Prentice Hall of India Pvt. Ltd

PRODUCTION AND OPERATIONS MANAGEMENT 3 1 0 4

UNIT I

INTRODUCTION: Scope of operations management, strategy and productivity, productivity tools. Forecasting - introduction, measures of forecast. Accuracy, forecasting methods - time series smoothing - regression models - exponential smoothing - seasonal forecasting - cyclic forecasting. Introduction to auto-regression models for forecasting. (9)

UNIT II

LONG TERM PLANNING: Product design. Capacity planning. Facility location – factors, location evaluation methods. Process selection and facility layout – Types of layouts for operations and production. Arrangement of facilities within departments. Flexible manufacturing system - concepts - advantages and limitation.

(9)

UNIT III

PRODUCTION PLANNING AND CONTROL: Aggregate planning – approaches, graphical, empirical, and optimization. Development of a master production schedule, materials requirement planning (MRP- I), manufacturing resource planning (MRP -II), and ERP.

(4)

INVENTORY ANALYSIS AND CONTROL: Definitions - ABC inventory system - EOQ models for purchased parts - inventory order policies - EMQ models for manufactured parts - lot sizing techniques. Inventory models under uncertainty.

(5)

UNIT IV

SCHEDULING AND CONTROLLING: Objectives in scheduling - major steps involved - information system linkages in production planning and control - production control in repetitive, batch and job shop manufacturing environment. Scheduling with resource constraints – allocation of units for a single resource - allocation of multiple resources - resource balancing. Line balancing - Helgeson Brine approach - Region approach. Stochastic mixed - product line balancing.

(9)

UNIT V

JUST IN TIME MANUFACTURING: Introduction - elements of JIT - uniform production rate - pull versus push method- Kanban system - small lot size - quick, inexpensive set-up - continuous improvement. Optimised production technology.

(5)

PROJECT PLANNING: Evolution of network planning techniques - critical path method (CPM) - project evaluation and review technique (PERT). Network stochastic consideration. Project monitoring. Line of balance.

(5)

Total 45

REFERENCES:

Richard B Chase, Robert Jacobs F and Nicholas J Aquilano, "Operations Management for Competitive Advantage", McGraw-Hill/Irwin; Tenth Edition, 2003.

Gaither N, "Production and Operations Management: Problems Solving And Decision", Dryden Press; Fourth Edition, 1990.

Dilworth B James, "Operations Management Design, Planning and Control for Manufacturing and Services", McGraw Hill, Inc, New Delhi, 1992.

Bedworth D D, "Integrated Production Control Systems Management, Analysis, Design", John Wiley and Sons, New York, 1982.

Vollman T E, "Manufacturing Planning and Control Systems", Galgotia Publication (P) Ltd., New Delhi, 1998.

CIM Lab II 4 0 0 4

List of Experiments:

1) Simulation of CMS/FMS/CIM
2) Programming for automated inspection
3) Programming exercises for CMS/FMS
4) Programming for tool retrieval
5) Programming for automatic data collection

Equipments required:

1) In addition to the FMS and CIM Softwares, the following items are required:

i) Trainer - Coordinate Measuring Machine (CMM)
ii) Automated tool storage - Trainer
iii) Automatic data collection - Trainer

E00 NANOTECHNOLOGY 4 0 0 4

Unit I

1. INTRODUCTION TO NANOMATERIALS 9

Amorphous, Crystalline, microcrystalline, quasicrystalline and nanocrystalline materials-historical sevelopment of nano materials-problems in fabrication and characterization of nano materials.

Unit II

2. PRODUCTION OF NANOMATERIALS 09

Methods of production of nanomaterials, Sol-gel synthesis, Inert gas condensation, Mechanical alloying or high-energy ball milling, Plasma synthesis, and Electrodeposition.

Unit III

3. APPLICATION OF NANO MATERIALS 09

Applications in Electronics, Chemical, Mechanical engineering industries-Use of nanomaterials in automobiles, aerospace, defence and medical applications – Metallic, polymeric, organic and ceramic nanomaterials.

Unit IV **09**

4. NANOFABRICATION AND MACHINING

LIGA, Ion Beam Etching, Molecular Manufacturing Techniques - Nano Machining Techniques, Top/ Bottom up Nano fabrication Techniques, Quantum Materials.

Unit V

5. INSPECTION OF NANOMATERIALS 09

Scanning Probe Microscopy (SPM)- Contact Mode, Tapping Mode, Scanning Tunnelling Mode (STM). Advanced Scanning Probe Microscopy – Electrostatic force Mode (EFM)-Magnetic Force Mode (MFM)- Scanning Thermal Mode (SthM), Piezo Force Mode (PFM). Scanning Capacitance Mode (SCM), Nanoidentation.

Total No of periods: 45

REFERENCES:

Tlusty J, “Machining Processes and Equipment”, 2nd Edn, Prentice Hall, 2000
Mark Ratner and Daniel Ratner, “Nano Technology”, Pearson Education, New Delhi, 2003.
Timp Gregory, Nano Technology, Springer Verlog, 2005
Booker Richard, Boysen Earl, Nano Technology, John Wiley & Sons, 2005
Sylvin Morris, Nano Technology, Sarup & Sons, 2006

E01 NETWORKS AND DISTRIBUTED SYSTEMS 3 0 0 3

1. NETWORK FUNDAMENTALS 09

Introduction to networks, definition of layers, services, interfaces and Protocols, communication themes, switching techniques-Circuit switched, Package-switched and message switched networks-Reference Models, (OSI, TCP/IP, ATM)-layers and duties comparison of models.

2. ARCHITECTURAL PROTOCOLS AND STANDARDS 09

Physical layer-General description, characteristics, signalling limits, media types and comparison, topologies, examples of physical layer (RS232-C, ISDN, ATM, SONNET). Data link layer-sliding window protocols, A104A protocols, LAN protocols-performance, specification and verification IEEE-standards.

3. NETWORK INTERCONNECTION 09

Internet working-inter connection issues, bridges-Transparent & source routing bridges, routers, flow and congestion command algorithms, gateways-Network security internet protocols.

4. DISTRIBUTED SYSTEMS 09

Models, Hardware concepts, communication, synchronisation, Mechanism, Case study (MPI & PVM).

5. DISTRIBUTED FILE SYSTEM 09

Design, implementation and Trends of distributed file systems.

TOTAL = 45

REFERENCES:

STALLINGS.W., Data and Computer Communications, IV edition, Prentice Hall of India, 1996.
TANENBAUM,A.S., Computer Networks, Prentice Hall of India, III edition, 1993
KEISER, Local Area Network, Tata McGraw Hill, 1997.
KESHAV.S., An Engineering Approach to Computer Networking, Addison - Wesley, 1999
STEVENS.R.W.-TCP/IP illustrated(volume 1) The protocols, Addison - Wesley, 1999
COMERD.E.- Internetworking with TCP/IP (VOLUME 1), Principles, protocols and architecture, III Edition, Prentice hall of India, 1999.
FORAUZAN,B-Introduction to Data Communication & Networking McGraw Hill, 1998.

E02 FLEXIBLE MANUFACTURING SYSTEMS 3 0 0 3

Unit I

INTRODUCTION: Definition of an FMS - types and configurations concepts - types of flexibility and performance measures. Functions of FMS host computer - FMS host and area controller function distribution. (9)

Unit II

DEVELOPMENT AND IMPLEMENTATION OF AN FMS: Planning phases - integration - system configuration - FMS layouts - simulation - FMS project development steps. Project management - equipment development - host system development - planning - hardware and software development. (9)

Unit III

AUTOMATED MATERIAL HANDLING AND STORAGE: Functions - types - analysis of material handling equipments. Design of conveyor and AGV systems, storage system performance - AS/RS - carousel storage system - WIP storage system - interfacing handling storage with manufacturing. (5)

MODELLING AND ANALYSIS OF FMS: Types of analysis: queuing- single server, multiple servers, queue disciplines, markovian queing models. Simulation and petrinet modelling techniques. (4)

Unit IV

DISTRIBUTED NUMERICAL CONTROL AND PROGRAMMABLE CONTROLLERS: DNC system - communication between DNC computer and machine control unit - hierarchical processing of data in DNC system - features of DNC systems, PLC - control system architecture - elements of programmable controllers: languages, control system flowchart, comparison of programming methods.

(5)

PROCESS PLANNING: Approaches to process planning, study of a typical process planning, manufacturing planning and control, overview of production control.

(4)

Unit V

RECONFIGURABLE MACHINES AND SYSTEMS: Challenges, enabling technologies for reconfiguration– system level design issues in RMS – reconfigurable machines. (5)

FMS RELATIONALE: Economic and technological justification for FMS – JIT, KANBAN, Poke Yoka. Tool management of FMS, typical case studies - future prospects.

(4)

Total 45

REFERENCES:

Parrish D J, “Flexible Manufacturing”, Butter Worth Heinemann Ltd, Oxford, 1993.
Groover M P, “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall India (P) Ltd, 1989.
Tien-Chien chang, Richard A Wysk, “An Introduction to Automated Process Planning Systems”, Prentice Hall, Inc., Englewood cliffs, New Jersey, 1985
Considine D M and Considine G D, “Standard Handbook of Industrial Automation”, Chapman and Hall, London, 1986.
Viswanadham N and Narahari Y, “Performance Modeling of Automated Manufacturing Systems”, Prentice Hall India (P) Ltd, 1992.
Ranky P G, “The Design and Operation of FMS”, IFS Pub. UK, 1988.

E03 QUALITY ENGINEERING

3 1 0 4

Unit I

CONCEPT OF QUALITY ENGINEERING: Quality value and engineering- overall quality system-quality engineering in product design - quality engineering in design of production processes - quality engineering in production - quality engineering in service. (9)

Unit II

LOSS FUNCTION: Derivation –use-loss function for products/system- justification of improvements- loss function and inspection- quality evaluations and tolerances-N type, S type, L type. (4)

ON-LINE QUALITY CONTROL: On-line feedback quality control variable characteristics-control with measurement interval- one unit, multiple units-control systems for lot and batch production. On-line process parameter control variable characteristics- process parameter tolerances- feedback control systems- measurement error and process control parameters. (5)

Unit III

ON-LINE QUALITY CONTROL ATTRIBUTES CHARACTERISTS: Checking intervals- frequency of process diagnosis. (5)

ON-LINE QUALITY CONTROL METHODS FOR PROCESS IMPROVEMENTS: Production process improvement method- process diagnosis improvement method- process adjustment and recovery improvement methods. (4)

Unit IV

QUALITY ENGINEERING AND TPM: Preventive maintenance schedules- PM schedules for functional characteristics- PM schedules for large scale systems. Quality tools–fault tree analysis, event tree analysis, failure mode and effect analysis. ISO quality systems. (9)

Unit V

SIX SIGMA: Introduction- definition-methodology- impact of implementation of six sigma-DMAIC method-roles and responsibilities –leaders, champion, black belt, green belts. (5)

IMPLEMENTATION OF SIX SIGMA: Do's and dont's- readiness of organization – planning- management role- six sigma tools – sustaining six sigma. (4)

Total 45

REFERENCES:

De Feo J A and Barnard W W, "Six Sigma: Breaktrough and Beyond", Tata McGraw-Hill, New Delhi, 2005.

Taguchi G, Elsayed E A and Hsiang, T.C.,"Quality Engineering in Production Systems"", Mc-Graw-Hill Book company, Singapore, International Edition, 1989

3. Pyzdek T and Berger R W,"Quality Engineering Handbook", Tata-McGraw Hill, New Delhi, 1996

4. Brue G, "Six Sigma for Managers", Tata-McGraw Hill, New Delhi, Second reprint, 2002.

E04 PRODUCT DATA MANAGEMENT 3 0 0 3

Unit I 9

INTRODUCTION: Introduction to PDM- present market constraints- need for collaboration – internet and developments in server- client computing.

COMPONENTS OF PDM: Components of a typical PDM setup-hardware and software-document management – creation and viewing of documents- creating parts- version and version control of parts and documents- case studies.

Unit II 9

CONFIGURATION MANAGEMENT: Base line- product structure- configuration management- case studies.

Unit III 9

PROJECTS AND ROLES: Creation of projects and roles- life cycle of project- life cycle management- automation information flow- work flows- creation of work flow templates-life cycle- work flow integration and case studies.

Unit IV 9

CHANGE MANAGEMENTS: Change issue- change request-change investigation-change proposal- change activity-case studies.

Unit V 9

GENERIC PRODUCTS AND VARIANTS: product configuration –comparison between sales configuration and product configuration – generic product modeling in configuration modeler- use of order generator for variant creation- registering of variants in product register-case studies.

Total : 45

REFERENCES:

1. David Bedworth. Mark Henderson & Philip Wolfe," Computer Integrated Design And Manufacturing" McGraw hill inc..1991.
2. Terry Quatrain," Visual Modeling with Rational Rose and UML", Addison Wesley, 1998
3. Wind-chill R5.0 Reference manuals, 2000.

E05 LEAN MANUFACTURING TOOLS **3 1 0 4**

Unit I

INTRODUCTION TO LEAN MANUFACTURING: Objectives of lean manufacturing-key principles and implications of lean manufacturing- traditional Vs lean manufacturing. (4)

LEAN MANUFACTURING CONCEPTS: Value creation and waste elimination- main kinds of waste- pull production-different models of pull production-continuous flow-continuous improvement / Kaizen- Worker involvement -cellular layout- administrative lean. (5)

Unit II

LEAN MANUFACTURING TOOLS & METHODOLOGIES: Standard work - communication of standard work to employees -standard work and flexibility -visual controls-quality at the source- 5S principles -preventative maintenance-total quality management-total productive maintenance -changeover/setup time -batch size reduction - production leveling. (9)

Unit III

VALUE STREAM MAPPING: The as-is diagram-the future state map-application to the factory simulation scenario-line balancing -poke yoka-Kanban – overall equipment effectiveness. (9)

Unit IV

JUST IN TIME MANUFACTURING: Introduction - elements of JIT - uniform production rate - pull versus push method- Kanban system - small lot size - quick, inexpensive set-up - continuous improvement. Optimised production technology. (9)

UNIT V

ONE-PIECE FLOW: Process razing techniques – Cells for assembly line – Case studies.

IMPLEMENTING LEAN: Road map-senior management Involvement-best practices.

RECONCILING LEAN WITH OTHER SYSTEMS: Toyota production system-lean six sigma-lean and ERP-lean with ISO9001: 2000 (9)

Total 45

REFERENCES:

Askin R G and Goldberg J B, “Design and Analysis of Lean Production Systems”, John Wiley and Sons Inc., 2003.

Michael L George, David T Rowlands, Bill Kastle, “What is Lean Six Sigma”, McGraw-Hill, New York, 2004.

Micheal Wader, “Lean Tools: A Pocket Guide to Implementing Lean Practices”, Productivity and Quality Publishing Pvt Ltd, 2002.

Kenichi Sekine, “One-piece flow”, Productivity Press, Portland, Oregon, 1992

Alan Robinson “Continuous Improvement in Operations”, Productivity Press, Portland, Oregon, 1991.

Richard B Chase F. Robert Jacobs and Nicholas J Aquilano, “Operations Management for Competitive Advantage”, McGraw-Hill/Irwin; Tenth Edition, 2003.

E06 MECHATRONICS **3 0 0 3**

1. INTRODUCTION **9**

Introduction to Mechatronics - Systems - Mechatronics in Products - Measurement Systems - Control Systems - Traditional design and Mechatronics Design.

2. SENSORS AND TRANSDUCERS **9**

Introduction - Performance Terminology - Displacement, Position and Proximity - Velocity and Motion - Fluid pressure - Temperature sensors - Light sensors - Selection of sensors - Signal processing - Servo systems.

3. MICROPROCESSORS IN MECHATRONICS **9**

Introduction - Architecture - Pin configuration - Instruction set - Programming of Microprocessors using 8085 instructions - Interfacing input and output devices - Interfacing D/A converters and A/D converters –Applications - Temperature control - Stepper motor control - Traffic light controller.

4. PROGRAMMABLE LOGIC CONTROLLERS **9**

Introduction - Basic structure - Input / Output processing - Programming -Mnemonics Timers, Internal relays and counters - Data handling - Analog input / output - Selection of PLC.

5. DESIGN AND MECHATRONICS **9**

Designing - Possible design solutions - Case studies of Mechatronics systems.

Total: 45

TEXT BOOKS

Michael B.Histand and David G. Alciatore, " Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 1999.

Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ, "Mechatronics ", Chapman and Hall, 1993.

Ramesh.S, Gaonkar, "Microprocessor Architecture, Programming and Applications" Wiley Eastern, 1998.

Lawrence J.Kamm, " Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics ", Prentice-Hall, 2000.

Ghosh, P.K. and Sridhar, P.R., 0000 to 8085, " Introduction to Microprocessors for Engineers and Scientists ", Second Edition, Prentice Hall, 1995.

WEB REFERENCE:

1. www.cs.Indiana.edu.

E07 IMAGE PROCESSING IN MANUFACTURING 3 0 0 3

Unit I
INTRODUCTION 9

Image representation and nomenclature – Relationship of image processing and computer vision – Digital image fundamentals – Geometrical model for imaging and applications – imaging requirements

Unit II
IMAGE PROCESSING FUNDAMENTALS 9

Image transformers – Sampling – Enhancement – Restoration and conversions – Segmentation – Thresholding representation and description

Unit III
IMAGE ANALYSIS 9

Processing binary images – Image measurements – Multi level image analysis – Higher dimensional Modeling – Image based knowledge manipulation

Unit IV
PRACTICAL IMAGE PROCESSING 9

2D/3D Image acquisition – 3D image visualisation – Imaging surfaces – Image processing system components

Unit V
APPLICATION IN MANUFACTURING 9

Study of surface finish – Sorting and counting of objects – Tool wear measurement, measurement technique – Robot applicationS

TOTAL = 45

REFERENCES:

The Image processing Hand Book, III Edition, John C Russ, CRC Press / IEEE Press, 2000
Digital Image Processing and computer Vision – Robert J Schalkoff, John Wiley & Sons Inc, 1998
Digital Image Processing, Rafael C, Gon Zalez & Richard E Woods, Addison Wesley Publishing, 1993
Introduction to Machine Vision, Ramesh C John, 1995, Tata McGraw Hill

E08 DESIGN FOR MANUFACTURE AND ASSEMBLY 3 0 0 3

1. INTRODUCTION 5

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances - Geometric tolerances - Assembly limits -Datum features - Tolerance stacks.

2. FACTORS INFLUENCING FORM DESIGN 13

Working principle, Material, Manufacture, Design- Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.

3. COMPONENT DESIGN - MACHINING CONSIDERATION 8

Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly.

4. COMPONENT DESIGN - CASTING CONSIDERATION 10

Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

5. DESIGN FOR THE ENVIRONMENT 9

Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment - Weighted sum assessment method – Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for recyclability – Design for remanufacture – Design for energy efficiency – Design to regulations and standards.

Total 45

REFERENCES:

1. Boothroyd, G, 1980 Design for Assembly Automation and Product Design. New York, Marcel Dekker.
2. Bralla, Design for Manufacture handbook, McGraw hill, 1999.
3. Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994.
4. Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA, 1995.
5. Fixel, J. Design for the Environment McGraw hill., 1996.
6. Graedel T. Allen By. B, Design for the Environment Angle Wood Cliff, Prentice Hall. Reason Pub., 1996.
7. Kevien Otto and Kristin Wood, Product Design. Pearson Publication, 2004.

WEBSITE

1. www.ulrich – Epingar. Net
2. www.dfma.com

E09 RAPID PROTOTYPING, TOOLING AND MANUFACTURING 3 0 0 3

UNIT - I **7**

Introduction : Need for time compression in product development, Product development – conceptual design – development – detail design – prototype – tooling.

UNIT – II **9**

Classification of RP systems, Stereo lithography systems – Principle – process parameters – process details – machine details, Applications.
Direct Metal Laser Sintering (DMLS) system – Principle – process parameters – process details – machine details, Applications.

UNIT -III 9

Fusion Deposition Modeling – Principle – process parameters – process details – machine details, Applications.
Laminated Object Manufacturing – Principle – process parameters – process details – machine details, Applications.

UNIT - IV **10**

Solid Ground Curing – Principle – process parameters – process details – machine details, Applications. 3-Dimensional printers – Principle – process parameters – process details – machine details, Applications, and other concept modelers like thermo jet printers, Sander's model maker, JP system 5, Object Quadra system.

UNIT – V **10**

Laser Engineering Net Shaping (LENS), Ballistic Particle Manufacturing (BPM) – Principle. Introduction to rapid tooling – direct and indirect method, software for RP – STL files, Magics, Mimics. Application of Rapid prototyping in Medical field.

Total : 45

TEXT BOOK:

1. Pham,D.T. & Dimov.S.S., Rapid manufacturing, Springer-Verlag, London, 2001.

REFERENCE:

1. Terry wohlers, Wohlers Report 2000, Wohlers Associates, USA, 2000.

OCCUPATIONAL SAFETY AND HEALTH ENGINEERING

3 0 0 100

PHYSICAL HAZARDS

Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments, octave band analyzer, noise networks, noise surveys, noise control program, industrial audiometry, hearing conservation programs- vibration, types, effects, instruments, surveying procedure, permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, OSHA standard- non-ionizing radiations, effects, types, radar hazards, microwaves and radio-waves, lasers, TLV- cold environments, hypothermia, wind chill index, control measures- hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control **8**

CHEMICAL HAZARDS

Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, TLV - Methods of Evaluation, process or operation description, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard. Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling. Methods of Control - Engineering Control, Design maintenance considerations, design specifications - General Control Methods - training and education **9**

BIOLOGICAL AND ERGONOMICAL HAZARDS

Classification of Biohazardous agents – examples, bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases - Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design. Work Related Musculoskeltal Disorders –carpal tunnel syndrome CTS- Tendon pain-disorders of the neck- back injuries. **9**

OCCUPATIONAL HEALTH AND TOXICOLOGY

Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax, lead-nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests. Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems **9**

OCCUPATIONAL PHYSIOLOGY

Man as a system component – allocation of functions – efficiency – occupational work capacity – aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – categorization of job heaviness – work organization – stress – strain – fatigue – rest pauses – shift work – personal hygiene. **7**

Total 42

TEXT BOOK

1. Hand book of “Occupational Safety and Health”, National Safety Council, Chicago, 1982

REFERENCE

1. Encyclopedia of “Occupational Health and Safety”, Vol.I and II, published by International Labour Office, Geneva, 1985

E10 CONCURRENT ENGINEERING 3 0 0 3

UNIT I

CONCURRENT ENGINEERING: Introduction - basic concepts - traditional Vs concurrent approach - schemes and tools of concurrent engineering - application of computers in the practice of concurrent engineering. (9)

UNIT II

BASIC PROCESS ISSUES: Process models - types - importance. Relation between models, specifications, technology, automation and process improvement. Fabrication processes - assembly processes - models of manufacturing, testing and inspection. (9)

UNIT III

CONCURRENT ENGINEERING APPROACH IN MANUFACTURING SYSTEMS: System design procedure - features - intangibles - assembly resource alternatives - task assignment - tools and tool changing - material handling alternatives. (9)

UNIT IV

CONCURRENT AUTOMATED FABRICATION SYSTEMS: Introduction - methodology - preliminary and detailed work content analysis - alternatives - human resource considerations. "Technical - Economic" performance evaluation - concurrent assembly work station - strategic issues - technical issues - economic analysis. (9)

UNIT V

ECONOMIC ANALYSIS OF SYSTEMS: Types of manufacturing cost - pro-forma, cash-flow, determining allowable investment - evaluation of investment alternatives - sensitivity analysis - effect of recycling and rework. (6)

CASE STUDIES OF CONCURRENT ENGINEERING PRACTICE: Automobile air-conditioning module - robot assembly of automobile rear-axles. (3)

Total 45

REFERENCES:

1. James L Nevins and Daniel E Whitney, "Concurrent Design of Products and Processes", McGraw Hill Publishing Company, 1989.
2. David D Bedworth, Mark R Handerson and Philip M Wilze, "Computer Integrated Design and Manufacturing", McGraw Hill International Edition, 1991.
3. Proceedings of the "Summer School on Applications of Concurrent Engineering to Product Development" held at PSG College of Technology, May 1994.

E11 MANAGEMENT INFORMATION SYSTEMS 3 0 0 3

UNIT I

INTRODUCTION: Definitions **–** management information system, elements of management information system – information –data, **i**nformation, knowledge, quality and value of information (4)

DECISION MAKING PROCESS: Programmed versus non programmed decisions, behavioral model of organizational decision making, decision- making concepts for information system design – human information processing – limits, human cognition and learning.

(5)

UNIT II

ORGANIZATIONAL SYSTEMS AND MANAGEMENT: System – definition, types, subsystems, system concepts and organizations – organizational structures, information processing model of organization structure, MIS and formal organizational structure – organizational planning –goals and objectives, hierarchy of planning, computational support for planning, Control process, nature of control in organizations, information systems support for control. (6)

INFORMATION TECHNOLOGY: Introduction – hardware – data management architecture – software – telecommunications and networks – the internet and internet-related technologies – trends in information technology.

(3)

UNIT III

INFORMATION SYSTEMS DEVELOPMENT: Introduction – system planning – system analysis – system design – system implementation – system support - alternative methods of system development – information systems management – strategic approaches to IS management – introduction to operational issues of IS management.

(9)

UNIT IV

INFORMATION SYSTEMS: Introduction – office systems and knowledge work systems – basic data-gathering systems – management information systems – decision support systems – expert systems – geographic Information systems – executive information systems – information system trends.

(9)

UNIT V

MANUFACTURING INFORMATION SYSTEM: Product data management :- ERP-introduction, architecture, application, case studies.

(4)

QUALITY ASSURANCE, SECURITY AND ETHICS: Concepts of quality in information systems – quality assurance for applications – quality assurance with user-developed systems – computer crime – computer security – information system ethics.

(5)

Total 45

REFERENCES:

Jessup L and Valacich J, “Information Systems Today”, Prentice Hall of India Pvt Ltd, 2003.

Murdick R G, Ross J E and Claggett J R, “Information Systems for Modern Management”, Prentice Hall of India Private Ltd., India, Third Edition, 1992.

Henry C Lucas Jr., “The Analysis, Design and Implementation of Information Systems”, McGraw Hill Company, New York, Fourth Edition, 1992.

Burch J E, Strater F R and Grudnikski G, “Information Systems: Theory and Practice”, John Wiley and Sons, New York, 1987.

Leon Alexis, “Enterprise Resource Planning”, Tata McGraw Hill Company, New Delhi, 1999.

Kenneth C Laudon, Jane P Laudon, “Management Information Systems”, Prentice Hall Inc., 1999.

Ivica Crnkovic, Aunita Persson Dahlquist and Ulf Asklund, “Implementing and Integrating Product Data Management and Software Configuration Management”, Artech House, 2003.

E12 ENGINEERING OPTIMIZATION - THEORY AND APPLICATIONS

3

2 0 4

UNIT I

NONLINEAR OPTIMIZATION: Introduction, unconstrained optimization, one-dimensional optimization, elimination methods, fibonacci method, golden section methods, interpolation methods, quadratic, cubic interpolations, direct root methods, multivariable optimization**,** direct search methods, pattern search methods, univariate method, Hooks and Jeeves method, Powel's method, Simplex method, descent methods, steepest descent, conjugate gradient, Newton methods.

(9)

UNIT II

CONSTRAINED NONLINEAR OPTIMIZATION: Direct methods, the complex method, cutting plane method, Indirect methods, transformation techniques, interior and exterior penalty function methods, Khun-Tucker conditions, Lagrangian method.

(9)

UNIT III

INTEGER AND DYNAMIC PROGRAMMING: Introduction to Integer Programming – Solution Techniques , Graphical method, the branch and bound technique, Gomary's cutting plane method, Examples on the application in manufacturing / design systems – Introduction to Dynamic Programming , Bellman's principle of optimality, examples on the application on routing problem, inventory problem, marketing problem (9)

UNIT IV

NETWORK OPTIMIZATION MODELS: Terminology of Networks – the shortest route problem – the minimum spanning tree problem – the maximum flow problem – the minimum cost flow problem – the network simplex method. (5)

NON TRADITIONAL OPTIMIZATION – I: Introduction to non,traditional optimization, Computational Complexity – NP,Hard, NP,Complete, No free lunch theorem – Working principles of Simulated Annealing, Tabu Search, and Neural Networks, Simple applications.

UNIT V

NON TRADITIONAL OPTIMIZATION – II : Introduction to Genetic Algorithms, Ant Colony Algorithm, Particle Swarm Algorithm, Hybrid Algorithms, Simple Applications. (9)

Total 45

REFERENCES:

Singiresu S Rao, "Engineering Optimization: Theory and Practice", Wiley,Interscience, 3rd Edition, 1996.

Kalyanmoy Deb, " Optimization for engineering design", Prentice Hall India (Pvt) Ltd., New Delhi, 2000.

R.Saravanan, "Manufacturing optimization through intelligent techniques", Taylor and Francis Publications, CRC Press, 2006.

David E Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison, Wesley Pub Co., 1989.

Fred Glover, Manuel Laguna, and Fred Laguna, "Tabu Search", Kluwer Academic Publishers, 1997.

Cihan H Dagli**,** "Artificial Neural Networks for Intelligent Manufacturing", Chapman and Hall, London, 1994

E13 FINITE ELEMENT ANALYSIS **3 1 0 4**

1. INTRODUCTION **9**

Relevance of finite element analysis in design – Modeling and discretization Interpolation, elements, nodes and degrees-of-freedom-applications of FEA

One-Dimensional Elements and Computational Procedures: Bar element – beam element – bar and beam elements of arbitrary orientation – assembly of elements – properties of stiffness matrices-boundary conditions-solution of equations-mechanical loads and stresses-thermal loads and stresses-example problems.

2. BASIC ELEMENTS **9**

Interpolation and shape functions - element matrices-linear triangular elements (CST)-quadratic triangular elements – bilinear rectangular elements-quadratic rectangular elements-solid elements-higher order elements-nodal loads-stress calculations-example problems.

3. ISOPERIMETRIC ELEMENTS **9**

Introduction-bilinear quadrilateral elements – quadratic quadrilaterals – hexahedral elements – Numerical Integration – quadrature - static condensation – load considerations – stress calculations – examples of 2D and 3D applications.

4. FINITE ELEMENTS IN STRUCTURAL DYNAMICS APPLICATIONS 9

Dynamic equations – mass and damping matrices – natural frequencies and modes – damping – reduction of number of degrees-of-freedom-response history – model methods – Ritz vectors – component mode synthesis – harmonic response – direct integration techniques – explicit and implicit methods – analysis by response spectra – example problems.

5. HEAT TRANSFER AND FLUID MECHANICS APPLICATIONS **9**

Heat transfer – element formulation – reduction-nonlinear problems-transient thermal analysis-acoustic frequencies and modes-fluid structure interaction problems-plane incompressible and rotational flows-example problems.

Total **45**

TEXT BOOK:

Cook, Robert Davis et al “Concepts and Applications of Finite Element Analysis “, Wiley, John & Sons, 1999.

REFERENCES:

Reddy J.N. An Introduction to the Finite Element Method, McGraw Hill, International Edition, 1993.

Segerlind L.J., “Applied Finite Element Analysis”, John Wiley, 1984

Chandrupatla & Belagundu, “Finite Elements in Engineering”, Prentice Hall of India Private Ltd., 1997.

George R Buchaman , “ Schaum’s Outline of Finite Element Analysis” , McGraw Hill Company , 1994.

S.S.Rao, Finite Element Analysis, 2002 Edition.

WEB REFERENCES:

1. http://www.vector-space.com/
2. http://www.mech.port.ac.uk/sdalby/mbm/CTFRProg.htm

LOGISTICS AND SUPPLY CHAIN MANAGEMENT

3 0 0 100

INTRODUCTION: Definition, decision phases in a supply chain, objectives of SCM, examples of supply chains, supply chain drivers, supply chain integration, supply chain performance measures. (4)

NETWORK DESIGN: Role of distribution in supply chain – distribution network design – factors influencing distribution network design, distribution networks in practice – network design in the supply chain – factors influencing the network design, framework for network design, models for facility location and capacity allocation – Impact of uncertainty on network design. (6)

INVENTORY MANAGEMENT: Cycle inventory – economies of scale to exploit fixed costs, quantity discounts, example problems – multi-echelon inventory – safety inventory in supply chain – safety level estimation, supply uncertainty, data aggregation, replenishment policies, managing safety inventory in practice – product availability – optimal level, affecting factors, supply chain contracts, examples. (9)

DISTRIBUTION STRATEGIES: Push strategy, pull strategy-Kanban replenishment systems, types, implementation, push-pull strategy. (4)

STRATEGIC ALLIANCE: Framework for strategic alliance - 3PL and 4PL – retailer-supplier partnerships – distribution integration – procurement and outsourcing –benefits, E-procurement – design for logistics – supplier integration into new product development – mass customization. (4)

CUSTOMER VALUE AND GLOBAL SUPPLY CHAINS: Customer value – dimensions, strategic pricing, measures, IT and customer value – global supply chain – introduction, driving factors, risks and advantages, issues, regional differences in logistics. (4)

INFORMATION TECHNOLOGY FOR SCM: Goals – standardization – infrastructure – interface devices, communications, databases, system architecture – system components – integrating the supply chain information technology - DSS for supply chain management. (5)

E-BUSINESS AND THE SUPPLY CHAIN: Value of information – Bullwhip effect, information and supply chain technology – customer relationship management, supplier relationship management. (6)

Total 42

TEXT BOOKS:

1. Simchi – Levi Davi, Kaminsky Philip and Simchi-Levi Edith, "Designing and Managing the Supply Chain", Tata McGraw –Hill Publishing Company Ltd, New Delhi, 2003.
2. Chopra S and Meindl P, "Supply Chain Management: Strategy, Planning, and Operation", Second edition, Prentice Hall India Pvt. Ltd, New Delhi, 2005.

REFERENCES:

1. Robert B Handfield, And Ernest L Nichols, " Introduction To Supply Chain Management", Prentice Hall, Inc, New Delhi, 1999.
2. Sahay B S, "Supply Chain Management", Macmillan Company, 2000
3. David Brunt, And David Taylor, "Manufacturing Operations And Supply Chain Management : The Lean Approach", Vikas Publishing House , New Delhi, 2001
4. Hartmud Stadler, And Christoph Kilger, "Supply Chain Management And Advanced Planning: Concepts, Models, Software", Springer-Verlag, 2000
5. David F Ross, "Introduction To E-Supply Chain Management", CRC Press, 2003.

E14 MODELING AND SIMULATION IN MANUFACTURING SYSTEMS

3 1 0 4

UNIT I

MANUFACTURING SYSTEMS AND MODELS: Types and principles of manufacturing systems, types and uses of manufacturing models, physical models, mathematical models, model uses, model building

(9)

UNIT II

MATERIAL FLOW SYSTEMS: Assembly lines-Reliable serial systems, approaches to line balancing, sequencing mixed models. Transfer lines and general serial systems – paced lines without buffers, unpaced lines. Shop scheduling with many products. Flexible manufacturing systems- System components, planning and control. Group technology-Assigning machines to groups, assigning parts to machines. Facility layout-Quadratic assignments problem approach, graphic theoretic approach.

(9)

UNIT III

SUPPORTING COMPONENTS: Machine setup and operation sequencing-integrated assignment and sequencing. Material handling systems-conveyor analysis, AGV systems. Warehousing-storage and retrieval systems, order picking. (5)

GENERIC MODELING APPROACHES: Analytical queuing models, a single workstation, open networks, closed networks. Empirical simulation models-Event models, process models, simulation system, example manufacturing system

(4)

UNIT IV

SYNCHRONIZATION MANUFACTURING: Synchronization Vs Optimization, defining the structure, identifying the constraint, exploitation, buffer management.

(9)

UNIT V

PETRI NETS: Basic definitions – dynamics of Petri nets, transformation methods, event graphs, modeling of manufacturing systems.

(9)

Total: 45

REFERENCES:

Ronald G Askin, “Modeling and Analysis of Manufacturing Systems”, John Wiley and Sons, Inc, 1993

Mengchu Zhou, “Modeling, Simulation, and Control of Flexible Manufacturing Systems: A Petri Net Approach”,
World Scientific Publishing Company Pvt Ltd., 2000

Jean Marie Proth and Xiaolan Xie, “ Petri Nets: A Tool for Design and Management of Manufacturing Systems”, John Wiley and Sons, New York, 1996.

P Brandimarte, A Villa, “ Modeling Manufacturing Systems” Springer Verlag, Berlin, 1999

E15 PRODUCTIVITY MANAGEMENT 3 1 0 4

UNIT I

INTRODUCTION: Fundamental concepts of different types of conventional and advanced manufacturing systems, types, characteristic features, application examples and selection criteria. (9)

UNIT II

LEAN MANUFACTURING: Primary elements and principles of lean manufacturing – road map for lean – traditional Vs lean manufacturing – benefits – case studies. Single piece product flow - pull production system - continuous improvement - value stream mapping (VSM) - cellular manufacturing – lean assessment – case studies of lean manufacturing programs and projects (9)

UNIT III

ADVANCED MANUFACTURING CONCEPTS: Evolution, synchronise manufacturing, lean manufacturing, agile manufacturing world class manufacturing, JIT, zero inventory, six sigma concepts performance evaluation of manufacturing systems: lean manufacturing assessment, OEE, and six sigma on advanced manufacturing systems. (9)

UNIT IV

PRODUCTIVITY CONCEPTS: Macro and micro factors of productivity, productivity benefit model, productivity cycle; Productivity models: productivity measurement at international, national and organisational level, total productivity models. Productivity management in manufacturing and service sector. Productivity evaluation models, productivity improvement models and techniques.

(9)

UNIT V

METHODS ENGINEERING: Methods design, formulation and analysis of methods design problems, review of methods engineering. Principle of motion economy, micromotion study (therbligs), memo motion study, SIMO chart, chronocycle graph, recording. (5)

WORK MEASUREMENT: Importance of time standards for manufacturing process, performance-rating systems, various types of allowances. Techniques for work measurements - stop watch time study, work sampling, PMTS, MTM, analytical estimation, various forms used in time study methods, measurement of indirect labour. (4)

Total 45

REFERENCES:

Askin R G and Goldberg J B, “Design and Analysis of Lean Production Systems”, John Wiley and Sons Inc., 2003.

Parish D, “Flexible Manufacturing”, Butterworth-Heinemann Ltd., 1990.

ILO, ‘Introduction to Work Study: Indian adaptation’, Oxford and IBH publishing Co. Pvt. Ltd. 2001.

Sumanth, D J, " Productivity Engineering and Management ", TMH, New Delhi, 1990.

Ralph M Barnes, ‘Motion and time : Study Design and Measurement of Works’, John-Wiley and Sons Inc., 2002

Premvrat Sardana G D and Sahay B S, " Productivity Management - A Systems Approach ",Narosa Pub. New Delhi, 1998.

E16 MICROPROCESSOR AND MICROCONTROLLER 3 1 0 4

UNIT I
ARCHITECTURE 9

General 8 bit & 16 bit Microprocessor and their architectures – 8085, 8086 functions of different sections – Microcontroller family – 8031, 8051 etc.,

UNIT II
ASSEMBLY LANGUAGE PROGRAMMING 9

Instruction formats of 8085,8031 – Addressing Modes, Instruction sets, timing diagram, programming techniques, Assemblers.

UNIT III
DATA TRANSFER SCHEME 9

Programmed I/O, Interrupt driven I/O, DMA, Serial I/O, - Examples.

UNIT IV
PERIPHERAL DEVICES & INTERFACING 9

Types – Programmable peripheral Interface – 8255, Timer Interface – 8253, 8254, A/D&D/A converter Interface, Keyboard, switches, EPROM, RAM Interfacing, Display Interface, communication interface 8251.

UNIT V
APPLICATION WITH MICROCONTROLLERS 9

DATA Acquisition system, programmable logic controller – Hydraulic actuators & their interfacing – CNC machines – Robot system, Measurement, inspection and quality control – Stepper Motors.

TOTAL = 45

REFERENCES:

HALL, D.V. 'Microprocessor and interfacing, Tata McGraw Hill, Edition 1992.
ADITYA P. MATHUR, - Introduction to Microprocessors, III Edition, Tata McGraw Hill Publishing Co Ltd., New Delhi, 1989.
RAMESH GAENKAR, - Microprocessor Architecture – Programming and Application with 8085/8080A, Wiley Eastern Ltd., New Delhi 1995.
KANNETHAYALA – 8051 Microcontroller, New German Publication.
JAMES. W. STEWART – 8051 Microcontroller – Hardware software and interfacing-Regents- Prentice Hall, 1993.

E17 FUZZY LOGIC AND NEURAL NETWORKS 3 0 0 3

UNIT I

FUZZY SET THEORY & FUZZY LOGIC CONTROL 9

Basic concepts of Fuzzy sets – operations on fuzzy sets – Fuzzy relational equations – Fuzzy logic control – Different phases – its types examples – fuzzy graphs

UNIT II

ADAPTIVE FUZZY SYSTEMS 9

Performance Index – Modification of Rule base – Modification of membership functions- Simultaneous modification of Rule base and membership functions- Genetic Algorithms for Adaptive Fuzzy systems.

UNIT III

ARTIFICIAL NEURAL NETWORKS (ANN) 9

Introduction – Types of ANN – Multi layer perception – Back propagation Algorithms- Different types of learning methods – examples.

UNIT IV

OTHER NETWORK ARCHITECTURES 9

Hop field nets – unsupervised learning methods – Kohenen nets – ART I, ART II, Grorsbengnets, recurrent network – Reinforcement learning.

UNIT V

ADVANCED STUDY 9

Application of Fuzzy logic and neural networks in measurement, control, manufacturing, signal processing and image processing.

TOTAL = 45

REFERENCES:

DRIANKOV.D, HELLENDOORN.H, REINFRANK.M. - An Introduction to fuzzy control – Narosa Publishing House 1996.
KLIR, G.J, YUAN B.B., - Fuzzy logic, Prentice Hall of India Pvt Ltd., 1997.
ZURADA.J.M., - Introduction to Artificial Neural Systems – JAICO Publishing House, 1994.
KOSKO.B. - Neural Networks and Fuzzy systems – Prentice Hall.

E18 ADVANCED MATERIALS AND THEIR PROCESSING 3 0 0 3

UNIT I

INTRODUCTION: Chemistry and classification of polymers , properties of thermo plastics, properties of thermosetting plastics , applications , merits and demerits. (9)

UNIT II

PROCESSING OF PLASTICS: Extrusion, injection moulding, blow moulding, compression and transfer moulding, casting, thermo forming. (9)

UNIT III

MACHINING AND JOINING OF PLASTICS : General machining properties of plastics, machining parameters and their effect, joining of plastics, mechanical fastners, thermal bonding, press fitting and welding. (9)

UNIT IV

COMPOSITE MATERIALS AND PROCESSING: Fibres, glass, boron, carbon, organic, ceramic and metallic fibers, matrix materials polymers, metals and ceramics, composites processing, open mould processes, bag moulding, compression moulding with BMC and SMC, filament winding, pultrusion, centrifugal casting, injection moulding, testing and application of PMC's. (9)

UNIT V

PROCESSING OF METAL MATRIX COMPOSITES : Solid state fabrication techniques, diffusion bonding, powder metallurgy techniques, plasma spray, chemical and physical vapour deposition of matrix on fibres, liquid state fabrication methods, infiltration, squeeze casting, Rheo casting, application of MMCS. (9)

Total 45

REFERENCES:

1. Harold Belofsky, Plastics : " Product Design and Process Engineering", Hanser Publishers, 1995.
2. Bera E and Moet A, " High Performance Polymers ", Hanser Publishers, 1991.
3. Hensen F, " Plastics Extrusion technology", Hanser Publishers, 1988.
4. Johannaber F, " Injection Moulding Machines ", Hanser Publishers, 1983.
5. Rauwendaal C, " Polymer extrusion ", Hanser Publishers, 1990.
6. Rosatao D V, " Blow Moulding Handbook", Hanser Publisher, 1989.
7. Mallick P K and Newman S, " Composite Materials Technology ", Hanser Publishers, 1990.