UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025

REGULATIONS - 2009

CURRICULUM I TO IV SEMESTERS (FULL TIME)

M.E. MANUFACTURING SYSTEMS AND MANAGEMENT

I SEMESTER

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MA9105	Probability and Statistical Methods	3	1	0	4
2	MS9111	Manufacturing Planning And Control	3	1	0	3
3	IE9124	Supply Chain Management	3	0	0	3
4.	MS9112	Computer Integrated Manufacturing Systems	3	0	0	3
5.	MS9113	Human Resourse Management	3	0	0	3
6.	E1	Elective – I	3	0	0	3
7.	MS9114	Manufacturing Optimization Laboratory	0	0	3	2

II SEMESTER

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IE9131	Design And Analysis Of Experiments	3	1	1	4
2	CI9158	Design for manufacturing	**3**	**0**	**0**	**3**
3.	IE9156	Maintainability Engineering	3	0	0	3
4.	IE9162	Management Accounting & Financial Management	3	0	0	3
5.	E2	Elective – II	3	0	0	3
6.	E3	Elective – III	3	0	0	3
PRACTICAL						
7.	MS9121	Technical Seminar	0	3	0	1

III SEMESTER

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	E4	Elective – IV	3	0	0	3
2	E5	Elective – V	3	0	0	3
3	E6	Elective – VI	3	0	0	3
4	MS9131	Project Work Phase – I	3	0	12	6

IV SEMESTER

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	MS9141	Project Work Phase – II	0	0	24	12

No. of Credits: 69

ELECTIVES

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	IE9157	Human Factors and Ergonomics	3	0	0	3
2.	CI9152	Computer Aided Process Planning	3	0	0	3
3.	IE9176	Design of Cellular Manufacturing System	3	1	0	4
4.	PD9154	Enterprise Resource Planning	3	0	0	3
5.	MS9150	Safety Engineering and Industrial Hygiene	3	0	0	3
6.	MS9151	Logistics Management	3	0	0	3
7.	MS9152	Flexible Competitive Manufacturing Systems	3	0	0	3
8.	ED9158	Industrial Robotics and Expert Systems	3	0	0	3
9.	PD9121	Integrated Product Design and Process Development	3	0	0	3
10.	MS9153	Project Management	3	0	0	3
11.	PD9153	Reverse Engineering	3	0	0	3
12.	MS9154	Nanostructured Materials and Technology	3	0	0	3
13.	CI9159	Rapid Prototyping	3	0	0	3
14.	CI9114	Advances In Manufacturing Technology	3	0	0	3
15.	MS9155	Processing of Composites and Polymer Materials	3	0	0	3
16.	IE9159	Decision Support Systems	3	0	0	3
17.	ED9164	Design of Hydraulic and Pneumatic Systems	3	0	0	3
18.	MS9156	Six Sigma and Lean Manufacturing	3	0	0	3
19.	CI9122	Mechatronics in Manufacturing Systems	3	0	0	3
20.	MS9157	Modern Techniques of Materials Characterization	3	0	0	3
21.	CI9171	Manufacturing Information Systems	3	0	0	3
22.	MS9158	Manufacturing Management	3	0	0	3
23.	MS9159	Materials Handling System And Design	3	0	0	3

MA 9105   **PROBABILITY AND STATISTICAL METHODS**   **L T P C**
                                                                     3 1 0 4

AIM: The course aims at providing knowledge for the basic concepts of Probability and Statistics and the techniques for solving mathematical problems for probability analysis which will be useful in solving some Engineering problems.

OBJECTIVE:
- To introduce the basic concepts of one dimensional and two dimensional Random Variables.
- To provide information about Estimation theory, Correlation, Regression and Testing of hypothesis.

To enable the students to use the concepts of multivariate normal distribution and principle components analysis.

UNIT-I PROBABILITY AND RANDOM VARIABLES   **10**
Probability – Random variables - Binomial, Poisson, Geometric, Uniform, Normal, Exponential distributions – Moments – Moments generating functions and their properties – Function of Random variables.

UNIT-II ESTIMATION THEORY   **8**
Partial and Multiple correlation – Partial and Multiple regression – Estimation of parameters using maximum likelihood estimator and method of moments.

UNIT-III TESTING OF HYPOTHESIS   **9**
Basic definitions of statistical hypothesis – Tests based on Normal, t, Chi-square and F distributions for mean, variance and proportion

UNIT-IV DESIGN OF EXPERIMENTS   **9**
Analysis of variance – One way and Two-way Classifications – Completely randomized design – Randomised block design – Latin square design – 2^2 factorial design.

UNIT-V MULTIVARIATE ANALYSIS   **9**
An overview of multivariate methods, multivariate normal distribution, Eigen values and Eigen vectors.

                                                       Total: 60

REFERENCE BOOKS:
1. Gupta, S.C. and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi (2001).
2. Johnson, R.J., Miller & Freund's, "Probability and Statistical for Engineers", 6th Edition, Prentice – Hall of India, Private Ltd., New Delhi (2002).
3. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Thomson and Duxbury, Singapore (2002).
4. Dallas E Johnson et al., "Applied Multivariate Methods for Data Analysis", Thomson and Duxburpress, Singapore(1998).

MS 9111   MANUFACTURING PLANNING AND CONTROL   L T P C
3 0 0 3

AIM:

OBJECTIVE:

UNIT-I   INTRODUCTION TO MANUFACTURING SYSTEMS ENGINEERING   10
Process Planning-Logical design of process planning-Shortcomings of traditional process planning-Computer aided process planning-Computerization of files management-Variant (Retrieval) approach-generative approach-Semi generative approach-General remarks on CAPP developments and trends.

UNIT-II   PRODUCTION CONTROL   9
Overview of production control - Forecasting - Master production schedule - Materials requirements planning - Order release-shop floor control - Cellular manufacturing - JIT and MRP II - Computer generated time standards.

UNIT-III   LOADING AND SCHEDULING   8
Information retrieval for loading and scheduling-master scheduling-perceptual loading-despatching – progress chasing-expediting-order scheduling devices

UNIT-IV   MATERIAL FLOW PATH ANALYSIS IN MANUFACTURING   9
Material handling function-Types of equipment used-conveyor systems-Automated guided vehicle systems- Guiding and routing-Traffic control and safety-Interfacing handling and storage with manufacturing-design factors in material handling systems.

UNIT-V   LAYOUT OF MANUFACTURING SYSTEMS   9
Plant layout-Definition-Objectives-Principles-Factors influencing layout-Types of layout - Cellular layout- Tools and tooling system for cellular manufacturing

Total: 45

REFERENCE BOOKS:

1.G.Halevi And R.D.Weill, "Principles of Process Planning", Chapman and Hall, Madras 1995.

2.M.P.Groover, "Automatic Production System and Computer Integrated Manufacturing", Prentice Hall, 1990.

3. Bary Hawkes, "CAD/CAM Processes", 1990.

4. Evert E. Adams Jr and Donold J. Ebert, "Production and Operation Management", Prentice Hall of India, 1994

5.S.N.Chary, "Production and Operations Management", 3rd Edition, Tata McGraw Hill, New Delhi,1991

IE 9124   **SUPPLY CHAIN MANAGEMENT**   **L T P C**
                                                                3 0 0 3

AIM:

OBJECTIVE:

UNIT-I   INTRODUCTION   6
Definition of Logistics and SCM: Evolution, Scope, Importance & Decision Phases – Drivers of SC Performance and Obstacles.

UNIT-II   LOGISTICS MANAGEMENT   10
 Factors – Modes of Transportation   - Design options for Transportation Networks-Routing and Scheduling – Inbound and Outbound logistics- Reverse Logistics – 3PL- Integrated Logistics Concepts- Integrated Logistics Model – Activities - Measuring logistics cost and performance – Warehouse Management - Case Analysis

 UNIT-III SUPPLY CHAIN NETWORK DESIGN   10
Distribution in supply chain – Factors in distribution network design –Design options-Network Design in Supply Chain – Framework for network decisions - Managing cycle inventory and safety.

UNIT-IV   SOURCING, AND PRICING IN SUPPLY CHAIN   9
Supplier selection and contracts - Design collaboration -Procurement process. Revenue management in supply chain

 UNIT-V   COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN   10
 Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work. E Business & SCM Metrics for SC performance – Case Analysis

                                                            Total: 45

REFERENCE BOOKS:

1. Sunil Chopra and Peter meindl- PHI, "Supply Chain Management, Strategy, Planning, and Operation", Second edition, 2004.
2. David J.Bloomberg, Stephen Lemay and Joe B.Hanna, "Logistics", PHI 2002
3. Martin Christopher, "Logistics and Supply Chain Management –Strategies for Reducing Cost and Improving Service", Pearson Education Asia, Second Edition.
4. Jeremy F.Shapiro, Thomson Duxbury, "Modeling the supply chain", 2002
5. James B.Ayers, "Handbook of Supply chain management", St.Lucle Press, 2000.

MS 9112   COMPUTER INTEGRATED MANUFACTURING SYSTEMS   L T P C
3 0 0 3

AIM: To acquire the knowledge of the computer integrated manufacturing syllabus

OBJECTIVE: To learn about automation and production systems technologies in modern manufacturing.

UNIT-I   INTRODUCTION   5
Types of production-functions-automation strategies- production economics- cost in manufacturing-breakeven analysis.

UNIT-II   AUTOMATED FLOWLINES   10
Transfer Mechanism-Buffer storages-Analysis of Transfer lines- Line unbalancing Concepts- Automated assembly systems

UNIT-III   COMPUTER CONTROLLED SYSTEMS   10
NC – CNC part programming – DNC systems – Adaptive control – pallets and fixtures systems – Manufacturing cells.

UNIT-IV AUTOMATIC HANDLING STORAGE AND INSPECTION   10
Automated transfer system – Automated material handling system – Automated storage/ retrieval system – Justification – Components – Systems – Carosel system –Automated Inspection – contact – Non contact types.

UNT-V MACHINE AND SYSTEM CONTROL   10
Cell control – cell controllers – Linear feed back control – Optimal control – sequential programmable controller – Automatic tracking – barcodes – RFID system.

TOTAL:45

 REFERENCE BOOKS:

1.Mikell P.Groover, Automation, "Production systems and Computer Integrated Manufacturing" PHI, 1995.
2. Weatherall, "Computer Integrated Manufacturing", A total company strategy, 2nd edition, 1995.
 3. Ronald G.Askin, "Modelling and Analysis of Manufacturing Systems", John Wiley sons, 1993.

MS 9113　　　　　　**HUMAN RESOURCE MANAGEMENT**　　　　　**L T P C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　3 0 0 3

AIM: To understand the importance of human resources in management system

OBJECTIVE: To have thorough knowledge about various sources, selection and training, managing quality, labour relations and employee security. Hence the effective planning of human resources within the system.

UNIT-I HUMAN RESOURCE FUNCTION　　　　　　　　　　　　　　　　5

Human Resource Philosophy – Changing environments of HRM – Strategic human resource management – Using HRM to attain competitive advantage – Trends in HRM –Organization of HR departments – Line and staff functions – Role of HR Managers.

UNIT-II RECRUITMENT & PLACEMENT　　　　　　　　　　　　　　　10
Job analysis: Methods - IT and computerized skill inventory - Writing job specification -HR and the responsive organization. Recruitment and selection process : Employment planning and forecasting – Building employee commitment : Promotion from within - Sources, Developing and Using application forms - IT and recruiting on the internet .Employee Testing & selection : Selection process, basic testing concepts, types of test, work samples & simulation, selection techniques, interview, common interviewing mistakes, Designing & conducting the effective interview, small business applications, computer aided interview.

UNIT-III TRAINING & DEVELOPMENT　　　　　　　　　　　　　　10
Orientation & Training: Orienting the employees, the training process, need analysis, Training techniques, special purpose training, Training via the internet.Developing Managers: Management Development - The responsive managers - On-the job and off-the-job Development techniques using HR to build a responsive organization. Management Developments and CD-ROMs - Key factor for success. Performance appraisal: Methods - Problem and solutions - MBO approach – The appraisal interviews - Performance appraisal in practice. Managing careers: Career planning and development - Managing promotions and transfers.

UNIT-IV COMPENSATION & MANAGING QUALITY　　　　　　　　　10
Establishing Pay plans: Basics of compensation - factors determining pay rate – Current trends in compensation - Job evaluation - pricing managerial and professional jobs - Computerized job evaluation.
Pay for performance and Financial incentives: Money and motivation - incentives for operations employees and executives - Organization wide incentive plans - Practices in Indian organizations. Benefits and services: Statutory benefits - non-statutory (voluntary) benefits – Insurance benefits - retirement benefits and other welfare measures to build employee commitment.

UNIT-V LABOUR RELATIONS AND EMPLOYEE SECURITY　　　　　　10
Trade unions - Collective bargaining – future of trade unionism. Discipline administration - grievances handling - managing dismissals and separation. Labour Welfare : Importance &

Implications of labour legislations - Employee health - Auditing HR functions, Future of HRM function

Total: 45

REFERENCE BOOKS:
1. Gary Dessler, "Human Resource Management", IIth edition, Prentice-Hall of India . 2008
2. David A. DeCenzo & Stephen P.Robbins, Personnel/Human Resource Management,Third edition,PHI/Pearson.
3. Diane. Arthur, Recruiting, Interviewing, Selecting and Orienting new employees, 4th Edition, PHI, 2007.
4. Biswajeet Pattanayak, Human resource management, 3rd Edition PHI 2008.
5. VSP Rao, Human Resource Management: Text and cases, First edition, Excel Books,New Delhi - 2000.
6. Dr. R.Venkatapathy & Assissi Menacheri, Industrial Relations & Labour Welfare, Adithya Publications, CBE, 2001.
7. Robert L.Gibson and Marianne H.Mitchell, Introduction to Counseling and Guidance,VI edition, PHI, 2005.

MS 9114   **MANUFACTURING OPTIMIZATION LABORATORY**   **L T P C**
0 0 3 2

LIST OF EXERCISES

1. Solving optimization problems using software packages
2. Statistical analysis: Frequency distribution, Identifying the appropriate distribution, Testing for goodness of fit.
3. Simulation in manufacturing activities: scheduling & Logistics.
4. Optimization Techniques: Solving optimization problems using non traditional optimization techniques.
5. Case Studies: Solving of real time problems related to manufacturing activities using simulation software.

Total: 45

SOFTWARE REQUIREMENTS
Simulation Software like : WITNESS, LINDO, LINGO, TORA, EXTEND etc.

IE 9131 **DESIGN AND ANALYSIS OF EXPERIMENTS**

L T P C
3 1 0 4

AIM:

OBJECTIVE:

UNIT-I EXPERIMENTAL DESIGN FUNDAMENTALS **6**
Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression model.

UNIT-II SINGLE FACTOR EXPERIMENTS **9**
Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests.

UNIT-III MULTIFACTOR EXPERIMENTS **10**
Two and three factor full factorial experiments, 2^K factorial Experiments, Confounding and Blocking designs.

UNIT-IV SPECIAL EXPERIMENTAL DESIGNS **10**
Fractional factorial design, nested designs, Split plot design, Introduction to Response Surface Methodology, Experiments with random factors, rules for expected mean squares, approximate F-tests.

UNIT-V TAGUCHI METHODS **10**
 Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design- control and noise factors, S/N ratios, parameter design, case studies.

.   **Total: 60**
REFERENCE BOOKS:
1. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, 2003.
2. Nicolo Belavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.
3. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.

CI9158   **DESIGN FOR MANUFACTURING**

L T P C
3 0 0 3

AIM: The aim is impart the students with knowledge of the general design principles of manufacturing and to provide complete informations for further study

OBJECTIVE: At the end of this course the student should be able to understand the design principles of casting, welding, forming, machining and assembly by considering various manufacturing constraints

UNIT – I   INTRODUCTION   6
Economics of Process selection – General design principles of manufacturability – Proper material selection – Strength and Mechanical factors- application of form design.

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

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

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

UNIT- V   DESIGN FOR ASSEMBLY   9
Types of assembly – DFA –Index – evaluation of assembly – assembly cost reduction – case of assembly – impact on quality – related software usage – case studies.

Total: 45

TEXT BOOKS:

James G. Bralla – "Handbook of product design for manufacture", McGraw Hill Book Co., 1986.

REFERENCE BOOKS:
1.Henry Peck – "Designing for manufacture", Sir Isaac Pitman & Sons Ltd., 1973.
2.Matousek – "Engineering Design", Blackie & sons, 1956.

IE 9156   **MAINTAINABILITY ENGINEERING**

AIM:

OBJECTIVE:

UNIT – I   MAINTENANCE CONCEPT   6
Need for maintenance – Maintenance definition – Maintenance objectives – Challenges of Maintenance management – Tero technology – Scope of maintenance department – Maintenance costs

UNIT – II   MAINTENANCE MODELS   12
Proactive/Reactive maintenance – Imperfect maintenance – Maintenance policies – PM versus b/d maintenance – Optimal PM schedule and product characteristics – Optimal Inspection frequency: Maximizing profit – Minimizing downtime – Replacement models.

UNIT-III   MAINTENANCE LOGISTICS   11
Human factors – Crew size decisions: Learning curves – Simulation – Maintenance resource requirements: Optimal size of service facility – Optimal repair effort – Maintenance planning – Maintenance scheduling – Spare parts control – Capital spare.

UNIT – IV MAINTENANCE QUALITY   8
Maintenance excellence –Five Zero concept –FMECA –Root cause analysis – System effectiveness – Design for maintainability – Maintainability allocation – CMMS – Reliability Centered Maintenance

UNIT – V   TOTAL PRODUCTIVE MAINTENANCE   8
TPM features – Chronic and sporadic losses – Equipment defects – Six major losses – Overall Equipment Effectiveness – TPM pillars –TPM implementation – Autonomous maintenance.

REFERENCE BOOKS:

1. Andrew K.S.Jardine & Albert H.C.Tsang, "Maintenance, Replacement and Reliability", Taylor and Francis, 2006.
2. Bikas Badhury & S.K.Basu, "Tero Technology: Reliability Engineering and Maintenance Management", Asian Books, 2003.
3. Seichi Nakajima, "Total Productive Maintenance", Productivity Press, 1993.

IE 9162   MANAGEMENT ACCOUNTING AND FINANCIAL MANAGEMENT

L T P C
3 0 0 3

AIM:

OBJECTIVE:

UNIT – I   Financial Accounting   **10**
Salient features of Balance sheet and Profit & Loss Statement, Cash Flow and Fund Flow Analysis, Working Capital management, Inventory valuation, Financial Ratio analysis – Depreciation

UNIT – II   Cost Accounting   **10**
Cost accounting systems: Job costing, Process costing, Allocation of overheads, Activity based costing, differential cost and incremental cost, Variance analysis, Software costing.

UNIT-III   Budgeting

                                                                      10

Requirements for a sound budget, fixed budget-preparation of sales and production budget, flexible budgets, zero base budgeting and budgetary Control.

UNIT – IV   Financial Management   **10**
Investment decisions – Capital Investment process, types of investment proposals, investment appraisal techniques – pay back period method, Accounting rate of return, net present value method, internal rate of return and profitability index method.

UNIT – V   Financial decisions   **5**
Cost of Capital – Capital structure – Dividend Policy – Leasing

                                                        Total: 45

REFERENCE BOOKS:

1. Bhattacharya, S.K. and John Deardon, "Accounting for Management – Text and Cases", Vikas Publishing House, New Delhi, 1996.
2. Charles, T.Horn Green – "Introduction to Management Accounting", Prentice Hall, New Delhi, 1996.
3. James, C.Van Horne, "Fundamental of Financial Management", Pearson Education, 12th Edition, 2002.
4. Pandey, I.M., "Financial Management", Vikas Publishing House, New Delhi, 8th Edition, 2004

IE 9157   HUMAN FACTORS AND ERGONOMICS   L T P C
                                                          3 0 0 3

AIM:

OBJECTIVE:

UNIT – I   PHYSIOLOGICAL PERFORMANCE   10
Factors affecting physiological performance, physical work load and energy expenditure, heat stress, manual lifting, shift work

UNIT – II   WORK SPACE DESIGN   10
Anthropometry, Workspace designs for standing and seated workers, arrangement of components within a physical space, interpersonal aspect of workplace design.

UNIT-III   DESIGN OF EQUIPMENT   10
Ergonomic factors to be considered in the design of displays and control, design for maintainability, design of human computer interaction.

UNIT – IV   COGNITIVE ERGONOMICS   5
Information Theory, Information processing, signal detection theory, Human response, human errors, cognitive task analysis.

UNIT – V   DESIGN OF ENVIRONMENT   10

Vision and Illumination design – Noice and Vibration

                                                      Total:45

REFERENCE BOOKS:
1. Martin Helander, A guide to Human Factors and Ergonomics, 2nd Edition, CRC, Taylor & Francis Group 2006.
2. Bridger, R.S., Introduction to Ergonomics, McGraw Hill, 1995.
3. MeCormik, J., Human Factors Engineering and Design, McGraw Hill, 1992.

CI 9152   COMPUTER AIDED PROCESS PLANNING   L T P C
                                                          3 0 0 3

AIM: To provide sound knowledge in process planning in the manufacturing using computers.

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   5
The role of Process Planning in the Manufacturing cycle – Process Planning and Production Planning – Process Planning and Concurrent Engineering, CAPP, Group Technology

UNIT – II   PART DESIGN REPRESENTATION   10
Design Drafting – Dimensioning – conventional tolerating – Geometric tolerancing, CAD
– Input/output devices – topology – Geometric transformation – Perspective
transformation – Data structure – Geometric modeling for process planning – GT coding
– The opitz system – The MICLASS system.

**   10**
UNIT-III   PROCESS ENGINEERING AND PROCESS PLANNING
Experience based planning - Decision table and decision trees – Process capability
analysis – Process Planning – Variant process planning – Generative process planning–
Forward and Backward planning, input format.

UNIT – IV   COMPUTER AIDED PROCESS PLANNING SYSTEMS   10
 Logical Design of Process Planning – Implementation considerations – Manufacturing
system components, production volume, No. of production families – CAM-I, CAPP,
MIPLAN, APPAS, AUTOPLAN and PRO, CPPP

UNIT – V   INGTEGRATED PROCESS PLANNING SYSTEMS   10
Totally Integrated process planning systems – An Overview – Module structure – Date
Structure, operation – Report Generation, Expert process planning.

**   Total: 45**

TEXT BOOKS:
1.Gideon Halevi and Roland D.Weill, "Principles of Process Planning", A logical
approach – Springer, 2003.
2.Tien-Chien Chang, Richard A.Wysk, "An Introduction to automated process planning
systems", Prentice Hall, 1985
3.Chang, T.C., "An Expert Process Planning System", Prentice Hall, 1985.

IE9176   DESIGN OF CELLULAR MANUFACTURING SYSTEMS
**   L T P C**
**   3 0 0 3**
AIM:
OBJECTIVE:

UNIT – I INTRODUCTION   5
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   12
Problems in GT/CMS - Design of CMS – Production Flow Analysis, Optimization Models,
traditional approaches and non-traditional approaches- Simulated Annealing, Genetic
Algorithms,

UNIT-III IMPLEMENTATION OF GT/CMS   10
Inter and intra cell layout and capacity planning. Managerial structure and groups, batch
sequencing and sizing, life cycle issues in GT/CMS. Linkages to JIT systems

UNIT - IV PERFORMANCE MEASUREMENT AND CONTROL   10
Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP - framework.

UNIT - V ECONOMIC OF GT/CMS   8
Conventional Vs group   use of computer models in GT/CMS, Human aspects of GT/CMS - cases.

Total: 45

REFERENCE BOOKS :
1. Burbidge, J.L, Group Technology in Engineering Industry, Mechanical Engineering pub. London, 1979.
2 .Askin, R.G and Vakharia, A.J., GT planning and operation, in "The automated factory - Hand book: Technology and Management", Cleland, D.I and Bidananda, B (Eds), TAB Books, NY, 1991.
3. Irani, S.A, Cellular Manufacturing Systems - Hand book

PD 9154   ENTERPRISE RESOURCE PLANNING   L T P C
3 0 0 3
AIM:
OBJECTIVE:

UNIT-I   Enterprise Resource Planning   10
Principle – ERP framework – BusinessBlue Print – Business Engineering vs Business process Re-Engineering – Tools – Languages – Value chain – Supply and Demand chain – Extended supply chain management – Dynamic Models –Process Models

UNIT-II   Technology and Architecture   10
Client/Server architecture – Technology choices – Internet   direction – Evaluation framework – CRM – CRM pricing – chain safety – Evaluation framework.

UNIT-III ERP System Packages   10
SAP,. People soft, Baan and Oracle – Comparison – Integration of different ERP applications – ERP as sales force automation – Integration of ERP and Internet – ERP Implementation strategies – Organisational and social issues.

UNIT-IV   Oracle   7
Overview – Architecture – AIM – applications – Oracle SCM. SAP : Overview – Architecture – applications -Before and after Y2k – critical issues – Training on various modules of IBCS ERP Package-Oracle ERP and MAXIMO, including ERP on the NET

UNIT-V   ERP Procurement Issues   8
Market Trends – Outsourcing ERP – Economics – Hidden Cost Issues – ROI – Analysis of cases from five Indian Companies.

Total: 45

REFERENCE BOOKS:
1. Sadagopan.S , ERP-A Managerial Perspective, Tata Mcgraw Hill, 1999.
2.Jose Antonio Fernandez , The SAP R/3 Handbook, Tata Mcgraw Hill, 1998.

3. Vinod Kumar Crag and N.K.Venkitakrishnan , Enterprise Resource Planning –
Concepts and Practice, Prentice Hall of India, 1998.
4. ERPWARE , ERP Implementation Framework, Garg & Venkitakrishnan,
Prentice Hall, 1999.
5. Thomas E Vollmann and Bery Whybark , Manufacturing and Control Systems,
Galgothia Publications, 1998.

MS 9150   SAFETY ENGINEERING AND INDUSTRIAL HYGIENE   L T P C
3 0 0 3

AIM: To acquire the knowledge about the safety engineering and industrial hygiene for
       various manufacturing industry.

OBJECTIVE:
To impart the safety rules and principles for different manufacturing environment like
machine erection, welding, gas cutting and forming field. This subject will ensure the
good industrial hygiene to the industrial workers.

UNIT-I SAFETY IN METAL WORKING AND WOOD WORKING MACHINES   5
General safety rules, principles, maintenance, Inspections of turning machines, boring
machines, milling machine, planning machine and grinding machines, CNC machines,
wood working machinery, types, safety principles, electrical guards, work area, material
handling, inspection, standards and codes(saws, types) - hazards.

UNIT-II PRINCIPLES OF MACHINE GUARDING   10
Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS
– guarding of hazards - point of operation protective devices, machine guarding, types,
fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control
guard, fixed guard fencing- guard construction- guard opening.
Selection and suitability: lathe-drilling-boring-milling-grinding-shaping-sawing-shearing-
presses-forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chains-
pulleys and belts-authorized entry to hazardous installations-benefits of good guarding
systems.

UNIT-III SAFETY IN WELDING AND GAS CUTTING   10
Personal protective equipment, training, safety precautions in brazing, soldering and
metalizing – explosive welding, selection, care and maintenance of the associated
equipment and instruments – safety in generation, distribution and handling of industrial
gases-colour coding – flashback arrestor – leak detection-pipe line safety-storage and
handling of gas cylinders.

UNIT-IV SAFETY IN COLD WORKING AND HOT WORKING OF METALS   10
Cold working, power presses, point of operation safe guarding, auxiliary mechanisms,
feeding and cutting mechanism, hand or foot-operated presses, power press electric
controls, power press set up and die removal, inspection and maintenance-metal
sheers-press brakes.
Safety in forging, hot rolling mill operation, guards in hot rolling mills – hot bending of
pipes, hazards and control measures.
Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work
environment, material handling in foundries, foundry production cleaning and finishing

foundry processes – safety in heat treatment – electro plating – painting – sand blasting – short blasting.

UNIT-V INDUSTRIAL HYGINE AND SAFETY IN TESTING 10
Safety in radiography – personal monitoring devices – radiation hazards – occupational hazards – health and welfare measures in engineering industry – pollution control – industrial waste disposal – Indian boiler regulations – safety in testing – dynamic balancing – hydro testing – walls and boilers headers and pressure vessels – leak testing – air and steam.

Total: 45

REFERENCE BOOKS:
1. "Accident Prevention Manual", NSC, Chicago, 1982.
2. "Occupational safety Manual", BHEL, Trichy, 1988
3. John V. Grimaldi and Rollin H. Simonds, "Safety Management", All India Travelers Book seller, New Delhi, 1989.
4. N.V. Krishnan, "Safety in Industry", Jaico Publishery House, 1996.
5. "Indian Boiler acts and Regulations", Government of India.
6. "Safety in the use of woodworking machines", HMSO, UK 1992.
7. "Health and Safety in welding and Allied processes, Welding Institute", UK, High Tech.Publishing Ltd., London, 1989.
8. Industrial safety – Blake

MS 9151	LOGISTICS MANAGEMENT	L T P C
		3 0 0 3

AIM: To understand the essentials of logistics and its management in manufacturing systems and management.

OBJECTIVE: To impart the knowledge of logistics from the management perspective and there by reducing the lead time and optimizing the transportation cost.

UNIT-I INTRODUCTION TO LOGISTICS 5
Scope of Logistics – elements – philosophy and concept, work of Logistics, service response logistics – Trade logistics service provider, freight costs and accounting methods, quality customer service and integrated logistics.

UNIT-II INTEGRATED LOGISTICS MANAGEMENT 10
Distribution network designs – factors influencing network designs, distribution networks in practice frame work for network design decision.

UNIT-III DISTRIBUTION MANAGEMENT 10
Distribution network designs – factors influencing network designs, distribution networks in practice frame work for network design decision.

UNIT-IV INTEGRATED LOGISTICS ACTIVITIES 10
Domestic transportation – Models - Regulations – Intermodal transportation – Cost structures, Global transportation, Out sourcing – 3 PL and 4 PL service providers – Model characteristics and selection – Transportation management, vehicle routing and scheduling.

UNIT-V ROLE OF INFORMATION TECHNOLOGY IN LOGISTICS MANAGEMENT   10
IT applications in freight logistics – Technology, Commercial fleet management, freight tracking,   toll plaza, net work analysis

Total: 45

REFERENCE BOOKS:
1. David J. Bloomberg, Stephen Lemay, Joe B. Hanna – "LOGISTICS" – Prentice Hall of India – 2008.
2. Satish C.Ailawadi and Rakesh Singh, "Logistics Management", Prentice Hall of India, May 2008.
3. Benjamin.S Blarchard, "Logistics, Engineering and Management – 6th Edition- Prentice Hall of India,2006.
4. Sunil Chopra, Peter Meindl, D.V. Kalra, "Supply Chain Management – Strategy, Planning and Operation – 1st Imprint 2007, Pearson Education, India.
5. Coyle J.J., Bardi JE, "The Management of Business Logistics", West Publishing Company, Newyork, 1984

MS 9152   FLEXIBLE COMPETITIVE MANUFACTURING SYSTEMS   L T P C
3 0 0 3
AIM:

OBJECTIVE:

UNIT-I MANUFACTURING IN A COMPETITIVE ENVIRONMENT   10
Automation of manufacturing process - Numerical control - Adaptive control - material handling and movement - Industrial robots - Sensor technology - flexible, fixturing - Design for assembly, disassembly and service.

UNIT-II GROUP TECHNOLOGY   9
Part families - classification and coding - Production flow analysis - Machine cell design - Benefits.

UNIT-III FLEXIBLE MANUFACTURING SYSTEMS   9
Introduction - Components of FMS - Application workstations - Computer control and functions - Planning, scheduling and control of FMS - Scheduling - Knowledge based scheduling - Hierarchy of computer control - Supervisory computer.

UNIT-IV COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS   8
System issues - Types of software - specification and selection - Trends - Application of simulation - software - Manufacturing data systems - data flow - CAD/CAM considerations - Planning FMS database.

UNIT-VJUST IN TIME   9
Characteristics of JIT - Pull method - quality -small lot sizes - work station loads - close supplier ties - flexible work force - line flow strategy - preventive maintenance - Kanban system - strategic implications - implementation issues - MRD JIT - Lean manufacture

Total: 45

REFERENCE BOOKS:
1. Groover M.P., "Automation, Production Systems and Computer Integrated Manufacturing", Prentice-Hall of India Pvt. Ltd., New Delhi, 1996.
2. Jha, N.K., "Handbook of Flexible Manufacturing Systems", Academic Press Inc., 1991.
3. Kalpakjian, "Manufacturing Engineering and Technology", Addison-Wesley Publishing Co., 1995.
4. Taiichi Ohno, Toyota, "Production System Beyond Large-Scale production", Productivity Press (India) Pvt.Ltd., 1992.

ED 9158   INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS   L T P C
3 0 0 3

AIM:
OBJECTIVE:

UNIT-I INTRODUCTION AND ROBOT KINEMATICS   10
Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors.
Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.

UNIT-II ROBOT DRIVES AND CONTROL   9
Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

UNIT-III   ROBOT SENSORS   9
Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

UNIT-IV   ROBOT CELL DESIGN AND APPLICATION   9
Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.

UNIT-V   ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS   8
Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

Total: 45

TEXT BOOK
1. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, "Robotics Control, Sensing, Vision and Intelligence", Mc Graw Hill, 1987.

REFERENCE BOOKS:
1. Yoram Koren," Robotics for Engineers' Mc Graw-Hill, 1987.
2. Kozyrey, Yu. "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R." Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey," Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al ,"Expert Systems and Robotics ", Springer –Verlag,   New York, May 1991.

WEB REFERENCES:
1. http://www.ifr.org/gallery/type.htm

PD 9121   INTEGRATED PRODUCT DESIGN AND PROCESS DEVELOPMENT

L T P C
3 1 0 4

AIM:
OBJECTIVE:

UNIT-I   INTRODUCTION   8
Need for IPPD-Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement

UNIT-II CONCEPT GENERATION , SELECTION AND TESTING   10
Plan and establish product specifications. Task - Structured approaches - clarification - search-externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology - benefits. Implications - Product change - variety - component standardization - product performance - manufacturability – Concept Testing Methodologies.

UNIT-III   PRODUCT ARCHITECTURE   8
Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

UNIT-IV INDUSTRIAL DESIGN   8
Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically - Need for industrial design-impact – design process - investigation of customer needs - conceptualization - refinement - management of the industrial design process - technology driven products - user - driven products - assessing the quality of industrial design.

UNIT-V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT   11

Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis - Understanding and representing tasks-baseline project planning - accelerating the project-project execution.

Term Project   **15**

Term Project and Presentation by the students which will be considered for one of the assessments.

Total : 45+15=60

TEXT BOOK:

1. Product Design and Development, Karl T.Ulrich and Steven D.Eppinger, McGraw –Hill International Edns.1999

REFERENCE BOOKS:

1. Concurrent Engg./Integrated Product Development. Kemnneth Crow, DRM Associates,   6/3,Via Olivera, Palos Verdes, CA 90274(310) 377-569,Workshop Book
2. Effective Product Design and Development, Stephen Rosenthal, Business One Orwin, Homewood, 1992,ISBN, 1-55623-603-4
3. Tool Design – Integrated Methods for successful Product Engineering, Stuart Pugh, Addison Wesley Publishing,Neyourk,NY,1991, ISBN 0-202-41639-5
4. www.me.mit/2.7444

MS 9153   **PROJECT MANAGEMENT**   **L T P C**
                                                                         3 0 0 3

AIM:
OBJECTIVE:

UNIT-I   TOOLS FOR CONCEPT DEVELOPMENT   9

Products division, Quality function deployment, Concept engineering – Tools for Design Development design failure mode and design analysis. Reliability prediction – Tools for Design optimization. The Taguchi Loss Function. Optimization Reliability – Tools for Design Verification: Reliability Testing, Measurement system evaluation, Process Capability Evaluation.

UNIT-II TOOLS FOR PROCESS IMPROVEMENT   9

Process improvement methodologies. The Deming Cycle-FADE-Basic tools for process improvement: flow charts; run charts and control charts, check sheets, histograms. Pareto diagrams. Cause and Effect Diagrams – Scatter Diagrams – Other tools for processes improvement.   Kalzen Blitz.   Poka-yoke (mistake proofing), process simulation-Engaging the work force in process improvement.

UNIT-III STATISTICAL PROCESS CONTROL   9

Quality control measurements - SPC methodology – Control charts for variables data-Special control charts for variables data-control charts for attributes – Summary of control charts   construction chart, np-charts, c & u charts – Designing control charts: sampling, size, frequency-SPC, ISO 9000-2000, AND SIX SIGMA-Pre control.

**UNIT-IV BENCHMARKING AND ESTABLISHING ENGINEERING   9
SPECIFICATIONS**

A Benchmarking Approach – Support tools for the benchmarking process: indented assembly cost analysis, form diagram, trend analysis – Setting product specifications: Basic, Advanced method.

UNIT-V PROJECT MANAGEMENT   9

Understanding and representing tasks: Tasks, charts – Baseline project planning – Accelerating projects-project execution – Postmortem execution.

Total: 45

TEXT BOOK:

1. Product Design & Development, Karl T.Ulrich, Steven D.Eppinger, TATA McGraw-HILL – 3rd Edition, 2003.

REFERENCE BOOKS:

1. Kevin Otto & Kristin Wood, "Product Design Technique in Reverse Engineering and New Product Development", Pearson Education (LPE), 2001
2. James R.Evens, William M.Lindsay, "The Management and Control of Quality", 6th edition. Pub: son south-western (www.swlearning.com)

| PD 9153 | REVERSE ENGINEERING | L T P C |
| | | 3 0 0 3 |

AIM:
OBJECTIVE:

UNIT-I INTRODUCTION   5

Scope and tasks of RE - Domain analysis- process of duplicating

UNIT-II TOOLS For RE   8

Functionality- dimensional- developing technical data - digitizing techniques - construction of surface model - solid-part material- characteristics evaluation -software and application- prototyping - verification

UNIT-III CONCEPTS   12

History of Reverse Engineering – Preserving and preparation for the four stage process – Evaluation and Verification- Technical Data Generation, Data Verification, Project Implementation

UNIT-IV DATA MANAGEMENT   10

Data reverse engineering – Three data Reverse engineering strategies – Definition – organization data issues - Software application – Finding reusable software components – Recycling real-time embedded software – Design experiments to evaluate a Reverse Engineering tool – Rule based detection for reverse Engineering user interfaces – Reverse Engineering of assembly programs: A model based approach and its logical basics

UNIT-V INTEGRATION **10**

Cognitive approach to program understated – Integrating formal and structured methods in reverse engineering – Integrating reverse engineering, reuse and specification tool environments to reverse engineering -–coordinate measurement – feature capturing – surface and solid members

Total: 45

REFERENCE BOOKS:
1. Design Recovery for Maintenance and Reuse, T J Biggerstaff, IEEE Corpn. July 1991
2. White paper on RE, S. Rugaban, Technical Report, Georgia Instt. of Technology, 1994.
3. Reverse Engineering, Katheryn, A. Ingle, McGraw-Hill, 1994.
4. Data Reverse Engineering, Aiken, Peter, McGraw-Hill, 1996.
5. Reverse Engineering, Linda Wills, Kluiver Academic Publishers, 1996
6. Co-ordinate Measurment and reverse engineering, Donald R. Honsa, ISBN 1555897, American Gear Manufacturers Association

MS 9154   NANOSTRUCTURED MATERIALS AND TECHNOLOGY

L T P C
3 0 0 3

AIM:
OBJECTIVE:

UNIT-I INTRODUCTION TO NANOMATERIALS **7**

Amorphous, Crystalline, microcrystalline, quasicrystalline and nanocrystalline materials - historical development of nanotechnology – Gleiter's Classification of Nanostructured materials – properly changes done to size effects, inverse Hall - Petch effects - polymeric nanostructures

UNIT-II ZERO DIMENSIONAL NANOMATERIALS **10**

Nano Particles – Properties – Processing – Liquid state processing - Sol-gel process, wet chemical synthesis – Vapour state processing – PVD, CVD, Aerosol processing, solid state processing – mechanical, mechanochemical synthesis – Application of nanoparticle. Quantum Dots – Quantum confinement – Pauli Exclusion Principle – Processing – Optical lithography – MOCVD – Droplet epitaxy - Applications.

UNIT-III ONE DIMENSIONAL NANOMATERIALS **10**

Carbon nanotubes – Old and new forms of carbon – Structure of CNT and classification – Processing – Solid carbon based production techniques – Gaseous carbon based production technique - growth mechanisms – Applications.
Nanowire – processing – vapour – liquid – solid growth (VLS technique) – Laser ablation – Oxide assisted growth – Vapour–Solid growth (VS growth) – carbo thermal reactions – Thermal evaporation – Temperature based synthesis – Electro spinning – Applications.

UNIT-IV SUPER HARD COATINGS AND BULK NANOSTRUCTURE FORMATION **9**

Superhard coating – types – characteristics – thermal stability – case studies (nc-TiN/a-Si_3N_4 coating) – Applications.

Buck nanostructure formation – Equal Channel angular pressing (ECAP) – High pressure torsion (HPT), Accumulative roll bending – Reciprocating extrusion compression, cyclic close die forging – Repetitive corrugation and straightening – Grain refinement mechanisms.

UNIT-V CHARACTERIZATION OF NANOMATERIALS   9
Nano indentation – Types of nanoindenter - Atomic force microscope (AFM) –– Electrostatic force mode (EFM) – Magnetic force mode (MFM) – Scanning Tunneling microscope (STM) - Scanning electron microscope (SEM) – Transmission electron microscope (TEM).

Total: 45

REFERENCE BOOKS:
1. Mark Ratner and Daniel Ratner, "Nano Technology", Pearson Education, New Delhi, 2003
2. G. Wilde, "Nanostructured Materials', Elsevier, 2008.
3. Bamberg,D., Grundman, M. and Ledentsov,N.N.," Quantum Dot Heterostructures", Wiley, 1999.
4. N John Dinardo," Nanoscale characterisation of surfaces & interfaces" , Weinheim Cambridge: Wiley-VCH, 2000 2nd ed
5. G Timp (ed)," Nanotechnology", AIP press/Springer, 1999.
6. Bhusan, Bharat (Ed)," Springer Handbook of Nanotechnology", 2nd edition, 2007.
7. Charles P. Poole Jr., Frank J. Ownes, 'Introduction to Nanotechnology", Wiley Interscience, 2003.

CI 9159   **RAPID PROTOTYPING**   **L T P C**
                                                                3 0 0 3

AIM:
To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields

OBJECTIVE:
Generating a good understanding of RP history, its development and applications. Expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.

UNIT-I INTRODUCTION   10
Pattern and prototype – Product design - features – Impact of Rapid Prototyping and tooling on product development – Benefits – Applications

UNIT-II RAPID PROTOTYPING PROCESSES   10
Introduction – Classification – Laminated object manufacturing – Fused deposition modeling – Sterolithography – Solid ground curing – Selective laser sintering - 3D printing.

UNIT-III CAD PROCESSES   10
Introduction – Data requirements – Solid modeling – Surface modeling – Geometric processing – Interface formats – Model preparation – Slicing, Support structures and machine instructions

UNIT-IV MATERIALS FOR RAPID PROTOTYPING **5**

Plastics – Resins – Metals – Ceramics – Biomedical materials, Selection of Materials for suitable processes – advantages – limitations

UNIT-V RAPID TOOLING PROCESSES **10**

Introduction – Classification – Indirect rapid tooling – Silicone rubber molding – epoxy molding – Electroforming – Vacuum casting – Vacuum forming – Direct Rapid tooling processes – SLS rapid tool – Shape deposition manufacturing – Laser deposition – Lamination – Rapid tooling roots.

Total: 45

References:

1. Paul F. Jacobs, "Rapid Prototyping and Manufacturing", Fundamentals of Sterolithography, SME, 1992.
2. "Rapid Prototyping Reports", CAD/CAM Publishing, 1991.
3. Ibrahim Zeid, "CAD/CAM theory and practice", Tata Mcgraw Hill, 1998.

CI 9114   ADVANCES IN MANUFACTURING TECHNOLOGY   L T P C
3 0 0 3

AIM: The aim of this course is to impart knowledge in various fields of advanced manufacturing technology

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

UNIT-I METAL CUTTING AND TOOL MATERIALS **12**

Orthogonal and oblique cutting - Types of tool wear, Abrasion, Diffusion, Oxidation, Fatigue and Adhesive wear - Prediction of tool life - Monitoring of tool wear, Cutting forces and vibration - Tool materials, Cemented carbide, Coated carbide, Cermets, Ceramic, CBN and PCD - Selection of machining parameters and Tools.

UNIT-II SPECIAL MACHINING **9**

Deep hole drilling - Gun drills - Gun boring - Trepanning - Honing - Lapping - Super finishing - Burnishing - Broaching - High speed machining.

UNIT-III UNCONVENTIONAL MACHINING **9**

Principles, processes, Various influencing parameters and Applications of Ultrasonic machining, Electro Discharge Machining, Electro Chemical Machining, Electron and Laser Beam Machining, Plasma Arc Machining and Water Jet Machining.

UNIT-IV RAPID PROTOTYPING **6**

Sterolithography - Laminated object manufacturing - selective laser sintering - Vacuum process casting – Resin injection - Applications of RPT - Micro finishing process.

UNIT-V ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS   9

Introduction - Pattern recognition - Control strategies - Heuristic search, Forward and Backward reasoning - Search algorithms - Game playing - Knowledge representation - structural representation of knowledge – Expert systems in manufacturing.

Total: 45

REFERENCE BOOKS:
1. Armarego E.J.A. and Brown R.H., "The machining of metals", Prentice Hall, 1982
2. Battacharya,"Theory of metal cutting", NCB Agency, 1984
3. HMT Manual, "Non-traditional machining methods", 1975
4. Rich E. and Knight K., "Artificial Intelligence", McGraw Hill Inc, 1991
5. Pham D.T., "Expert Systems in Engineering", IFS Publishers Springer-Verlag, 1988
6. Durvent W.R., "The Lithographic hand book", Narosa Publishers, 1995.
7. Pandey P.S. and Shah N. "Modern Manufacturing Processes", 1980.
8. Sadasivan T.A. and Sarathy D. "Cutting tools for Productive Machining", Widia (India) Limited, 1999.

WEB REFERENCES:
1. www.mfgtech.orog/publications/productivity-summary.pdf
2. www.mfgtech.org/publications/productivity-report.pdf

MS 9155   PROCESSING OF COMPOSITE AND POLYMER MATERIALS

L T P C
3 0 0 3

AIM: The aim is impart the students with knowledge of the polymers and advanced materials and its manufacturing

OBJECTIVE: At the end of this course the student should be able to understand the different types of polymers, ceramics and advanced composites and manufacturing methods, properties and applications in engineering industries

UNIT-I INTRODUCTION   9

Type of polymers – Polymerization – properties – methods of manufacturing – Deformation – processing of plastics - ceramics – properties – Raw materials – processing – Fibres – Glass, carbon - Ceramic and Aramid fibres – processing.

UNIT-II COMPOSITE MATERIALS   9

Definition – Types – properties – characteristics – reinforcement materials – particle, fiber, whiskers – properties – Matrix materials – polymers – metals - ceramics – characteristics – rule of mixture – laminates – Interlaminer stresses - fracture mechanics of composites.

UNIT-III   POLYMER MATRIX COMPOSITES   9

Processing - Processing of thermoset composites – processing of thermo plastic composites – interface in PMC – Applications.

UNIT-IV METAL MATRIX COMPOSITE   9

Types – Processing – Liquid state processing – solid state processing – Vapour state processing – Interface – properties.

UNIT-V CERAMIC MATRIX COMPOSITES   9

Processing – Hot pressing – Reaction bonding – Infiltration – DIMOX – CVD and CVI – Sol-gel – Interface of CMC – Properties – Applications**.**

Total:45

TEXT BOOK:

1. Krishnan K. Chawle. "Composite Material: Science and Engineering" Second Edition, Springer, 1998
2. T.W.Clyne, P.J. Withers, " An Introduction to metal matrix composites", Cambridge University Press,1993.

REFERENCE BOOKS:

1. B.T.Astrom, " Manufacturing of polymer composites", Champman & Hall,1997
2. S.C.Sharma, " Composite Materials", Narosa Publishing House,2000
3. Berins, ISBN 0442010699, "Design with Plastics and Plastic Engineering", Wiley & Sons Inc., 1995.
4. D. Huda, M.A. E1 Baradie and M.S.J. Hashmi, "Metal-matrix composites: Materials aspects-Part II", Journal of Materials Processing Technology, 37 (1993) 521-541.
5. D. Huda, M.A. E1 Baradie and M.S.J. Hashmi, "Metal-matrix composites: Manufacturing aspects-Part I", Journal of Materials Processing Technology, 37 (1993) 513 528.

IE 9159   **DECISION SUPPORT SYSTEMS**   **L T P C**
                                                           3 0 0 3
AIM:
OBJECTIVE:

UNIT-I DECISION MAKING   5

Managerial decision making, system modeling and support-preview of the modeling process-phases of decision making process.

UNIT-II MODELING AND ANALYSIS   12

DSS components- Data warehousing, access, analysis, mining and visualization-modeling and analysis-DSS development.

UNIT-III KNOWLEDGE MANAGEMENT   12

Group support systems- enterprise DSS- supply chain and DSS-knowledge management methods, technologies and tools.

UNIT-IV INTELLIGENT SYSTEMS   12

Artificial intelligence and expert systems-concepts, structure, types-knowledge acquisition and validation, knowledge representation.

UNIT-V IMPLEMENTATION   4

Implementation, integration and impact of management support systems.

REFERENCE BOOKS:
1. Efraim Turban and Jay E Aronson, Decision Support and Intelligent Systems, Pearson education Asia, Seventh edition, 2005.
2. Elain Rich and Kevin Knight, Artificial intelligence, TMH,2006.

ED 9164   DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS   L T P C
                                                                     3 0 0 3

AIM:

OBJECTIVE:

UNIT-I OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS   5
Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics.

UNIT-II CONTROL AND REGULATION ELEMENTS   12
Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems.

UNIT-III HYDRAULIC CIRCUITS   5
Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits - industrial circuits - press circuits - hydraulic milling machine - grinding, planning, copying, - forklift, earth mover circuits- design and selection of components - safety and emergency mandrels.

UNIT-IV PNEUMATIC SYSTEMS AND CIRCUITS   16
Pneumatic fundamentals - control elements, position and pressure sensing - logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods - step counter method - compound circuit design - combination circuit design.

UNIT-V INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS   7
Pneumatic equipments- selection of components - design calculations – application - fault finding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

                                                                    Total:45

REFERENCE BOOKS:
1. Antony Espossito, "Fluid Power with Applications", Prentice Hall, 1980.

2. Dudleyt, A. Pease and John J. Pippenger, "Basic fluid power", Prentice Hall, 1987.
3. Andrew Parr, "Hydraulic and Pneumatics" (HB), Jaico Publishing House, 1999.
4. Bolton. W., "Pneumatic and Hydraulic Systems ", Butterworth –Heinemann, 1997.
5. K.Shanmuga Sundaram, "Hydraulic and Pneumatic Controls: Understanding made Easy" S.Chand & Co Book publishers, New Delhi, 2006 (Reprint 2009).

MS 9156   SIX SIGMA AND LEAN   MANUFACTURING   L T P C
3 0 0 3

AIM:

OBJECTIVE:

UNIT-I LEAN MANUFACTURING AND SIX SIGMA – OVERVIEW   2
Evolution of Lean; Traditional versus Lean Manufacturing; Business of Survival and Growth; Business Model Transformation; Ford Production System; Job Shop Concepts Concept of Lean; Toyota's foray in Lean;

UNIT-II SYSTEM DESIGN -   VALUE STREAM MANAGEMENT   12
Definition; VSM Types;Product Family Selection; Value Stream Manager;Current State Map; Process Box; Value Stream Icons; 3 Ms - Muda, Mura, Muri - 7 Types of Muda; Future State Map;Value Stream Plan; Process Stability - Loss Reduction 7 Major Losses Reduction.

Demand Stage :Market Dynamics; Customer Demand;PQ Analysis; PR Analysis; TAKT Time; Pitch; Finished Goods Stock; Cycle Stock; Buffer Stock; Safety Stock.

UNIT-III SYSTEM IMPLEMENTATION   12
Flow Stage : Continuous Flow; Cell Layout; Line Balancing; Macro and Micro Motion Analysis; Standardised Work; Concept of Kaizen; Steps involved in Kaizen Deployment; Industrial Engineering - Concepts and Fundamentals; Kanban Concepts ; Types of Kanbans ; and Practical Application ; Concept of Pull; Changeover Time Reduction - External & Internal Single Minute Exchange of Die; Quick Die Change; Quality-Vendor,In Process and Customer Line ; Concept of PPM; Pokayoke; Prevention & Detection Types; Maintenance - Preventive, Time Based and Condition Based; Human Development for Lean (Training and Involvement through Autonomous Maintenance)
Leveling Stage of Lean Implementation : Production Leveling ; Leveling Box; Concept of Water Spider.

UNIT-IV LEAN METRICS AND LEAN SUSTENANCE   7
Identify Lean Metrics; Steps involved in Goal Setting; Corporate Goals; Kaizen Cloud identification in VSM ; Lean Assessment.
Cultural Change; Reviews; Recognition; Improving Targets and Benchmarks;

UNIT-V SIX SIGMA AND DMAIC TOOLS   12
Project charter, stakeholder analysis, SIPOC, Voice of the customer, Rolled throughput yield, KANO Models, CTQ Tree, Process Mapping
Data collection, measurement system analysis, sampling plans, process capability, cost of poor quality (COPQ), FMEA

Regression Analysis, cause & effect diagram, Hypothesis testing, Design of experiments, Response Surface methodology, Poka-yoke, Quality Control, Control charts.

Total: 45

REFERENCE BOOKS:
1. The ultimate six sigma by Keki R. Bhote, Prentice hall India
2. Rath & Strong's Six sigma pocket guide.
3. Value Stream Management by Don Tapping, Tom Luyster and Tom Shuker
4. Your Lean Future State by Tom Luyster
5. Creating Continuous Flow by Mike Rother and Rick Harris
6. Making Materials Flow by Rick Harris, Chris Harris & Earl Wilson

Since the above books are purely of Management category related to the Manufacturing sector of Global perspective, they could be sourced only through select channels of publications. All the books are published through Productivity Press, New York. With respect to Indian market the distributors are K K Books, Nr 20 Thanickhachalam Road, T Nagar, Chennai – 17 Tel : 0 4 4 2 4 3 4 4 5 1 9

CI 9122   MECHATRONICS IN MANUFACTURING SYSTEMS   L T P C
                                                                                                3 0 0 3

AIM: To impart knowledge in the inter disciplinary field of Mechatronics as related to Manufacturing.

OBJECTIVE: This syllabus is formed to create knowledge in Mechatronic systems and impart the source of concepts and techniques, which have recently been applied in practical situation. It gives a framework of knowledge that allows engineers and technicians to develop an interdisciplinary understanding and integrated approach to engineering.

UNIT-I INTRODUCTION   5
Mechatronics definition - Systems- Need for Mechatronics - Emerging area of Mechatronics - Classification of Mechatronics - Measurement Systems - Control Systems.

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

                                                                                                        12
UNIT-III ACTUATORS
Actuators – Mechanical - Electrical - Fluid Power - Piezoelectric – Magnetostrictive - Shape memory alloy - applications - selection of actuators.

UNIT-IV PROGRAMMABLE LOGIC CONTROLLERS   8
 Introduction - Basic structure - Input and output processing - Programming - Mnemonics- Timers, counters and internal relays - Data handling - Selection of PLC.

UNIT-V DESIGN AND MECHATRONICS CASE STUDIES   8

Designing - Possible design solutions-Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot - Conveyor based material handling system - PC based CNC drilling machine – Mechatronic control in automated manufacturing - Data acquisition Case studies.

Total: 45

TEXT BOOK

1. Bolton.W, "Mechatronics" , Pearson education, second edition, fifth Indian Reprint, 2003
2. Smaili.A and Mrad.F , "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008

REFERENCE BOOKS:

1. Devadas Shetty and Richard A.Kolk, "Mechatronics systems design", PWS Publishing company, 2007.
2. Godfrey C. Onwubolu, "Mechatronics Principles and Applications", Elsevier, 2006.
3. Nitaigour Premchand Mahalik, "Mechatronics Principles, Concepts and Applicatlions" Tata McGraw-Hill Publishing company Limited, 2003.
4. Michael B.Histand and Davis G.Alciatore," Introduction to Mechatronics and Measurement systems". McGraw Hill International edition, 1999.
5. Bradley D.A, Dawson.D, Buru N.C and Loader A.J, "Mechatronics" Nelson Thornes ltd, Eswar press, Indian print, 2004.

MS 9157   MODERN TECHNIQUES OF MATERIALS CHARACTERISATION
L T P C
3 0 0 3

AIM:

OBJECTIVE: Characterisation of materials is very important for studying the structure of materials and to interpret their properties

UNIT-I METALLOGRAPHIC TECHNIQUES   8

Specimen preparation techniques, components of microscope, Resolution, depth of focus, polarized light, phase contrast, differential interference microscopy, hot stage and quantitative metallographic techniques

UNIT-II X-RAY DIFFRACTION TECHNIQUES   12

Crystallography basics, characteristic spectrum, Bragg's law, Diffraction methods – Laue, rotating crystal and powder methods. Intensity of diffracted beams –structure factor calculations and other factors. Cameras- Laue, Debye-Scherer cameras, Seeman-Bohlin focusing cameras. Diffractometer – general feature and optics, proportional, scintillating and Geiger counters.

UNIT-III APPLICATION OF X-RAY DIFFRACTION   9

Determination of crystal structure, lattice parameter, phase diagram and residual stress – quantitative phase estimation, ASTM catalogue of Materials identification

UNIT-IV ELECTRON MICROSCOPY   **8**

Construction and operation of Transmission electron microscope – Selected Area Electron Diffraction and image formation, specimen preparation techniques. Construction, modes of operation and application of Scanning electron microscope, Energy Dispersive Spectroscopy, Electron probe micro analysis (EPMA), Scanning Tunnelling Microscope (STM) and Atomic Force Microscope

UNIT-V CHEMICAL AND THERMAL ANALYSIS   **8**

Basic principles, practice and applications of X-ray spectrometry, Wave dispersive X- ray spectrometry, Auger spectroscopy, Secondary ion mass spectroscopy – proton induced X-ray Emission spectroscopy, Differential thermal analysis, differential scanning calorimetry DSC and thermogravimetric analysis TGA

        Total: 45

TEXTBOOKS:

1. Cullity, B. D.," Elements of X-ray diffraction", Addison-Wesley Company Inc., New York, 3rd Edition, 2000.
2. Cherepin and Malik, "Experimental Techniques in Physical Metallurgy", Asia Publishing Co. Bombay, 1968.

REFERENCE BOOKS:

1. Brandon D. G, "Modern Techniques in Metallography", Von Nostrand Inc NJ, USA, 1986..
2. Thomas G., "Transmission electron microscopy of metals", John Wiley, 1996.
3. Weinberg, F., "Tools and Techniques in Physical Metallurgy", Volume I & II, Marcel and Decker, 1970

CI 9171   MANUFACTURING INFORMATION SYSTEM   L T P C
                                                 3 0 0 3

AIM : To impart the knowledge in manufacturing information system.

OBJECTIVE: On completion of this course, the students are expected to be conversant with order policies, data base terminologies, designing, manufacturing considerations and information system for manufacturing.

UNIT-I INTRODUCTION   **5**

The Evolution of order policies, from MRP to MRP II, the role of Production organization, Operations control.

UNIT-II DATABASE   **7**

Terminologies – Entities and attributes – Data models, schema and subschema - Data Independence – ER Diagram – Trends in database.

UNIT-III DESIGNING DATABASE   **13**

Hierarchical model – Network approach- Relational Data model concepts, principles, keys, relational operations – functional dependence – Normalization types – Query languages.

UNIT-IV MANUFACTURING CONSIDERATION   10
product and its structure, inventory and process flow – Shop floor control Data structure and procedure – various model – the order scheduling module Input/output analysis module the stock status database – the complete IOM database.

UNIT-V INFORMATION SYSTEM FOR MANUFACTURING   10
Parts oriented production information system – concepts and structure –Computerized production scheduling, online production control systems, Computer based production management system, computerized manufacturing information system – case study

                                                                    Total: 45

TEXT BOOKS:
1. Luca G.Sartori, "Manufacturing Information Systems", Addison-Wesley Publishing Company, 1988.
2. Date.C.J.,"An Introduction to Database Systems" Addison Wesley, 8th Edn,. 2003.
3. Orlicky.G., "Material Requirements Planning", McGraw-Hill, 1994

MS 9158	**MANUFACTURING MANAGEMENT**	**L T P C**
		3 0 0 3

AIM: To Understand the importance of operations management in manufacturing management

OBJECTIVE: To impart trough knowledge in layout planning, forecasting, production planning, inventory control & maintenance system and thereby by effective utilization of resources in manufacturing system.

UNIT-I FACILITY, CAPACITY AND LAYOUT PLANNING   9
Facility planning - factors affecting selection of plant location, plant design, plant layout, criteria for good layout. Capacity planning- analysis of designed capacity, installed capacity, commissioned capacity, utilized capacity, factors affecting productivity. Facility layout planning – Assignment model, load distance analysis, closeness ratings.

UNIT-II DEMAND FORECASTING AND PROJECT MANAGEMENT   10
Demand forecasting – Quantitative and qualitative techniques, measurement of forecasting errors, numerical problems. Project management – its role in functional areas of management, network diagrams, CPM and PERT techniques, crashing, resource levelling and resource smoothing.

UNIT-III PRODUCTION PLANNING AND CONTROL   9
Steps in PPC process mapping, preparation of process mapping and feedback control for effective monitoring. Aggregate production planning, production planning strategies, Disaggregating the aggregate plan, Materials Requirement Planning (MRP), MRP-II, Supply chain management, Operation scheduling, prioritization.

UNIT-IV INVENTORY PLANNING AND CONTROL   8
EOQ models- with and without shortages, price breaks, effect of quantity discount – selective inventory control techniques – ABC, FSN, VED etc. Types of inventory control – Perpetual, two-bin and periodic inventory system – JIT.

UNIT-V MAINTENANCE SYSTEM   8

Maintenance strategies and planning – quantitative analysis, optimal number of machines/crew size, Replacement strategies and policies – economic service life, opportunity cost, replacement analysis using specific time period, spares management.

Total: 45

REFERENCE BOOKS:

1. S.N.Chary, Production and Operations management, 3rd edition, SIE, TMH2007.
2. R.Pannererselvam, Production and operations management, 2nd edition PHI, 2008.
3. James.B.Dilworth, Operations management-Design, planning and control for manufacturing and services, Mc.Graw hill ,Inc Management series 1992
4. Melnyk.Denzler, Operations management-A value drive approach,Irwin Mcgrawhill 1996.
5. Lee.J.Krajewski, L.P.Ritzman, M.K.Malhothra, Operations management – Process and value chains -8th edition,PHI,2007.
6. R.B.Chase, N.J.Aquilano, F.R.Jacobs, Operations management – for competitive advantage , 11th edition SIE, TMH 2007.
7. Kanishka Bedi, Production and Operations management, 2nd edition, Oxford higher education 2007.

MS 9159   MATERIALS HANDLING SYSTEM AND DESIGN   L T P C
                                                                3 0 0 3

AIM: To understand the importance of material handling system and its design in systems management.

OBJECTIVE: To introduce the concepts of layout planning and the various algorithms used in and also to introduce the design of material handling systems, mechanized assembly, hoppers and feeders and transfer systems.

UNIT-I MATERIALS HANDLING EQUIPMENT   7

The Material Handling Function. Types of Material Handling Systems.
Selection and Applications
Analysis of Material Handling Equipment.
Economic Analysis of Material Handling Equipments: Breakeven Analysis – Equipment Operating Cost Per Unit Distance – Work Volume Analysis – Illustrative Problems. Productivity/Indicator Ratios.

UNIT-II DESIGN OF HOISTS AND HOISTING GEAR   15

Design of hoisting elements: Welded and roller chains – Hemp and wire ropes – Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks – crane grabs – lifting magnets - Grabbing attachments – Design of arresting gear – Brakes: shoe, band and cone types.Hand and power drives – Traveling gear – Rail traveling mechanism – cantilever and   Monorail cranes – slewing, jib and luffing gear – cogwheel drive – selecting the motor ratings.

UNIT-III CONVEYORS 7

Types – description – design and applications of Belt conveyors, apron conveyors and escalators, Pneumatic conveyors, Screw conveyors and vibratory conveyors, AGV Systems, AS/RS Systems, Carousel Storage Systems & WIP Storage Systems.

UNIT-IV ELEVATORS 7

Bucket elevators: design – loading and bucket arrangements – Cage elevators – shaft way, guide, counter weights, hoisting machine, safety devices – Design of   form lift trucks.

UNIT-V MECHANIZED ASSEMBLY 9

Principles and Operating Characterstics of Part Feeders such as Vibratory Bowl Feeder, Reciprocating Tube Hopper, Centrifugal Hopper Feeder and Center Board hopper feeder – Orientation of Parts – In-bowl and Out-of-bowl tooling – Different Types of Escapments Transfer Systems and Indexing Mechanisms.
Packaging: Functions – Materials – Palletizing – Packaging Equipments.

Total: 45

REFERENCE BOOKS:
1. Rudenko, N., "Materials handling equipment", Elnvee Publishers, 1970
2. Material Handling, John R. Immer, McGraw Hill Book Coy, 1953
3. Materials Management & Materials Handling, Sharma S. C., Khanna Publishers, New Delhi.
4. Spivakovsy, A.O., and Dyachkov, V.K., "Conveying Machines", Volumes I and II, MIR Publishers, 1985.
5. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.
6. Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.

MS 9159   MATERIALS HANDLING SYSTEM AND DESIGN   3   0   0   3
AIM: To understand the importance of material handling system and its design in systems management.

OBJECTIVE: To introduce the concepts of layout planning and the various algorithms used in and also to introduce the design of material handling systems, mechanized assembly, hoppers and feeders and transfer systems.

UNIT-I   MATERIALS HANDLING EQUIPMENT   7

The Material Handling Function. Types of Material Handling Systems. Selection and Applications
Analysis of Material Handling Equipment.
Economic Analysis of Material Handling Equipments: Breakeven Analysis – Equipment Operating Cost Per Unit Distance – Work Volume Analysis – Illustrative Problems. Productivity/Indicator Ratios.

UNIT-II   DESIGN OF HOISTS AND HOISTING GEAR   15

Design of hoisting elements: Welded and roller chains – Hemp and wire ropes – Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks – crane grabs – lifting magnets - Grabbing attachments – Design of arresting gear – Brakes: shoe, band and cone types.Hand and power drives – Traveling gear – Rail traveling mechanism – cantilever and   Monorail cranes – slewing, jib and luffing gear – cogwheel drive – selecting the motor ratings.

UNIT-III   CONVEYORS   7

Types – description – design and applications of Belt conveyors, apron conveyors and escalators, Pneumatic conveyors, Screw conveyors and vibratory conveyors, AGV Systems, AS/RS Systems, Carousel Storage Systems & WIP Storage Systems.

UNIT-IV   ELEVATORS   7

Bucket elevators: design – loading and bucket arrangements – Cage elevators – shaft way, guide, counter weights, hoisting machine, safety devices – Design of   form lift trucks.

UNIT-V   MECHANIZED ASSEMBLY   9

Principles and Operating Characterstics of Part Feeders such as Vibratory Bowl Feeder, Reciprocating Tube Hopper, Centrifugal Hopper Feeder and Center Board hopper feeder – Orientation of Parts – In-bowl and Out-of-bowl tooling – Different Types of Escapments Transfer Systems and Indexing Mechanisms.
Packaging: Functions – Materials – Palletizing – Packaging Equipments.

Total: 45

REFERENCES

1   Rudenko, N., "Materials handling equipment", Elnvee Publishers, 1970
2   Material Handling, John R. Immer, McGraw Hill Book Coy, 1953
3   Materials Management & Materials Handling, Sharma S. C., Khanna
        Publishers, New Delhi.
4   Spivakovsy, A.O., and Dyachkov, V.K., "Conveying Machines", Volumes I
        and II, MIR Publishers, 1985.

5   Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.
6   Boltzharol, A., Materials Handling Handbook, The Ronald Press Company,
        1958.