AFFILIATED INSTITUTIONS

ANNA UNIVERSITY, CHENNAI

REGULATIONS -2009

CURRICULUM II TO IV SEMESTERS (FULL - TIME)

M.E. – INDUSTRIAL ENGINEERING

SEMESTER II

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
IE 9321	Modelling and Simulation in Manufacturing	3	0	0	3
IE 9322	Quality Engineering	3	0	0	3
IE 9323	Engineering Optimisation : Theory and applications	3	0	0	3
E1**	Elective I	3	0	0	3
E2**	Elective II	3	0	0	3
E3**	Elective III	3	0	0	3
PRACTICALS					
IE 9328	Seminar II	0	0	2	1
	TOTAL	**18**	**0**	**2**	**19**

SEMESTER III

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
E4**	Elective IV	3	0	0	3
E5**	Elective V	3	0	0	3
E6**	Elective VI	3	0	0	3
IE 9331	Project Work (Phase I)	0	0	12	6
	TOTAL	**9**	**0**	**12**	**15**

SEMESTER IV

COURSE CODE	COURSE TITLE	L	T	P	C
THEORY					
IE 9341	Project Work (Phase II)	0	0	24	12
	TOTAL	**0**	**0**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE : 67

LIST OF ELECTIVES

COURSE CODE	COURSE TITLE	L	T	P	C
CI9269	Lean Manufacturing	3	0	0	3
IE 9002	Management Information Systems	3	0	0	3
IE 9004	Occupational Safety and Health Engineering	3	0	0	3
IE 9005	Concurrent Engineering	3	0	0	3
IE 9007	Value Analysis and Engineering	3	0	0	3
IE 9008	Maintenance Management	3	0	0	3
IE 9009	Flexible Manufacturing Systems	3	0	0	3
IE 9010	Marketing Management	3	0	0	3
IE 9011	Intelligent Manufacturing Systems	3	0	0	3
IE 9012	Total Productivity Maintenance	3	0	0	3
IE 9013	Data Structures and Computing	3	0	0	3
IE 9014	Facilities Planning and Design	3	0	0	3
IE 9015	Robust Design	3	0	0	3
IS9325	Reliability Engineering	4	0	0	4
MF9252	Design for Manufacture and Assembly	3	0	0	3

IE 9321 MODELING AND SIMULATION IN MANUFACTURING L T P C
3 0 0 3

UNIT I MANUFACTURING SYSTEMS AND MODELS 8

Types and principles of manufacturing systems, types and uses of manufacturing models, physical models, mathematical models, model uses, model building

UNIT II MATERIAL FLOW SYSTEMS 10

Assembly lines-Reliable serial systems, approaches to line balancing, sequencing mixed models. Transfer lines and general serial systems – paced lines without buffers, unplaced 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

UNIT III SUPPORTING COMPONENTS AND SYNCHRONOUS MANUFACTURING: 10

Machine setup and operation sequencing-integrated assignment and sequencing. Material handling systems-conveyor analysis, AGV systems. Warehousing-storage and retrieval systems, order picking. Synchronization Vs Optimization, defining the structure, identifying the constraint, exploitation, buffer management.

UNIT IV GENERIC MODELING APPROACHES: 8

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

UNIT V PETRI NETS 9

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

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Ronald G Askin, “Modeling and Analysis of Manufacturing Systems”, John Wiley and Sons, Inc, 1993
2. Mengchu Zhou, “Modeling, Simulation, and Control of Flexible Manufacturing Systems: A Petri Net Approach”,World secientific Publishing Company Pvt Ltd., 2000
3. Jean Marie Proth and Xiaolan Xie, “ Petri Nets: A Tool for Design and Management of Manufacturing Systems”, John Wiley and Sons, New York, 1996.

REFERENCES:

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

IE9322 QUALITY ENGINEERING L T P C
3 0 0 3

UNIT I INTRODUCTION TO QUALITY ENGINEERING AND LOSS FUNCTION 9

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. 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

UNIT II ON-LINE QUALITY CONTROL 9

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.

UNIT III ON-LINE QUALITY CONTROL ATTRIBUTES AND METHODS FOR PROCESS IMPROVEMENTS 9

Checking intervals- frequency of process diagnosis. Production process improvement method- process diagnosis improvement method- process adjustment and recovery improvement methods.

UNIT IV QUALITY ENGINEERING AND TPM 9

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.

UNIT V SIX SIGMA AND ITS IMPLEMENTATION 9

Introduction- definition-methodology- impact of implementation of six sigma-DMAIC method-roles and responsibilities –leaders, champion, black belt, green belts. Do's and dont's - readiness of organization – planning-management role- six sigma tools – sustaining six sigma.

TOTAL : 45 PERIODS

REFERENCES :

1. De Feo J A and Barnard W W, "Six Sigma: Breaktrough and Beyond", Tata McGraw-Hill, NewDelhi, 2005.
2. 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.

IE 9323 ENGINEERING OPTIMIZATION - THEORY AND APPLICATIONS **L T P C 3 0 0 3**

UNIT I NONLINEAR OPTIMIZATION 9

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.

UNIT II CONSTRAINED NONLINEAR OPTIMIZATION 9

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

UNIT III INTEGER PROGRAMMING 9

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

UNIT IV NON TRADITIONAL OPTIMIZATION – I 9

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 9

Introduction to Genetic Algorithms, Ant Colony Algorithm, Particle Swarm Algorithm, Hybrid Algorithms, Simple Applications.

TOTAL : 45 PERIODS

REFERENCES:

1. Singiresu S Rao, "Engineering Optimization: Theory and Practice", Wiley,Interscience, 3rd Edition,1996.
2. Kalyanmoy Deb, " Optimization for engineering design", Prentice Hall India (Pvt) Ltd., New Delhi, 2000.

IE 9331	**PROJECT WORK PHASE I**	**L T P C** **0 0 12 6**

IE 9341	**PROJECT WORK PHASE II**	**L T P C** **0 0 24 12**

CI9269	**LEAN MANUFACTURING**	**L T P C** **3 0 0 3**

AIM:

The aim is to appreciate the students with the background, applications and current status of lean manufacturing and to make them understand the relevant basic principles in this field.

OBJECTIVES:

At the end of this course the students are expected to understand the general issues relating to lean manufacturing.

UNIT I INTRODUCTION 9

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

UNIT II STABILITY OF LEAN SYSTEM 9

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

UNIT III JUST IN TIME 9

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

UNIT IV JIDOKA (AUTOMATION WITH A HUMAN TOUCH) 9

Jidoka concept – Poka-Yoke (mistake proofing) systems – Inspection systems and zone control – Types and use of Poka-Yoke systems – Implementation of Jidoka.

UNIT V WORKER INVOLVEMENT AND SYSTEMATIC PLANNING METHODOLOGY 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Pascal Dennis, Lean Production Simplified: A Plain-Language Guide to the
2. World's Most Powerful Production System, (Second edition), Productivity Press, New York, 2007.
3. Mike Rother and John Shook, Learning to See: Value Stream Mapping to Add

4. Value and Eliminate MUDA, Lean Enterprise Institute, 1999.

REFERENCES:

1. Jeffrey Liker, The Toyota Way : Fourteen Management Principles from the World's Greatest Manufacturer,McGraw Hill, 2004.
2. Michael L. George, Lean Six SIGMA: Combining Six SIGMA Quality with Lean Production Speed,McGraw Hill, 2002.
3. Taiichi Ohno, Toyota Production System: Beyond Large-Scale Production,Taylor & Francis, Inc., 1988.

IE9002 MANAGEMENT INFORMATION SYSTEMS L T P C

3 0 0 3

UNIT I INTRODUCTION MIS AND DECISION MAKING PROCESS 10

Definitions **–** management information system, elements of management information system – information –data, **i**nformation, knowledge, quality and value of information. 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.

UNIT II ORGANIZATIONAL SYSTEMS AND MANAGEMENT 9

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.

UNIT III INFORMATION TECHNOLOGY AND INFORMATION SYSTEMS DEVELOPMENT 9

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

UNIT IV INFORMATION SYSTEMS AND MANUFACTURING INFORMATION SYSTEM 9

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

UNIT V QUALITY ASSURANCE, SECURITY AND ETHICS 8

Concepts of quality in information systems – quality assurance for applications – quality assurance with user-developed systems – computer crime – computer security – information system ethics.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Davis G B and Olson M H, "Management Information Systems; Conceptual Foundations, Structure and Development", McGraw Hill Company, New York, Second Edition, 1984.
2. Jessup L and Valacich J, "Information Systems Today", Prentice Hall of India Pvt Ltd, 2003.

REFERENCES :

1. 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.
2. Henry C Lucas Jr., "The Analysis, Design and Implementation of Information Systems", McGraw Hill Company, New York, Fourth Edition, 1992.
3. Burch J E, Strater F R and Grudnikski G, "Information Systems: Theory and Practice", John Wiley and Sons, New York, 1987.
4. Leon Alexis, "Enterprise Resource Planning", Tata McGraw Hill Company, New Delhi, 1999.
5. Kenneth C Laudon, Jane P Laudon, "Management Information Systems", Prentice Hall Inc., 1999.
6. Ivica Crnkovic, Aunita Persson Dahlquist and Ulf Asklund, "Implementing and Integrating Product Data Management and Software Configuration Management", Artech House, 2003.

IE 9004 OCCUPATIONAL SAFETY AND HEALTH ENGINEERING L T P C
3 0 0 3

UNIT I PHYSICAL HAZARDS 9

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

UNIT II CHEMICAL HAZARDS 9

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

UNIT III BIOLOGICAL AND ERGONOMICAL HAZARDS 9

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.

UNIT IV OCCUPATIONAL HEALTH AND TOXICOLOGY 10

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

UNIT V OCCUPATIONAL PHYSIOLOGY 8

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.

TOTAL : 45 PERIODS

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

IE 9005 CONCURRENT ENGINEERING L T P C
3 0 0 3

UNIT I CONCURRENT ENGINEERING 9

Introduction - basic concepts - traditional Vs concurrent approach - schemes and tools of concurrent engineering - application of computers in the practice of concurrent engineering.

UNIT II BASIC PROCESS ISSUES 9

Process models - types - importance. Relation between models, specifications, technology, automation and process improvement. Fabrication processes - assembly processes - models of manufacturing, testing and inspection.

UNIT III CONCURRENT ENGINEERING APPROACH IN MANUFACTURING SYSTEMS 9

System design procedure - features - intangibles - assembly resource alternatives - task assignment - tools and tool changing - material handling alternatives.

UNIT IV CONCURRENT AUTOMATED FABRICATION SYSTEMS 9

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.

UNIT V ECONOMIC ANALYSIS OF SYSTEMS: 9

Types of manufacturing cost - pro-forma, cash-flow, determining allowable investment - evaluation of investment alternatives - sensitivity analysis - effect of recycling and rework. Case studies of concurrent engineering practice.

TOTAL : 45 PERIODS

TEXT BOOKS:

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 Anderson and Philip M Wilze, "Computer Integrated Design and Manufacturing", McGraw Hill International Edition, 1991.

REFERENCE :

1. Proceedings of the "Summer School on Applications of Concurrent Engineering to Product Development" held at PSG College of Technology, May 1994.

IE 9007 VALUE ANALYSIS AND ENGINEERING L T P C
3 0 0 3

UNIT I CONCEPTS 9

Introduction – status of VE in India and origin country – impact of VE application – types of values – types of function – function identification on product – function matrix – function analysis – elements of costs – calculation of costs – cost allocation to function – evaluation of worth in VE methodology

UNIT II TECHNIQUES 9

General techniques: brain storming – godson feasibility ranking – morphological analysis – ABC analysis – probability approach – make or buy. Function – cost-worth analysis – function analysis – system techniques – function analysis matrix – customer oriented FAST diagram – fire alarm – Langrange plan – evaluation methods – matrix in evaluation – break even analysis.

UNIT III TEAM APPROACH IN VE 9

Team structure – team building – selection of reconsultant – starting training – selection of remembers – conduct of VE project study – task flow diagram – pre-study phase – workshop phase- host study phase.

UNIT IV COST MODELS 9

Matrix cost models – functional cost models – uses of project models – life cost – purpose and implication of LCC – economic principles of LCC – types of LCC – steps in LCC – case study

UNIT V VALUE ENGINEERING IN JOB PLAN 9

Orientation phase – information phase – functional analysis – creative phase – evaluation phase – recommendation phase – implementation phase – audit phase**.** Value engineering Case studies

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Richard J Park, "Value Engineering – A plan for inventions", St.Lucie Press, London, 1998
2. Mukhophadhyaya A K, "Value Engineering", Sage Publications Pvt. Ltd., New Delhi, 2003

REFERENCES :

1. Larry W Zimmesman. P E , "VE –A Practical approach for owners designers and contractors", CBS Publishers, Delhi, 1992
2. Arthus E Mudge, "Value Engineering", McGraw Hill book company, 1971.

IE9008 MAINTENANCE MANAGEMENT L T P C
3 0 0 3

UNIT I MAINTENANCE CONCEPT 7

Maintenance objectives and functions – Tero technology – Five zero concept – Maintenance costs and budgets – Maintenance organization.

UNIT II FAILURE DATA ANALYSIS 9

MTBF, MTTF, useful life – Survival curves – repair time distribution – exponential, Poisson, normal, Weibull applications – Standby systems - Availability of repairable systems – Maintainability prediction – Design for maintainability.

UNIT III MAINTENANCE MODELS 10

Maintenance policies – Imperfect maintenance – concept of minimal repair – Statistical aids for PM and break-down maintenance – PM schedules: deviations on both sides of target values – PM schedules for functional characteristics and large scale system – replacement models – DOM, opportunistic maintenance – Inspection and repair - Spare parts management.

UNIT IV TOTAL PRODUCTIVE MAINTENANCE 10

TPM philosophy – Policy and objectives – Pillars - Zero breakdown – loss prevention – Overall Equipment Effectiveness (OEE) – Failure Mode Effect Analysis (FMEA) – Risk Priority Number (RPN).

UNIT V ADVANCED TECHNIQUES 9

Condition monitoring: WDM, Vibration and corrosion monitoring – Signature analysis – MMIS – Expert systems – Reliability centered maintenance (RCM).

TOTAL : 45 PERIODS

REFERENCES:

1. Gopalakrishnan, P. Banerji, A.K. “Maintenance and spare parts management”, Prentice Hall of India, 1991.
2. Edward Hartmann, “Maintenance Management” Productivity and Quality publishing Pvt.Ltd. Madras, 1995.
3. Seiichi Nakagima, “Introduction to Total Productive Maintenance” Productivity Press (India) PVt.Ltd, 1993.

IE9009 FLEXIBLE MANUFACTURING SYSTEMS L T P C
3 0 0 3

UNIT I DEVELOPMENT AND IMPLEMENTATION OF AN FMS 9

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. Planning phases - integration - system configuration - FMS layouts - simulation - FMS project development steps. Project management - equipment development - host system development - planning - hardware and software development.

UNIT II AUTOMATED MATERIAL HANDLING AND STORAGE 9

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.

UNIT III MODELLING AND ANALYSIS OF FMS 9

Types of analysis: queuing- single server, multiple servers, queue disciplines, markovian queing models. Simulation and Petri net modelling techniques. Economic and technological justification for FMS

UNIT IV DISTRIBUTED NUMERICAL CONTROL AND PROGRAMMABLE CONTROLLERS 9

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.

UNIT V PROCESS PLANNING AND RECONFIGURABLE MACHINES AND SYSTEMS 9

Approaches to process planning, study of a typical process planning, manufacturing planning and control, overview of production control.Challenges, enabling technologies for reconfiguration– system level design issues in RMS – reconfigurable machines.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Parrish D J, “Flexible Manufacturing”, Butter Worth Heinemann Ltd, Oxford, 1993.
2. Groover M.P, “ , Production Systems and Computer Integrated Manufacturing”, Prentice Hall India (P) Ltd, 1989.
3. Tien-Chien chang, Richard A Wysk, “An Introduction to Automated Process Planning Systems”, Prentice Hall, Inc., Englewood cliffs, New Jersey, 1985

REFERENCES:

1. Considine D M and Considine G D, “Standard Handbook of Industrial Automation”, Chapman and Hall, London, 1986.
2. Viswanadham N and Narahari Y, “Performance Modeling of Automated Manufacturing Systems”, Prentice Hall India (P) Ltd, 1992.
3. Ranky P G, “The Design and Operation of FMS”, IFS Pub. UK, 1988.

IE9010 MARKETING MANAGEMENT L T P C
3 0 0 3

UNIT I ROLE OF MARKETING IN ORGANISATIONS 7

Core concepts of marketing, product concept, selling concept and marketing concept, marketing process, analyzing market opportunities, designing marketing strategies, planning marketing programmes, organizing, implementing and controlling the marketing effort, marketing planning, current marketing situation, opportunity and issue analysis, action programmes, profit and loss statement.

UNIT II MEASURING AND FORECASTING MARKET DEMANDS 8

Concepts in demand measurement, estimating current demand, estimating future demand, market segmentation, general approach to segmenting a market, patterns of market segmentation, market segmentation procedures, base for segmenting customer markets and industrial markets, market targeting - evaluating the market segments, selecting the market segmens; Trend forecasting.

UNIT III LAUNCHING NEW PRODUCTS AND SERVICES 7

New product development, effective organisational arrangements, idea generation, idea screening, concept development and testing, product development, market testing, commercialisation, consumer adoption process, product life cycle - introductory stage, growth stage, maturity stage and decline stage.

UNIT IV PLANNING MARKETING PROGRAMMES 8

Managing product lines, brands and packaging, product mix decisions, product line decisions, brand decisions, packaging and labeling decisions, managing service businesses and ancillary services - classification of services, marketing strategies for service firms, managing product support services, pricing strategies and programs - setting the price, adapting the price, initiating and responding to price changes.

UNIT V MANAGING MARKETING CHANNELS, COMMUNICATION AND PROMOTION-MIX STRATEGIES 10

Nature of marketing channels, channel design decision, channel management decisions, channel dynamics, channel co-operation, conflict and competition, retailing, wholesaling and distribution systems, nature and importance of retailing, types of retailers, wholesaling, physical distribution. The communication process, steps in developing effective communication, measuring promotion results, managing the sales force, designing the sales force, principles of personal selling.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Philip Kotler, "Marketing Management Analysis, Planning, Implementation and Control", Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
2. Ramanuj Majundar ,"Marketing Research", Wiley Eastern Ltd, 1991.

REFERENCES:

1. Stanton and William., "Fundamentals of Marketing", McGraw Hill, Tokyo, 1995.
2. Boyd and Kapoor, "Readings in Marketing Management", McGraw Hill Book Co. Ltd., 1989.
3. Ekzel M J and Walkar B J, "Marketing", McGraw Hill, 1997.

IE 9011 INTELLIGENT MANUFACTURING SYSTEMS L T P C
3 0 0 3

UNIT I HUMAN AND MACHINE INTELLIGENCE 9

Concepts of fifth generation computing - Programming in AI environment, developing artificial intelligence system, natural language processing, neural networks.

UNIT II KNOWLEDGE REPRESENTATION FOR SMART SYSTEMS 9

Forward chaining, backward chaining, use of probability and fuzzy logic. Semantic nets-structure and objects, ruled systems for semantic nets; certainty factors, automated learning.

UNIT III LANGUAGES USED IN AI AND EXPERT SYSTEM DEVELOPMENT 10

Using PROLOG to design expert systems, converting rules to PROLOG, conceptual example, introduction to LISP, function evaluation, lists, predicates, rule creation .Definition-choice of domain, collection of knowledge base, selection of inference mechanism, case studies of expert system development in design and manufacturing.

UNIT IV EXPERT SYSTEM TOOLS 10

Expert systems – controlling reasoning – rule based system –canonical systems – rules and meta rules – associative nets and frame systems – graphs trees and networks – representing uncertainity – probability in expert systems-learning- forms of learning – inductive learning – decision trees – knowledge in learning – Heuristic classification – Heuristic matching - case studies in expert systems – MYCIN – Meta-Dendral.- general structure of an expert system shell, examples of creation of an expert system using an expert system tool Fundamentals of object oriented programming, creating structure and object, object operations, invoking procedures, programming applications, object oriented expert system.

UNIT V INDUSTRIAL APPLICATION OF AI AND EXPERT SYSTEMS 7

Robotic vision systems, image processing techniques, application to object recognition and inspection, automatic speech recognition.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Robert Levine et al, "A Comprehensive Guide to AI and Expert Systems", McGraw Hill Inc,1986.
2. Henry C Mishkoff, "Understanding AI", BPB Publication, New Delhi, 1986.
3. Peter Jackson, “Introduction to Expert Systems”, First Indian Reprint, 2000, Addison-Wesley.

REFERENCES :

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Prentice Hall, 1995.
2. Elaine Rich et al., “Artificial Intelligence”, McGraw Hill, 1995.
3. Winston P H, “Artificial Intelligence”, Addison-Wesley, Reading, Massachusetts, Third Edition,1992

IE 9012 TOTAL PRODUCTIVITY MAINTENANCE L T P C
3 0 0 3

UNIT I BASIC PRINCIPLES AND CONCEPTS: **8**

Six basic principles-new demands of production-continuous productivity improvement-TPM definition-development stages of TPM-principle of learning –improving machine performance-the team approach-zero defects and TPM

UNIT II OVERALL EQUIPMENT EFFECTIVENESS 9

Power of OEE-six major losses-OEE metrics-OEE calculation for a single machine- plant OEE calculations-process average method-weighted process average method- total equipment effectiveness equipment performance (TEEP)- financial aspects of OEE – case studies.

UNIT III RESTORING EQUIPMENT TO 'NEW' CONDITION 8

Specific goals for equipment, operators, technicians-detecting minor machine defects-setting comp. standards-typical examples- machine tags-one point lessons –typical examples.

UNIT IV AUTONOMOUS MAINTENANCE AND PREVENTIVE MAINTENANCE 10

Sevel levels-initial cleaning- preventive cleaning machines-cleaning and lubrication standard- general inspection, autonomous inspection-process disciple-independent autonomous maintenance. Elements of a complete preventive maintenance- PM checklist-PM schedules-inspection specification, replacement parts numbers-PM procedure-part logs-quality checks-PM master plan.

UNIT V TPM IMPLEMENTATION 10

Introduction of TPM to the organization-creation of organization structure- Basic TPM policies and aids- master plan- Kick start.Small group activities- implementing AM-establishing planned maintenance- training and education- developing equipment management program- perfecting TPM implementation – raising TPM levels- Case studies.

TOTAL : 45 PERIODS

REFERENCES:

1. Hansen R C, "Overall Equipment Effectiveness", Industrial Press, USA, First Edition, 2001
2. Robinson C J and Ginder A P, "Implementing TPM: The North American Experience", Productivity Press, USA, 1995

IE 9013 DATA STRUCTURES AND COMPUTING L T P C
3 0 0 3

UNIT I INTRODUCTION 9

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

UNIT II BASIC DATA STRUCTURES 10

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

UNIT III ADVANCED DATA STRUCTURES 10

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

UNIT IV MEMORY MANAGEMENT 7

Issues - Managing Equal Sized Blocks - Garbage Collection Algorithms for Equal Sized Blocks -Storage Allocation for Objects with Mixed Sizes - Buddy Systems - Storage Compaction.

UNIT V SEARCHING, SORTING AND DESIGN TECHNIQUES 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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.

REFERENCES:

1. Horowitz, Sahni, Rajasekaran, “Computer Algorithms”, Galgotia, 2000
2. Tanenbaum A.S., Langram Y, Augestien M.J., ”Data Structures using C & C++”, Prentice Hall of India, 2002

IE 9014 FACILITIES PLANNING AND DESIGN L T P C
3 0 0 3

UNIT I FACILITY LOCATION AND ANALYSIS 7

Location decisions - Qualitative and Quantitative factors, Simple models in single facility and multi facility problems.

UNIT II LAYOUT DESIGN 10

Facilities requirement, need for layout study – types of layout; Design cycle – SLP procedure – Algorithms – ALDEP, CORELAP, CRAFT.

UNIT III CELLULAR LAYOUT 10

Group technology – Production Flow analysis (PFA), ROC (Rank Order Clustering) – Assembly Line balancing.

UNIT IV INTRODUCTION TO MATERIAL HANDLING 10

Principles, unit load concept, material handling system design, handling equipment types, selection and specification, containers and packaging.

UNIT V WAREHOUSE DESIGN 8

Introduction – Measuring & Benchmarking warehouse performance – Warehouse operations, Receiving and putaway principles, Pallet Storage and Retrieval system, Case Picking systems – Warehouse layout – Computerizing warehouse operations.

TOTAL : 45 PERIODS

REFERENCES :

1. Tompkins, J.A. and J.A.White, “Facilities planning”, John Wiley, 2003.
2. Richard Francis.L. and John A.White, “Facilities Layout and location”, an analytical approach, Prentice Hall Inc., 2002.
3. James Apple, M.Plant layout and “Material Handling”, John Wiley, 1977.
4. Sundaresh Heragu, “Facilities Design”, PWS Publishing Company, Boston, 1997.
5. Edward Frazelle, “World-Class Warehousing and Material Handling”, McGraw Hill Publishers, 2002.

IE 9015 **ROBUST DESIGN** **L T P C**

3 0 0 3

UNIT I INTRODUCTION **9**

Planning of experiments, terminology, ANOVA rationale, basics of quality by design, Loss function, Tolerance design, Single factor experiments, tests on means.

UNIT II FACTORIAL EXPERIMENTS. **10**

Multi factor experiments - EMS rules – 2 & 3 factors, 2^K design, confounding, Fractional, Nested designs – Response Surface Methodology

UNIT III ORTHOGONAL EXPERIMENTS **9**

Selection and application of orthogonal arrays for design, Conduct of experiments, collection and analysis of simple experiments, Modifying orthogonal arrays.

UNIT IV ROBUST DESIGN PROCESS . **9**

Comparison of classical and Taguchi's approach, variability due to noise factors, classification of quality characteristics and parameters, objective functions in robust design, S/N ratios

UNIT V PRODUCT / PROCESS IMPROVEMENT. **8**

Inner and outer OA experiments, Optimization using S/N ratios, attribute data analysis, a critique of robust design, multi response optimization – Case studies

TOTAL : 45 PERIODS

REFERENCES:

1. Phillip J.Ross, Taguchi techniques for quality engineering, Prentice Hall, 1996.
2. D.C. Montgomery, Design and Analysis of experiments, John Wiley and Sons, 2003.
3. Nicolo Belavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.

IS9325 RELIABILITY ENGINEERING L T P C
4 0 0 4

UNIT I RELIABILITY CONCEPT 12

Reliability function – failure rate – mean time between failures (MTBF) – mean time to failure (MTTF) – A priori and a posteriori concept - mortality curve – useful life – availability – maintainability – system effectiveness.

UNIT II FAILURE DATA ANALYSIS 12

Time to failure distributions – Exponential, normal, Gamma, Weibull, ranking of data – probability plotting techniques – Hazard plotting.

UNIT III RELIABILITY PREDICTION MODELS 12

Series and parallel systems – RBD approach – Standby systems – m/n configuration – Application of Bayes' theorem – cut and tie set method – Markov analysis – Fault Tree Analysis – limitations.

UNIT IV RELIABILITY MANAGEMENT 12

Reliability testing – Reliability growth monitoring – Non-parametric methods – Reliability and life cycle costs – Reliability allocation – Replacement model.

UNIT V RISK ASSESSMENT 12

Definition and measurement of risk – risk analysis techniques – risk reduction resources – industrial safety and risk assessment.

TOTAL : 60 PERIODS

REFERENCES

1. Srinath L.S, "Reliability Engineering", Affiliated East-West Press Pvt Ltd, New Delhi, 1998.
2. Modarres, "Reliability and Risk analysis", Maral Dekker Inc.1993.
3. John Davidson, "The Reliability of Mechanical system" published by the Institution of Mechanical Engineers, London, 1988.
4. Smith C.O. "Introduction to Reliability in Design", McGraw Hill, London, 1976.

MF9252 DESIGN FOR MANUFACTURING AND ASSEMBLY L T P C
3 0 0 3

UNIT I TOLERANCE ANALYSIS 9

Introduction – Concepts, definitions and relationships of tolerancing – Matching design tolerances with appropriate manufacturing process – manufacturing process capability metrics – Worst care, statistical tolerance Analysis – Linear and Non-Linear Analysis – Sensitivity Analysis – Taguchi's Approach to tolerance design.

UNIT II TOLERANCE ALLOCATION 9

Tolerance synthesis – Computer Aided tolerancing – Traditional cost based analysis – Taguchi's quality loss function – Application of the Quadratic loss function to Tolerancing – Principles of selective Assembly – Problems.

UNIT III GEOMETRIC DIMENSIONING AND TOLERANCING 9

Fundamentals of geometric dimensioning and tolerancing – Rules and concepts of GD&T – Form controls – Datum systems – Orientation controls – Tolerance of position – Concentricity and symmetry controls – Run out controls – Profile controls.

UNIT IV TOLERANCE CHARTING 9

Nature of the tolerance buildup – structure and setup of the tolerance chart – piece part sketches for tolerance charts – Arithmetic ground rules for tolerance charts – Determination of Required balance dimensions – Determination of Mean working Dimensions – Automatic tolerance charting – Tolerance charting of Angular surfaces.

UNIT V MANUFACTURING GUIDELINES 9

DFM guidelines for casting, weldment design – Formed metal components – Turned parts – Milled, Drilled parts – Non metallic parts – Computer Aided DFM software – Boothroyd and Dewhurst method of DFMA – DCS – Vis/VSA – 3D Dimensional control – Statistical tolerance Analysis Software – Applications.

TOTAL: 45 PERIODS

REFERENCES:

1. C.M. Creveling, "Tolerance Design – A handbook for Developing Optimal Specifications", Addison – Wesley, 1997.
2. James D. Meadows, 'Geometric Dimensioning and Tolerancing", Marcel Dekker Inc., 1995.
3. Alex Krulikowski, "Fundamentals GD&T", Delmar Thomson Learning, 1997.
4. Oliver R. Wade, "Tolerance Control in Design and Manufacturing", Industrial Press, NY, 1967.
5. James G. Bralla, "Handbook of Product Design for Manufacturing", McGraw Hill, 1986.