

ANNA UNIVERSITY TIRUCHIRAPPALLI
Tiruchirappalli – 620 024

Regulations 2008

Curriculum

M.E. INDUSTRIAL ENGINEERING

SEMESTER I

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	MA5144	Probability and Statistics	3	1	0	4
2	IE5101	Work Systems Design	3	0	0	3
3	IE5102	Applied Operations Research	3	0	0	3
4	IE5103	Production and Inventory Management	3	0	0	3
5	IE5104	Facilities location and Design	3	0	0	3
6	E1***	Elective I	3	0	0	3
Practical						
7	IE5105	Work Design Laboratory	0	0	3	2
Total						21

SEMESTER II

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	IE5151	Computer Integrated Manufacturing Systems	3	0	0	3
2	IE5152	System Simulation and Modelling	3	0	0	3
3	IE5153	Quality Engineering	3	1	0	4
4	IE5154	Supply Chain Management	3	0	0	3
5	E2***	Elective II	3	0	0	3
6	E3***	Elective III	3	0	0	3
Practical						
7	IE5155	Computer Applications Laboratory	0	0	3	2
8	IE5160	Seminar	0	0	3	2
Total						23

SEMESTER III

S.No.	Subject Code	Subject	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
Practical						
4	IE5251	Project Work – Phase I	0	0	12	6
Total						15

SEMESTER IV

S.No.	Subject Code	Subject	L	T	P	C
Practical						
1	IE5251	Project Wok - Phase II	0	0	24	12
Total						12

Total Credits to be Earned for the Award of the Degree = 71

LIST OF ELECTIVES

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	ED5013	Applied Object Oriented Programming	3	0	0	3
2	IE5001	Advanced Optimization Techniques	3	0	0	3
3	IE5002	Operations Scheduling	3	0	0	3
4	IE5003	Advanced Maintenance Management	3	0	0	3
5	IE5004	Business Process Re-Engineering	3	0	0	3
6	CC5055	Total Quality Management	3	0	0	3
7	IE5005	Reliability Engineering	3	0	0	3
8	IE5006	Robust Design	3	0	0	3
9	IE5007	Design and Analysis of Algorithm	3	0	0	3
10	IE5008	Artificial Intelligence and Expert system	3	0	0	3
11	IE5009	Enterprise Resource Planning	3	0	0	3
12	IE5010	Management Accounting and Financial Management	3	0	0	3
13	IE5014	Human Resource Management	3	0	0	3
14	IE5012	Stochastic Models of Manufacturing Systems	3	0	0	3
15	IE5013	Industrial Robotics	3	0	0	3

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Regulations 2008

Syllabus

M.E. INDUSTRIAL ENGINEERING

SEMESTER I

MA5144 – PROBABILITY AND STATISTICS

L T P C
3 1 0 4

UNIT I PROBABILITY AND RANDOM VARIABLE 9

Probability – Random variables – Moments – Moment generating function – Standard distributions – Functions of random variables – Two-Dimensional R.Vs – Correlation and Regression.

UNIT II ESTIMATION THEORY 9

Principle of least squares – Regression – Multiple and Partial correlations – Estimation of Parameters – Maximum likelihood estimates – Method of moments.

UNIT III TESTING OF HYPOTHESIS 9

Sampling distributions – Test based on Normal, t-distribution, chi-square and F-distributions – Analysis of variance – One-way and two way classifications.

UNIT IV DESIGN OF EXPERIMENTS 9

Completely Randomized Design – Randomized Block Design – Latin Square Design – 2 Factorial Design.

UNIT V TIME SERIES 9

Characteristics and Representation – Moving averages – Exponential smoothing – Auto Regressive Processes.

L: 45 T: 15 Total : 60

REFERENCES

1. Freund John, E and Miller Irvin, “Probability and Statistics for Engineering”, 5th Edition, Prentice Hall, 1994.
2. Jay, L.Devore, “Probability and Statistics for Engineering and Sciences”, Brooks Cole Publishing Company, 1982.
3. Montgomery D.C and Johnson, L.A, “Forecasting and Time series”, McGraw Hill, 1976.
4. Anderson, O.D, “Time series Analysis: Theory and Practice”, Elsevier Science Ltd, 1982.
5. Gupta, S.C and Kapoor, V.K., “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, 1999.

IE5103 – PRODUCTION AND INVENTORY MANAGEMENT

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 9

An overview of Production systems – Production Management objectives – Manufacturing strategy – Technological Innovations on Manufacturing – Corporate strategic choices – Management of Technology.

UNIT II FORECASTING 9

The forecasting process – Time series forecasting models – Monitoring – Controlling the forecasting system – Multi-item forecasting – Causal models – Judgement methods.

UNIT III PLANNING ACTIVITIES 9

Aggregate planning strategies and methods – Master Production Schedule – Planning of material requirements – Manufacturing Resources Planning.

UNIT IV CONTROL ACTIVITIES 9

Capacity planning and control – Production Activity Control – Scheduling in Manufacturing – Theory of constraints and synchronous manufacturing.

UNIT V INVENTORY MANAGEMENT 9

Inventory Control Policies – Deterministic Inventory models – Probabilistic Inventory models – Distribution inventory management.

Total : 45

REFERENCES

1. Lee J.Krajewski, Larry P.Ritaman, “Operations Management”, Addison-Wesley, 2000.
2. Seetharama L.Narasimhan, Dennis W.McLeavy, Peter J.Billington, “Production Planning and Inventory Control” , PHI, 2002.
3. Monks J.G.,”Operations Management”, John Wiley, 1999.
4. Norman Gaither and Gregory Frazier “Operations Management”, Thomson Learning Press, 2001.

IE5105 – WORK DESIGN LABORATORY

L	T	P	C
0	0	3	2

To understand the theory better and apply in practice, practical training is given in the following areas:

- Peg board experiment
- Stop watch time study
- Performance rating exercise
- Graphic tools for method study
- Work sampling
- MTM practice
- Study of physical performance using tread mill and Ergocycle
- Physical fitness testing of individuals
- Estimation of energy expenditure

Equipments Required

- | | | | |
|----|---------------------------|---|-------|
| 1. | Tread Mill | : | 1 No |
| 2. | Ergocycle / upbright bike | : | 1 No |
| 3. | Peg boards | : | 2 Nos |
| 4. | Stop watches | : | 5 Nos |

IE5151 – COMPUTER INTEGRATED MANUFACTURING SYSTEMS

L T P C
3 0 0 3

UNIT I **9**

Introduction to CIM – Nature of the CIM system – Types of manufacturing systems – Evolution of CIM – Computers in CIM. Process definition and manufacturing planning – Structures of a process plan – CAD based process planning – Coding systems – Methods of CAPP – Process planning systems. Background – Role of MRP – II in CIM systems – Major modules of MRP – II software – Manufacturing, engineering, financial, marketing and misc. applications.

UNIT II **9**

CNC Machine tools – Principle of Numerical Control – Types of CNC machine tools – Features and programming of CNC machine tools – CNC programming based on CAD – Applications and economics of usage of CNC machine – Capabilities of a typical NC – CAM software – Integration of computers in CIM environment.

UNIT III **9**

Computer communications – Principles of networking, Techniques, components of networking and wiring methods – Network interface cards – Network standards, examples – Operating system – Security – Managing remote systems – Design activity in a networked environment – Networking in an manufacturing company.

UNIT IV **9**

Flexible manufacturing – Introduction, types, major elements and optimization of FMS – Operational elements in a typical FMC – Typical FMS layout – Lean manufacturing – Agile manufacturing database and DBMS requirements – Features and architecture of a DBMS – Query language – SQL – SQL as a knowledge base query language. Integration and Implementation issues in CAD/CAM/CIM – Introduction – Requirements for integrated manufacturing systems – Economic justification of CAD/CAM/CIM technologies – Steps to implement CIM.

UNIT V **9**

Artificial Intelligence – Robots – Elements, types and specifications of robots – Robot programming methods – Robot operation – Applications of industrial robots – Integration of robots in CIM systems – Expert system – AI in vision system and scheduling – DSS in CIM environment.

Total : 45

REFERENCES

1. Ibrahim Zeidi, “CAD/CAM – Theory and Practice”, TMH, 1991.
2. Groover, “Automation of Production Systems”, PHI, 2003.
3. Eric Teicholz, “Computer Integrated Manufacturing Handbook”, 1st Edition, McGraw Hill, 1987.
4. Radhakrishnan P, Subramanyan S, “CAD/CAM/CIM”, Wiley Eastern Limited, 1994.

IE5152 – SYSTEM SIMULATION AND MODELLING

L	T	P	C
3	0	0	3

UNIT I	INTRODUCTION	7
<p>Systems – Modeling - General systems theory - Concept of simulation - Simulation as a decision making tool - Types of simulation.</p>		
UNIT II	RANDOM NUMBERS	7
<p>Pseudo random numbers, methods of generating random varieties, discrete and continuous distributions – Testing of random numbers.</p>		
UNIT III	DESIGN OF SIMULATION EXPERIMENTS	9
<p>Problem formulation, data collection and reduction – Time flow mechanism – Key variables – Logic flow chart – Starting condition – Run size – Experimental design consideration – Output analysis – Interpretation validation.</p>		
UNIT IV	SIMULATION LANGUAGES	13
<p>Simulation languages - Study of GPSS and Applications.</p>		
UNIT V	CASE STUDIES / MINI PROJECT	9
<p>Development of simulation models using the simulation language studied for systems like, queuing systems, production systems, inventory systems, maintenance and replacement systems, investment analysis and network.</p>		

Total : 45

REFERENCES

1. Jerry Banks, John S.Carson, Barry L Nelson and David M.Nicol, “Discrete event system simulation”, Prentice Hall, 2002.
2. Shannon, R.E, “Systems simulation, the art and Science”, Prentice Hall, 1975.
3. Thomas J.Schriber, “Simulation using GPSS”, John Wiley, 1991.
4. Narsingh Deo, “System Simulation with Digital Computer”, PHI, 1979.
5. Subramanian KRV and Sundaresan R Kadayam, “System Simulation – An Introduction to GPSS”, CBS Publishers, 1993.
6. Zaven A. Karian and Edward J. Dudewicz, “Modern Statistical, Systems, and GPSS Simulation”, CRC Press, 1999.

IE5153 – QUALITY ENGINEERING

L	T	P	C
3	1	0	4

UNIT I STATISTICAL PROCESS CONTROL 10

Quality objectives – Quality control – Quality Assurance – Process variability – Control charts for variables and attributes - Multivarichart - Demerit control chart – Process capability studies.

UNIT II ACCEPTANCE SAMPLING 8

Economics of sampling – Acceptance sampling by variables and attributes – Single, double and sequential plans – OC curves – ATI, ASN, AOQL – Standard sampling tables.

UNIT III DESIGN OF EXPERIMENTS 10

Factorial experiments – Single factor, multi factor, 2^k design– Taguchi methods – Use of orthogonal arrays.

UNIT IV QUALITY MANAGEMENT 9

ISO 9000 and TQM concepts - Quality circles, tools – Zero defect management – 6 sigma – Quality Function Deployment (QFD).

UNIT V RELIABILITY 8

Reliability concepts - Reliability prediction – Series and Parallel systems – Reliability testing.

L : 45 T : 15 Total : 45

REFERENCES

1. Logothetis, N, “Managing for total quality from Deming to Taguchi and SPC”, PHI ,1997.
2. Douglas, C.Montgomery, “Introduction to Statistical quality control”, 2nd Edition, John Wiley and Sons, 2001.
3. Srinath L S, “Reliability Engineering”, Affiliated East-West Press Pvt Ltd, 1998.
4. Grant E L , Leavenworth R S , “Statistical Quality Control”, 7th Edition, TMH, 2000.

IE5154 – SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 9

Logistics - Concepts, definitions, approaches, factors affecting logistics – Supply chain - basic tasks of the supply chain - New corporate model - New paradigm - Modular company - Supply process - Procurement process.

UNIT II SUPPLY CHAIN MODELS 9

Strategy and structure - Factors of supply chain - Manufacturing strategy stages – Supply chain progress - Model for competing through supply chain management - PLC grid – Supply chain redesign - Linking supply chain with customer – Structuring the SC and new products – Functional roles in SC – SC design framework – Collaborative product commerce (CPC).

UNIT III PLANNING AND MANAGING INVENTORY IN SUPPLY CHAIN 9

Economies of scale in a supply chain - Managing cycle inventory and safety stock – Determining optimal level of product availability – Distribution resource planning.

UNIT IV MANAGING LOGISTICS AND DISTRIBUTION 9

Logistics and Distribution Management - Factors affecting transportation decisions – Modes of transportation and performance characteristics – Routing and scheduling.

UNIT V COORDINATING SUPPLY CHAINS AND THE ROLE OF E-BUSINESS 9

Factors influencing coordination – Building strategic partnerships and trust – Impact of E-Business on supply chain performance – Setting up E-Business in practice.

Total : 45

REFERENCES

1. Sunil Chopra and Peter Meindl, “Supply Chain Management – Strategy, Planning, and Operation”, Pearson Education, 2004.
2. Scharj, P.B., Lasen, T.S., “Managing the global supply chain”, Viva Books, 2000.
3. Ayers, J.B., “Hand book of Supply Chain Management”, The St. Lencie press, 2000.
4. Nicolas, J.N., “Competitive manufacturing management- continuous improvement, Lean production, customer focused quality”, McGraw-Hill, 1998.
5. Steudel, H.J. and Desruelle, P., “Manufacturing in the nineties- How to become a mean, lean and world class competitor”, Van Nostrand Reinhold, 1992.

IE5155 – COMPUTER APPLICATIONS LABORATORY

L	T	P	C
0	0	3	2

To understand the theory better and apply in practice, practical training is given in the following areas.

UNIT I **9**

Solving optimization problems using software packages like LINDO, LINGO, TORA.

UNIT II **9**

Statistical analysis: Frequency distribution, Identifying the appropriate distribution, Testing for goodness of fit.

UNIT III **9**

Simulation Part 1: Development of Random number generator, Testing of random number generator.

UNIT IV **9**

Simulation Part 2: Non-uniform Random varieties generation and testing.

UNIT V **9**

Simulation Part 3: Simulation model building and conducting simulation experiments – GPSS.

Total : 45

Equipments required

1. Pentium 4 : 10 Nos
2. Software packages

- Lindo / Lingo / Tora / GPSS

3. Printers : 2 Nos

LIST OF ELECTIVES

IE5001 – ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 5

Classification of optimization problems – Applications of optimization – Concepts of design vector – Design constraints – Constrains surface - Objective function surfaces and multi-level optimization.

UNIT II OPTIMIZATION – I 10

Karmakars method of solving L.P. problem – Quadratic programming – Non-linear programming – Unconstrained optimization techniques – Basics of constrained optimization.

UNIT III OPTIMIZATION – II 10

Integer linear programming methods and application – Introduction to integer non-linear programming – Basics of geometric programming.

UNIT IV OPTIMIZATION – III 10

Multi-objective optimization methods and application – Formulation of problems – Separable programming and stochastic programming.

UNIT V OPTIMIZATION – IV 10

Introduction to Genetic algorithms – Simulated Annealing – Neural network based optimization and optimization of fuzzy systems.

Total : 45

REFERENCES

1. Singiresu S.Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice”, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.

IE5002 – OPERATIONS SCHEDULING

L	T	P	C
3	0	0	3

UNIT I SINGLE MACHINE MODELS 10

Sequencing and scheduling – Objectives and constraints – Pure sequencing model – Basic theorems performance measures – mean flow time, mean tardiness etc. - SPT, EDD order – Hodgson’s algorithm – Smith’s rule – WI algorithm – Hybrid algorithm – Neighbourhood search – Dynamic programming approach – Branch and Bound – dependent jobs – Sequence dependent set up times.

UNIT II PARALLEL MACHINE MODELS 8

Make span minimization of independent and dependent jobs – Mc Naughton’s algorithms – Weighted mean flow time minimization – Hu’s algorithm – Muntg coffmann algorithm.

UNIT III FLOW SHOP MODELS 10

Use of Gantt chart – Johnson’s method – Johnson’s rule for 3-machine problem – Jackson’s method – Compbell Dudek method – Palmer’s method – Milten’s algorithm.

UNIT IV JOB SHOP MODELS 8

Graphical representation – Feasible, semi-active and active schedules – Single pass approach – Non-delay schedule generation – Heuristic schedule generation – Priority dispatching rules – Dynamic job shop simulation.

UNIT V OTHER MODELS 9

Scheduling of intermittent production – Giffler Thomson algorithm – Branch and Bound – Scheduling of continuous production – RPW, Inverse RPW methods – Tree search – Largest candidate methods – COMSOAL – KANBAN/FMS system scheduling.

Total: 45

REFERENCES

1. Michael Pinedo, “Scheduling: theory, algorithms and systems”, Prentice Hall of India, 1996.
2. King, J.R, “Production planning and control”, Pergamon International Library, 1975.
3. Kenneth R.Baker, “Introduction to sequencing and scheduling”, John Wiley and Sons, 2000.

IE5003 – ADVANCED 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

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., 1995.
3. Seiichi Nakagima, “Introduction to Total Productive Maintenance” Productivity Press (India) Pvt. Ltd., 1993.

IE5004 – BUSINESS PROCESS RE-ENGINEERING

L	T	P	C
3	0	0	3

UNIT I BUSINESS PROCESS RE-ENGINEERING AND SETTING THE FOUNDATION 9

Introduction - Historical out look – Working definition of BPR – Overview on four phases of Re-engineering process – Fallacy of programme change – Elements of effective change – Exploration by the top management for Re-engineering – Work force preparation for involvement and change planning for the future: Importance of planning for Re-engineering - Limitations – Key points on planning for Re-engineering – Creating vision, missing and guiding principles – Developing three to five year strategic plan – Scenario approach – Critical.

UNIT II ISSUE APPROACH 9

Goal approach – Developing yearly operational or breakthrough plans.

UNIT III RE-ENGINEERING STEPS 9

Identification of current business processes – Establishing the scope of the process – Mapping project – Mapping and analyzing the process. Process Creation: Creating the ideal process – Testing the new process – Implementing the new process. Evaluation: Evaluating the improvement (criteria) of measurements hurdles foreseen in designing and implementing meaningful measures – Final Re-engineering steps.

UNIT IV RE-ENGINEERING MODELS 9

Re-engineering process improvement models and tools – PMI models, Edosomwan model, Moen and Nolan strategy for process improvement – LMICIP model – NPRDC model – Analytical and process tools and techniques – Role of IT in BPR.

UNIT V ORGANIZATION FOR RE-ENGINEERING 9

Responsibilities and roles of leader – Process owner, Re-engineering team steering committee and Re-engineering Czar – Key points for succeeding at Re-engineering – Case studies.

Total : 45

TEXT BOOKS

1. Jeffrey N.Lowenthal, “Re-engineering the organization – A step-by-step Approach to Corporate Revitalization”, Tata McGraw Hill Publishing Co. Ltd., 1995.
2. Michael Hammer and James Champy, “Re-engineering the corporation – A Manifesto for Business Revolution”, Nicholar Barkey Publishing, 1996.

REFERENCE

1. Michael Hammer, “The Re-engineering Revolution Handbook, “Herper – Collins Publishers, 1996.

CC5055 – TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

UNIT I CONCEPT OF TQM 7

Philosophy of TQM – Customer focus – Organization - Top management commitment – Teamwork – Goal setting and Bench Marking – Quality philosophies of Deming – Juran and Crosby.

UNIT II TQM PROCESS 10

Problem solving methodologies – Quality circles – QC tools – New management tools – Work habits – Strategic quality planning.

UNIT III TQM SYSTEMS 9

Quality policy deployment – Quality function deployment – Standardization – Designing for quality – Manufacturing for quality

UNIT IV QUALITY SYTEM 9

Need for ISO 9000 system – Advantages – Clauses of ISO 9000 – QS 9000 – Implementation – Quality auditing – Case studies.

UNIT V IMPLEMENTATION OF TQM 10

Steps – KAIZEN – 5S – JIT – POKAYOKE – Taguchi methods – Case studies.

Total: 45

REFERENCES

1. Rose, J.E. “Total Quality Management”, Kogan Page Ltd. 1993
2. John Bank, “The essence of total quality management”, PHI 1993
3. Greg Bounds, Lyle Yorks, “Beyond Total Quality Management”, McGraw Hill, 1994.
4. Takashi Osada, “The 5S’s The Asian Productivity Organisation”, 1991.

IE5005 – RELIABILITY ENGINEERING

L	T	P	C
3	0	0	3

UNIT I	RELIABILITY CONCEPT	7
<p>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.</p>		
UNIT II	FAILURE DATA ANALYSIS	10
<p>Time to failure distributions – Exponential, normal, Gamma, Weibull, ranking of data – Probability plotting techniques – Hazard plotting.</p>		
UNIT III	RELIABILITY PREDICTION MODELS	12
<p>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.</p>		
UNIT IV	RELIABILITY MANAGEMENT	10
<p>Reliability testing – Reliability growth monitoring – Non-parametric methods – Reliability and life cycle costs – Reliability allocation – Replacement model.</p>		
UNIT V	RISK ASSESSMENT	6
<p>Definition and measurement of risk – Risk analysis techniques – Risk reduction resources – Industrial safety and risk assessment.</p>		
Total :		45

REFERENCES

1. Srinath L.S, “Reliability Engineering”, Affiliated East-West Press Pvt Ltd, 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, 1988.
4. Smith C.O. “Introduction to Reliability in Design”, McGraw Hill, 1976.

IE5006 – 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 12

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 8

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 7

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

REFERENCES

1. Phillip J.Rose, "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.

IE5008 – ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Intelligence – Definition – Types cognitive aspect approach – Measuring intelligence – Early efforts, IQ and AI: aspects of intelligence – Learning, problem solving, creativity, behaviour and biology - Artificial intelligence: Historical background, applications of AI, objections and myths – AI languages: Introduction to PROLOG and LISP.

UNIT II COGNITIVE PSYCHOLOGY 11

The mind – Informative and cybernetics - Components for thought - Modes of perception – Visual – Auditory and other systems: memory mechanisms – Problem solving – Planning – Search – The GPS systems; types of learning – Rote – Parameter – Method and concept: Game playing – Reasoning - Artificial Vision – Picture processing – identifying real objects: Vision programs - Factory vision systems.

UNIT III KNOWLEDGE ENGINEERING 9

Introduction – Role of knowledge engineer – Knowledge representation – Psychology, production rules, logic and programming – Common sense and fuzzy logic – Semantic networks – Learning systems.

UNIT IV EXPERT SYSTEMS 9

Introduction – Knowledge acquisition for Expert system – Features of Expert systems – System structure – Inference Engines – Uncertainties – Memory mechanisms – Range of applications – Actual expert systems – VP expert. Assignment – Development of a simple expert system.

UNIT V INTRODUCTION TO NEURAL NETWORKS 7

Neural Network Architecture – Learning methods – Architecture of a Back Propagation Network – Selection of parameters – Simple variations of BPN.

Total : 45

TEXT BOOK

1. Elaine R., and Kevin, “Artificial Intelligence”, 2nd Edition, Tata McGraw Hill, 1994.

REFERENCES

1. Rajasekaran S and Vijayalakshmi Pai, G.A, “Neural Networks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications”, PHI, 2003.
2. Charnaik, E., and McDermott, D., “Introduction to Artificial Intelligence”, Addison Wesley, 1985.
3. Dan W.Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Prentice Hall of India, 1992.
4. Winston, P.H., “Artificial Intelligence”, Addison Wesley, 1990.
5. Nilsson, N.J., “Principles of AI”, Narosa Publishing House, 1990.
6. Schalkoff, R.J., “Artificial Intelligence” – An Engineering Approach”, McGraw Hill International Edition, Singapore, 1992.

IE5009 – ENTERPRISE RESOURCE PLANNING

L	T	P	C
3	0	0	3

UNIT I 8

Introduction: ERP an overview - Enterprise an overview – Benefits of ERP – Other related technologies – Data warehousing and mining – Online analytical processing (OLAP)

UNIT II 10

The business modules in an ERP package – Finance – Manufacturing – Human resource – Plant maintenance – Materials management – Quality management – Sales and distribution.

UNIT III 10

ERP – Implementation – Lifecycle – Implementation Methodology – Hidden costs in implementation – Organizing the implementation – Vendors – Consultants – Users-project management and monitoring.

UNIT IV 8

Future directions in ERP – Introduction – New markets – New channels – Faster implementation methodologies – Web enabling market snap shot.

UNIT V 9

Case studies in ERP

Total : 45

TEXT BOOK

1. Alexis Leon, “Enterprise Resource Planning”, Tata McGraw Hill – Publishing Company Ltd., 2000.

REFERENCES

1. V.K.Garg and N.K.Venkitakrishnan, “Enterprise Resource Planning Concepts and Practice”, Prentice Hall of India, 1999.
2. S.Sadagopan “ERP – A Managerial Perspective” – Tata MCGraw Hill Publishing Company Ltd, 1999.

ED5013 – APPLIED OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	0	3

UNIT I FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING 5

Elements of OOP – Classes – Subjects – Messaging – Inheritance – Polymorphism – OOP paradigm versus procedural paradigm – Object-oriented design

UNIT II C++ DATA TYPES 15

Expression and statements – Operators – Precedence – Type conversion – Flow control – Arrays structures – Argument passing – Reference argument – Overloaded function

UNIT III C++ CLASS 5

Definition – Class objects – Member functions – Pointer friends – Class member pointer – Scope – Unions – bit-fields – Class argument and ellises – Class member functions – Initialization – Operator overloading – User defined conversions.

UNIT IV CLASS DERIVATION 10

Derivation specification - Information hiding under derivation - Public and private base classes - Standard conversions under derivation - Class scope - Initialization and assignment under derivation.

UNIT V APPLICATION 10

OOP's applications in linear programming - Integer programming simulation – etc.

Total : 45

REFERENCES

1. Wiener, Richard, S. and Pinson, Lewis, J. “An introduction to objective oriented programming and C++”, 1999.
2. Stanley B.Lippman, “C++ Printer”, Addison – Wesley Pub.Co., 1989.
3. Robert Lafore, “Object oriented programming in Turbo C++”, Galgotia publication, 1992.
4. Strousstrup, Bjarne, “The C++ programming languages”, Addition Wesley, 1986.

IE5010 – MANAGEMENT ACCOUNTING AND FINANCIAL MANAGEMENT

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UNIT I FINANCIAL ACCOUNTING 10

Balance sheet – Profit and Loss Statement – Cash Flow and Funds Flow Analysis – Working Capital management – Inventory valuation – Inventory pricing – Financial Ratio analysis – Depreciation

UNIT II COST ACCOUNTING 10

Cost determination – Cost accounting systems – Job costing – Process costing – Allocation of overheads – Activity based costing – Differential cost and Direct costing – Variance analysis.

UNIT III BUDGETING 10

Flexible budgets – Control of programme expenses – Profit budgeting and analysis – Zero base budgeting.

UNIT IV FINANCIAL MANAGEMENT 10

Investment decisions: Investments in Capital – Assets – Capital budgeting – Techniques of Investment analysis.

5

UNIT V FINANCIAL DECISIONS

Cost of Capital – Capital structure – Dividend Policy – Leasing.

Total : 45

REFERENCES

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

IE5014 – HUMAN RESOURCE MANAGEMENT

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UNIT I PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT 5

Evolutions of Human Resource Management – Objectives of Human Resource Management - Role of Human Resource Manager – Human Resource Policies -Computer Applications in Human Resource Management

UNIT II HUMAN RESOURCE PLANNING 6

Importance of Human Resource Planning - Forecasting Human Resource requirement- Internal and External sources. Matching demand and supply

UNIT III RECRUITMENT AND SELECTION 10

Job Analysis – Recruitment – Selection Process - Selection devices - Interview – Medical Examination. Induction – Socialization benefits.

UNIT IV TRAINING AND EXECUTIVE DEVELOPMENT 13

Types of Training methods - Purpose- Benefits – Resistance – Evaluation – Executive Development programmes - Common practices – Benefits- Organizational Change - Knowledge Management.

UNIT V MOTIVATION AND PERFORMANCE APPRAISAL 11

Compensation Plans - Rewards - Motivation – Theories of motivation – Methods of performance evaluation – Feedback- Industry practice – promotion – Demotion – Transfer – Implications in job change.

REFERENCES

1. H.John Bernardin. “Human Resource Management An Experimental Approach”, 4th Edition, Tata Mc Graw Hill, 2007.
2. Decenzo and Robbins, Human Resource Management, Wiley & Sons, 1999.
3. Gary Dessler, “Human Resource Management”, 9th Edition, Prentice Hall of India.
4. Harry Alder, “Think Like a Leader”, Magna Publishing Co. Ltd., 1998.

IE5012 – STOCHASTIC MODELS OF MANUFACTURING SYSTEMS

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UNIT I INTRODUCTION 5

Types of manufacturing systems, classification and Evolution of manufacturing system models

UNIT II FLOW LINES 10

Types – Issues in design and operation - transfer lines and general serial systems – paced lines and unpaced lines – Issues on balancing and unbalancing of Production lines - models of indexing lines.

UNIT III GENERAL MANUFACTURING SYSTEMS 10

Analytical Queuing models – Open networks – Closed networks – Empirical simulation models – Dynamic jobshops – Modelling by open queuing networks – Flexible machining systems – Modelling by queuing networks.

UNIT IV MARKOV CHAIN MODELS IN MANUFACTURING 10

Markov model of a transfer line – Analysis of Markov chains with absorbing states – Analysis of semi-Markov processes in manufacturing – Performance estimation.

UNIT V PETRINET MODEL OF MANUFACTURING SYSTEMS 10

Stochastic petrinets – Performance evaluation using petrinet models.

Total : 45

REFERENCES

1. Narahari, “Performance Modeling of manufacturing systems”, PHI, 1998.
2. George Shantikumar, Buzacott, “Stochastic models of manufacturing systems” PHI, 1993.
3. Ronald G.Askin, Charles R.Standridge, “Modeling and Analysis of manufacturing systems” John Wiley and sons, 1993.

IE5013 – INDUSTRIAL ROBOTICS

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UNIT I **FUNDAMENTAL CONCEPTS OF ROBOTICS** **9**

Present status and future trends, Robotics and Automation – Laws of Robotics – Robot Definition – Robotic systems and Anatomy – Specification of Robotics Repeatability – Accuracy of manipulator.

Drives – Power Transmission system and control Robot drive mechanisms – Hydraulic – electric – pneumatic drives – Mechanical transmission method – Rotary-to-Rotary motion conversion – Rotary problem – Remote Centered compliance Devices – Control of actuators in Robotic Mechanisms.

UNIT II **SENSORS AND INTELLIGENT ROBOTS** **9**

Sensory devices – Non optical – Position sensors – Optical position sensors – Velocity sensors – Proximity sensors – Contact and non-contact type – Touch and slip sensors – Force and Torque sensors – AI and robotics.

UNIT III **COMPUTER VISION FOR ROBOTICS SYSTEMS** **6**

Robot vision systems – Imaging components – Image representation – Hardware aspects – Picture coding – Object recognition and categorization – Visual inspection – Software Considerations – Applications – Commercial Robotic vision systems.

UNIT IV **COMPUTER CONSIDERATIONS FOR ROBOTIC SYSTEMS** **12**

Computer architecture for robots – Hardware Computational elements in robotic applications – Robotic programming and languages – VAL II, RAIL, AML – Simple programs – Path planning – Robot’s computer system.

TRANSFORMATIONS AND KINEMATICS

Homogeneous co-ordinates – Co-ordinate reference frames – Homogeneous transformation for the manipulator – The forward and reverse problem of manipulator – Kinematics – Motion generation – Manipulator dynamics-Motion generation – Manipulator dynamics – Jacobean in terms of D.H.Matrices – Control-architecture

UNIT V **ROBOT CELL DESIGN AND CONTROL** **9**

Specifications of commercial robots – Robot design and procedure – Specifications – Work cell control – Robot cycle time analysis – Economic analysis of robotics.

Applications of robots in material transfer, machine loading and unloading – Welding – assembly – Inspection and future applications – Safety, training, maintenance and quality.

Total : 45

TEXT BOOKS

1. Klafter R.D., Chmielewski T.A., and Negin M., “Robot Engineering – An Integrated Approach”, Prentice Hall of India, 2003.
2. Fu K.S., Gonzalez R.C., and Lee C.S.G., “Robotics Controls Sensing, Vision Intelligence”, McGraw-Hill Book Co., 1987.

REFERENCES

1. Shimon Y.Nof, “Hand book of Robotics”, John Wiley Sons, 1985.
2. Mikell P.Groover et al, “Industrial Robotics – Technology, Programming and Applications”, McGraw – Hill International Editions, 1996.