UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY : : CHENNAI 600 025

REGULATIONS - 2013

M.E. INDUSTRIAL ENGINEERING (FT & PT)

I TO IV SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IL8101	Optimisation Methods	3	1	0	4
2	IL8102	Work Design and Ergonomics	3	0	0	3
3	IL8151	Facilities Design	3	0	0	3
4	IL8153	Production Management	3	1	0	4
5	MA8160	Probability and Statistical Methods	3	1	0	4
6		Elective I	3	0	0	3
PRACTICAL						
7	IL8111	Work Design and Ergonomics Lab	0	0	2	1
		TOTAL	**18**	**3**	**2**	**22**

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IL8201	Manufacturing Systems and Models	3	0	0	3
2	IL8202	Quality Engineering	3	0	0	3
3	IL8203	Systems and Simulation	3	0	0	3
4	IL8152	Logistics and Supply Chain Management	3	0	0	3
5		Elective II	3	0	0	3
6		Elective III	3	0	0	3
PRACTICAL						
7	IL8211	Computer Applications Lab	0	0	3	2
8	IL8212	Technical Seminar	0	0	2	1
		TOTAL	**18**	**0**	**5**	**21**

SEMESTER III

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IL8301	Design of Experiments and Taguchi Methods	3	1	0	4
2		Elective IV	3	0	0	3
3		Elective V	3	0	0	3
PRACTICAL						
4	IL8311	Project Work Phase I	0	0	12	6
		TOTAL	**9**	**1**	**12**	**16**

SEMESTER IV

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	IL8411	Project Work Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE: 71

ELECTIVES FOR M.E. INDUSTRIAL ENGINEERING

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	IL8001	Advanced Optimization Techniques	3	0	0	3
2	IL8002	Design of Algorithms	3	0	0	3
3	IL8003	Engineering Economics and Costing	3	0	0	3
4	IL8004	Human Factors Engineering	3	0	0	3
5	IL8005	Industrial Automation	3	0	0	3
6	IL8006	Knowledge Engineering and Management	3	0	0	3
7	IL8007	Maintainability Engineering	3	0	0	3
8	IL8008	Scheduling Algorithms	3	0	0	3
9	IL8009	Systems Science and Engineering	3	0	0	3
10	IL8071	Applied Object oriented programming	3	0	0	3
11	IL8072	Business Excellence Models	3	0	0	3
12	IL8073	Data Analysis Techniques	3	0	0	3
13	IL8074	Decision Support Systems	3	0	0	3
14	IL8075	Industrial Safety and Hygiene	3	0	0	3
15	IL8076	Lean Manufacturing and Six Sigma	3	0	0	3
16	IL8077	Logistics and Distribution Management	3	0	0	3
17	IL8078	Management Accounting and Financial Management	3	0	0	3
18	IL8079	Multi Variate Data Analysis	3	0	0	3
19	IL8080	Productivity Management and Re-Engineering	3	0	0	3
20	IL8081	Project Management	3	0	0	3
21	IL8082	Reliability Engineering	3	0	0	3
22	IL8083	Services Operations Management	3	0	0	3
23	IL8084	Systems Analysis and Design	3	0	0	3
24	IL8085	Technology Management	3	0	0	3
25	MS8071	Cellular Manufacturing Systems	3	0	0	3
26	QE8072	Product Innovation and Development	3	0	0	3
27	QE8151	Total Quality Management	3	0	0	3
28	QE8251	Software Quality Engineering	3	0	0	3

Attested

DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.

UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY : : CHENNAI 600 025

REGULATIONS - 2013

M.E. INDUSTRIAL ENGINEERING (PART TIME)

I TO VI SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MA8160	Probability and Statistical Methods	3	1	0	4
2	IL8101	Optimisation Methods	3	1	0	4
3	IL8102	Work Design and Ergonomics	3	0	0	3
PRACTICAL						
4	IL8111	Work Design and Ergonomics Lab	0	0	2	1
		TOTAL	**9**	**2**	**2**	**12**

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IL8201	Manufacturing Systems and Models	3	0	0	3
2	IL8203	Systems and Simulation	3	0	0	3
3	IL8202	Quality Engineering	3	0	0	3
PRACTICAL						
4	IL8211	Computer Applications Lab	0	0	3	2
		TOTAL	**9**	**0**	**3**	**11**

SEMESTER III

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IL8153	Production Management	3	1	0	4
2	IL8151	Facilities Design	3	0	0	3
3		Elective I	3	0	0	3
		TOTAL	**9**	**1**	**0**	**10**

SEMESTER IV

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IL8152	Logistics and Supply Chain Management	3	0	0	3
2		Elective II	3	0	0	3
3		Elective III	3	0	0	3
PRACTICAL						
4	IL8212	Technical Seminar	0	0	2	1
		TOTAL	**9**	**0**	**2**	**10**

Attested

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SEMESTER V

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IL8301	Design of Experiments and Taguchi Methods	3	1	0	4
2		Elective IV	3	0	0	3
3		Elective V	3	0	0	3
PRACTICAL						
4	IL8311	Project Work Phase I	0	0	12	6
		TOTAL	**9**	**1**	**12**	**16**

SEMESTER VI

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	IL8411	Project Work Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE: 71

ELECTIVES FOR M.E. INDUSTRIAL ENGINEERING

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	IL8001	Advanced Optimization Techniques	3	0	0	3
2	IL8002	Design of Algorithms	3	0	0	3
3	IL8003	Engineering Economics and Costing	3	0	0	3
4	IL8004	Human Factors Engineering	3	0	0	3
5	IL8005	Industrial Automation	3	0	0	3
6	IL8006	Knowledge Engineering and Management	3	0	0	3
7	IL8007	Maintainability Engineering	3	0	0	3
8	IL8008	Scheduling Algorithms	3	0	0	3
9	IL8009	Systems Science and Engineering	3	0	0	3
10	IL8071	Applied Object oriented programming	3	0	0	3
11	IL8072	Business Excellence Models	3	0	0	3
12	IL8073	Data Analysis Techniques	3	0	0	3
13	IL8074	Decision Support Systems	3	0	0	3
14	IL8075	Industrial Safety and Hygiene	3	0	0	3
15	IL8076	Lean Manufacturing and Six Sigma	3	0	0	3
16	IL8077	Logistics and Distribution Management	3	0	0	3
17	IL8078	Management Accounting and Financial Management	3	0	0	3
18	IL8079	Multi Variate Data Analysis	3	0	0	3
19	IL8080	Productivity Management and Re-Engineering	3	0	0	3
20	IL8081	Project Management	3	0	0	3
21	IL8082	Reliability Engineering	3	0	0	3
22	IL8083	Services Operations Management	3	0	0	3
23	IL8084	Systems Analysis and Design	3	0	0	3
24	IL8085	Technology Management	3	0	0	3
25	MS8071	Cellular Manufacturing Systems	3	0	0	3
26	QE8072	Product Innovation and Development	3	0	0	3
27	QE8151	Total Quality Management	3	0	0	3
28	QE8251	Software Quality Engineering	3	0	0	3

Attested

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IL8101 OPTIMISATION METHODS L T P C
3 1 0 4

UNIT I INTRODUCTION-LP 9

Concepts of OR, development, applications, LP Definitions, assumptions, formulation, graphical method, Simplex algorithm.

UNIT II LP-EXTENSIONS 9

Duality- primal dual relationships -Dual Simplex –- sensitivity analysis, Data Envelopment Analysis.

UNIT III NETWORKS 9

Transportation, Assignment, Maximal flow, Shortest route, Spanning tree problems, Project Net Works.

UNIT IV DYNAMIC PROGRAMMING 9

Dynamic Programming-Concepts, formulation, recursive approach; applications

UNIT V WAITNG LINES 9

Queuing characteristics and terminology, poisson and non-poisson models.

T=15, TOTAL: 60 PERIODS

REFERENCES:

1. Handy M.Taha, Operations research, an introduction, 7th edition, PHI, 2003.
2. Don T.Phillips, A.Ravindran & James Solberg, Operations Research: Principles and practice, John Wiley, India, 2006.
3. G.Srinivasan , Operations Research Principles and Applications, ,PHI 2008
4. Panneer Selvam,R Operations Research, 2nd Edition, PHI 2008.

IL8102 WORK DESIGN AND ERGONOMICS L T P C
3 0 0 3

UNIT I METHOD STUDY 9

Work design and Productivity – Productivity measurement - Total work content, Developing methods – operation analysis, motion & micro motion study, graphic tools.

UNIT II WORK MEASUREMENT 9

Stop watch time study, Performance rating, allowances, standard data-machining times for basic operations, learning effect

UNIT III APPLIED WORK MEASUREMENT 9

Methods time measurement (MTM), Work sampling, organization and methods (O & M), Wage incentive plans.

UNIT IV PHYSICAL ERGONOMICS 9

Physical work load and energy expenditure, Anthropometry – measures – design procedure, Work postures-sitting, standing - measurement – ergonomic implications. design of displays and controls,

UNIT V ENVIRONMENTAL FACTORS 9

Sources & effects of Noise, Vibration, lighting, temperature, humidity & atmosphere. Measures for monitoring control & mitigation.

TOTAL: 45 PERIODS

REFERENCES:

1. Benjamin W.Niebel, Motion and Time Study, Richard, D. Irwin Inc., Seventh Edition, 2002
2. Barnes, R.M. Motion and Time Study, John Wiley, 2002.
3. Introduction to work study, ILO, 3rd edition, Oxford & IBH publishing,2001
4. Martin Helander, A Guide to human factors and Ergonomics, Taylor and Francis, 2006.

IL8151 FACILITIES DESIGN L T P C
3 0 0 3

UNIT I PLANT LOCATION 9

Plant location analysis – factors, costs, location decisions – single facility location models, multi facility location models- set covering problem – warehouse location problems.

UNIT II FACILITIES LAYOUT 9

Facilities requirement, need for layout study – types of layout, Designing product layout-Line balancing.

UNIT III LAYOUT DESIGN 9

Design cycle – SLP procedure, computerized layout planning procedure – ALDEP, CORELAP, CRAFT

UNIT IV GROUP TECHNOLOGY AND LINE BALANCING 9

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

UNIT V MATERIAL HANDLING 9

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

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", PHI., 2002.
3. James Apple, M.Plant layout and "Material Handling", John Wiley, 1977.
4. Pannerselvam,R, "Production and Operations Management", PHI,2007

IL8153 PRODUCTION MANAGEMENT L T P C
3 1 0 4

UNIT I INTRODUCTION 5

Production Management – Input-output model, objectives, Trends and challenges, value chains, operations strategy, Technological Innovations in Manufacturing, Corporate strategic choices, Process planning and selection.

UNIT II FORECASTING: 10

Need for forecasting, the forecasting process, Forecasting methods- qualitative methods, Quantitative models-Time series forecasting models, moving averages, exponential smoothing with trend and seasonal adjustment, multi-item forecasting, Simple and multiple linear regression models, monitoring and controlling forecasts.

UNIT III INVENTORY MANAGEMENT: 10

Types of inventory, Inventory classification methods, Inventory costs Inventory models-deterministic models, probabilistic models - safety stock and reorder points – Inventory control systems.

UNIT IV PLANNING ACTIVITIES: 10

Capacity planning- short term and long term capacity, capacity of facilities, break even capacity, use of decision trees, aggregate production planning - strategies, methods, Master Production Schedule, MRP- lot sizing, MRP II, CRP, ERP.

UNIT V PRODUCTION CONTROL ACTIVITIES: 10

Production Activity Control, Just-in-time systems, Scheduling in Manufacturing, Theory of constraints and synchronous manufacturing.

T=15, TOTAL: 60 PERIODS

REFERENCES:

1. Seetharama L.Narasimhan, Dennis W.McLeavey, Peter J.Billington,"Production Planning and Inventory Control" , PHI, 2002.
2. Panneerselvam,R. Production and operations management, PHI, 2010.
3. Lee J.Krajewski, Larry P.Ritzman, "Operations Management", Pearson Education, 2006.
4. Mahadevan, B. Operations- Theory & Practice, Pearson Education, 2007.

MA8160 PROBABILITY AND STATISTICAL METHODS L T P C

3 1 0 4

OBJECTIVES:

- 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.

OUTCOMES:

- The course aims at providing the basic concepts of Probability and Statistical techniques for solving mathematical problems which will be useful in solving Engineering problems.

UNIT I ONE DIMENSIONAL RANDOM VARIABLES 9+3

Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY 9+3

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines.

UNIT IV TESTING OF HYPOTHESES 9+3

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V MULTIVARIATE ANALYSIS: 9+3

Random Vectors and Matrices - Mean vectors and Covariance matrices - Multivariate Normal density and its properties - Principal components: Population principal components – Principal components from standardized variables.

TOTAL: 60 PERIODS

BOOKS FOR STUDY:

1. Jay L. Devore, "Probability and statistics for Engineering and the Sciences", Thomson and Duxbury, Singapore, 2002.
2. Richard Johnson. "Miller & Freund's Probability and Statistics for Engineer", Prentice – Hall of India, Private Ltd., New Delhi, Seventh Edition, 2007.
3. Richard A. Johnson and Dean W. Wichern, "Applied Multivariate Statistical Analysis", Pearson Education, Asia, Fifth Edition, 2002.

REFERENCES:

1. Gupta S.C. and Kapoor V.K."Fundamentals of Mathematical Statistics", Sultan and Sons, New Delhi, 2001.
2. Dallas E Johnson et al., "Applied multivariate methods for data analysis", Thomson and Duxbury press, Singapore, 1998.

IL8111 WORK DESIGN AND ERGONOMICS LAB

L	T	P	C
0	0	2	1

AIM:

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

LIST OF EXPERIMENTS

1. Graphic tools for method study
2. Performance rating exercise
3. Stop watch time study
4. Peg board experiment
5. Work sampling
6. MTM practice
7. Study of physical performance using tread mill and Ergo cycle
8. Physical fitness testing of individuals
9. Experiments using sound level and lux meters
10. Experiments using Ergonomics software

TOTAL: 30 PERIODS

LABORATORY EQUIPMENTS REQUIREMENTS

1. Time study Trainer
2. Peg board
3. Stop watches
4. Tread mill
5. Ergo cycle
6. Any one Ergonomics software (Eg.: Ergomaster, Human CAD)

IL8201 MANUFACTURING SYSTEMS AND MODELS

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION **5**

Manufacturing systems – types and concepts, manufacturing automation - Performance measures – types and uses of manufacturing models.

UNIT II FOCUSSED FACTORIES **9**

GT/CMS, FMS planning, design and control. Process planning – variant and generative approaches of CAPP, general serial systems – analysis of paced and unplaced lines.

UNIT III LEAN SYSTEMS **9**

Characteristics of Lean systems for services and Manufacturing, Pull method of work flow, Small lot sizes, Kanban system, Value stream mapping, JIT

UNIT IV QUEUING MODELS OF MANUFACTURING **10**

Basic Queuing models, Queuing networks, application of queuing models for AMS.

UNIT V MARKOV AND PETRINET MODELS OF MANUFACTURING 12

Stochastic processes in manufacturing, discrete and continuous time Markov chain models. Concepts of Petri nets, ETPN and GSPN models.

TOTAL: 45 PERIODS

REFERENCES:

1. Nicolas, J.M, Competitive manufacturing management - continuous improvement, lean production, customer focused quality, McGraw-Hill, NY, 2001.
2. Viswanadam, N and Narahari, Y., Performance modeling of automated manufacturing systems, PHI, New Delhi, 1996.
3. Lee J. Krajewski, Operations Management – Processes and Value Chains, Pearson, 2008.
4 Ronald G.Askin, Charles R. Standridge, modeling and analysis of manufacturing systems, John wiley & sons, Inc , 2000.

IL8202 QUALITY ENGINEERING L T P C

3 0 0 3

UNIT I INTRODUCTION 7

Statistical concepts for quality- Fundamentals of quality- history, Quality definitions, Quality dimensions, Quality terminology- Inspection, Quality control, SQC, Quality Assurance, Quality planning- policies & objectives, Quality costs – Economics of quality, Quality loss function, Quality Vs productivity, Quality Vs reliability.

UNIT II STATISTICAL PROCESS CONTROL 10

Process variation, Control charts for variables- $\overline{X}$, R and S charts- preliminary decisions, computation of control limits, Construction and interpretation, Relation between process in control and specification limits, modified and warning control limits, O.C. curve for $\overline{X}$ chart, Control procedure, adjustment for trend in process mean.

UNIT III SPECIAL CONTROL PROCEDURES 10

Control charts for attributes- p, np, c and u charts, demerits control chart, O.C curve for p-chart, Control charts for individual measurements- X-chart, moving average and moving range charts, cumulative-sum and exponentially weighted moving average control charts, multi-vari chart.

UNIT IV PROCESS AND MEASUREMENT SYSTEM CAPABILITY 8

Process stability, process capability analysis using a Histogram or normal probability plot and control chart, process capability indexes, Gauge capability studies, setting specification limits.

UNIT V ACCEPTANCE SAMPLING 10

Acceptance sampling, Economics of sampling, Single sampling plan for attributes- O.C. curve, design, double sampling- O.C. curve, multiple and sequential sampling plans, sampling plans for variables, MIL-STD-105E and MIL-STD-414 & IS2500 standards.

TOTAL: 45 PERIODS

REFERENCES:

1. E.L. Grant and R.S. Leavenworth, Statistical Quality Control, Seventh Edition, TMH, 2000.
2. Douglas C Montgomery, Introduction to Statistical Quality Control, Sixth Edition, John Wiley & sons, Inc., 2009. IS 2500 Standard sampling plans

IL8203 SYSTEMS AND SIMULATION L T P C
3 0 0 3

UNIT I INTRODUCTION 3

Systems, modeling, general systems theory, concept of simulation, simulation as a decision making tool, types of simulation.

UNIT II RANDOM NUMBERS AND VARIATES 5

Pseudo random numbers, methods of generating random variates, testing of random numbers and variates.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 8

Problem formulation, data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation.

UNIT IV SIMULATION LANGUAGES 14

Comparison and selection of simulation languages, study of any one simulation language.

UNIT V CASE STUDIES / MINI PROJECT 15

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.

TOTAL: 45 PERIODS

REFERENCES:

1. Jerry Banks and John S.Carson, Barry L Nelson, David M.Nicol, P.Shahabudeen, Discrete event system simulation, Pearson Education, 2007.
2. Law A.M, Simulation Modelling and Analysis, Tata Mc Graw Hill,2008
3. Thomas J.Schriber, Simulation using GPSS, John Wiley, 1991
4. Tayfur Altiok, Benjamin Melamed, Simulation Modeling and Analysis with ARENA, Elsevier, 2007.

IL8152 LOGISTICS AND SUPPLY CHAIN MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To impart the fundamentals of logistics and supply chain management and to apply them to various manufacturing problems

OUTCOME:

The students should apply information, demand forecasting, inventory management, transportation, warehousing & distribution, protective packaging, order processing, materials handling, purchasing & sourcing management techniques to manufacturing systems

UNIT I INTRODUCTION TO L&SCM 9

Logistics: Nature & Concepts – Evolution – Importance – Advantage – Objectives – Components – Functions – Supply Chain Management: Nature & Concepts – Value chain – Functions & Contribution – Effectiveness – Framework – Outsourcing – 3 PLs – 4 PLs – Bull whip effect – SC Relationships – Conflict resolution – Harmonious relationship – Customer Service: Nature & Concepts – Importance – Components – Cost – Gap analysis – Strategic management – Case Study.

UNIT II INFORMATION, DEMAND FORECASTING, INVENTORY MANAGEMENT 9

Information: Position of Information in L&SCM – Logistical Informational Systems – Operational Logistical Informational Systems – Integrated Information Technology Solution for L&SCM – Emerging L&SCM – Demand Forecasting: Nature & Components – Impact of forecast on L&SCM – Effective forecasting – Techniques – Selection – Principles – Inventory: Concepts – Types – Functions – Elements – Inventory management – ABC analysis – ABC-VED matrix – Materials Requirement Planning – Distribution Requirement Planning – Just in Time System – Prerequisites – Case study.

UNIT III TRANSPORTATION, WAREHOUSING & DISTRIBUTION 11

Transportation: Introduction – Position of transportation in L&SCM – Elements of transportation cost – Modes – Multimodal transport – Containerization – Selection of transportation modes – Transportation decision – Transportation network: routing & scheduling – Warehousing & Distribution Centers: Introduction – Concepts – Types – Functions – Strategy – Design – Operational Mechanism – Case study.

UNIT IV PROTECTIVE PACKAGING, ORDER PROCESSING, MATERIALS HANDLING, PURCHASING & SOURCING MANAGEMENT 9

Protective Packaging: Introduction – Concepts – Functions – Forms – Problems – Policy – Order Processing: Introduction – Concepts – Functions – Elements – Significance – Materials Handling: Introduction – Concept – Objective- Principles – Equipments – Considerations – Purchasing & Sourcing Management: Introduction – Nature – Scope – Importance – Trends – Contemporary sourcing & supplier management – Case study.

UNIT V L&SCM ADMINISTRATION 7

Organization: Introduction – Evolutionary trends of L&SCM – Principles – Factors. Performance Measurement: Introduction – Dimensions – Basic tools – Impediments to improve performance – Case Study.

TOTAL: 45 PERIODS

REFERENCES:

1. Agrawal, D. K., "**A Textbook of Logistics & Supply Chain Management**", MacMillan Publishers India Ltd., 2009.
2. Sunil Chopra & Peter Meindl, "**Supply Chain Management, Strategy, Planning, and Operation**", 2nd Edition, PHI, 2004.
3. David J. Bloomberg, Stephen Lemay & Joe B. Hanna, "**Logistics**", PHI, 2002.
4. Jeremy F. Shapiro, "**Modeling the Supply Chain**", Thomson Duxbury, 2002.
5. James B. Ayers, "**Handbook of Supply Chain Management**", St. Lucle Press, 2000.

IL8211 COMPUTER APPLICATIONS LAB 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

Development of Simple Programs for Statistical analysis: Frequency distribution, Applications of Graphics. (Charts, Graphs etc).

UNIT II 9

Programs for OR applications like Initial solution of Transportation Problems, Net Works etc

UNIT III 9

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

UNIT IV 9

Development of Random number generator, Testing of random number generator. Non-uniform Random varieties generation and testing. Single server Queuing simulation, Case Studies

UNIT V 9

Program for Simulation of Single server Queuing System – Use of Simulation software. Case studies.

TOTAL: 45 PERIODS

LABORATORY EQUIPMENTS REQUIREMENTS

1. TURBO C++ Software
2. LINDO Software
3. LINGO Software
4. TORA Software
5. GPSS Software
6. MS EXCEL

IL8212 TECHNICAL SEMINAR L T P C
0 0 2 1

OBJECTIVE:

- To enrich the communication skills of the student through presentation of topics in recent advances in engineering/technology

OUTCOME:

- Students will develop skills to read, write, comprehend and present research papers.
- Students shall give presentations on recent areas of research in manufacturing engineering in two cycles. Depth of understanding, coverage, quality of presentation material (PPT/OHP) and communication skill of the student will be taken as measures for evaluation.

TOTAL: 30 PERIODS

IL8301 DESIGN OF EXPERIMENTS AND TAGUCHI METHODS L T P C
3 1 0 4

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 models.

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 9

Two and three factor full factorial experiments, Randomized block factorial design, Experiments with random factors, rules for expected mean squares, approximate F- tests. 2^K factorial Experiments.

UNIT IV SPECIAL EXPERIMENTAL DESIGNS: 9

Blocking and confounding in 2^k designs. Two level Fractional factorial design, nested designs, Split plot design, Response Surface Methods.

UNIT V TAGUCHI METHODS 12

Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design- control and noise factors, S/N ratios, parameter design, Multi-level experiments, Multi-response optimization.

T=15, TOTAL: 60 PERIODS

REFERENCES:

1. Krishnaiah, K. and Shahabudeen, P. Applied Design of Experiments and Taguchi Methods, PHI learning private Ltd., 2012.
2. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, Eighth edition, 2012.
3. Nicolo Belavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.
4. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.
5. Montgomery, D.C., Design and Analysis of Experiments, Minitab Manual, John Wiley and Sons, Seventh edition, 2010.

IL8001 ADVANCED OPTIMIZATION TECHNIQUES L T P C
3 0 0 3

UNIT I INTRODUCTION 5

Classification of optimization problems, concepts of design vector, Design constraints, constrains surface, objective function surface and multi-level optimization, parametric linear programming

UNIT II DECISION ANALYSIS 10

Decision Trees, Utility theory, Game theory, Multi Objective Optimization, MCDM- Goal Programming, Analytic Hierarchy process, ANP

UNIT III NON-LINEAR OPTIMIZATION 15

Unconstrained one variable and multi variable optimization, KKT Conditions, Constrained optimization, Quadratic programming, Convex programming, Separable programming, Geometric programming, Non-Convex programming

UNIT IV NON-TRADITIONAL OPTIMIZATION -1 10

Classes P and NP, Polynomial time reductions, Introduction to NP- Hard problems, Overview of Genetic algorithms, Simulated Annealing, neural network based optimization.

UNIT V NON-TRADITIONAL OPTIMIZATION -2 5

Particle Swarm optimization, Ant Colony Optimization, Optimization of Fuzzy Systems.

TOTAL: 45 PERIODS

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 India, 2006.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

IL8002 DESIGN OF ALGORITHMS L T P C
3 0 0 3

UNIT I INTRODUCTION 5

Algorithms, basic steps in development.

UNIT II REVIEW OF ANY ONE OF THE STRUCTURED LANGUAGES 10

UNIT III BASIC TOOLS 5

Top down, Structured programming, networks, data structure.

UNIT IV METHODS OF DESIGN 10

Sub goals, hill climbing and working backward, heuristics, back track programming, Branch and bound recursion process, program testing, documentation, Meta heuristics.

UNIT V APPLICATION 15

Development of sorting, searching, algorithms- combinatorial problems, shortest path, probabilistic algorithms.

TOTAL: 45 PERIODS

REFERENCES:

1. John R Hubbard, Fundamentals of Computing with C++,Tata Mc Graw Hill, 2000.
2. Goodman S.F. & Headtruemu, S.T.,Introduction to the design and analysis of algorithms, McGraw Gill, 2000.

Attested

DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.

3. Elias Horowitz, Sartaj Sahani, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Galgotia Publications, 2003
4. Dromey, “How to solve in by computers, Prentice Hall, 1982.
5. Panneerselvam. R, Design and Analysis of Algorithms, Prentice Hall of India, 2008.

IL8003 ENGINEERING ECONOMICS AND COSTING L T P C
3 0 0 3

UNIT I DEMAND ANALYSIS AND FORECASTING 10

Managerial Economics – Meaning, Nature and Scope – Managerial Economics and Business decision making – Role of Managerial Economist – Demand Analysis – Fundamental Concepts of Managerial Economics – Meaning, Determinants and Types of Demand – Elasticity of demand - Demand forecasting and forecasting methods.

UNIT II PRODUCTION FUNCTION AND COST ANALYSIS 9

Supply: Meaning and determinants – production function- Isoquants – Expanstion path Cobb Douglas function – Cost concepts – Cost output relationship – Economies and diseconomies of scale – Cost functions- Determination of cost- Estimation of cost.

UNIT III MARKET COMPETITION AND PRICING 9

Market Structure – Various forms – Equilibrium of a firm – Perfect competition – Monopolistic competition – Oligopolistic competition – Pricing of products under different market structures – Methods of pricing – Factors affecting pricing decision – Differential pricing – Government Intervention and pricing.

UNIT IV PROFIT ANALYSIS 7

The concept of profit: Profit planning, control and measurement of profits. Profit maximisation – Cost volume profit analysis – Investment Analysis.

UNIT V COSTING 10

Job costing-Process costing-Operating costing-Standard Costing (variance analysis) and budgeting-.

TOTAL: 45 PERIODS

REFERENCES :

1. A. Ramachandra Aryasry and V.V. Ramana Murthy. “ Engineering Economics and Financial Accounting:, Tata Mc graw Hill Publishing Company Ltd., New Delhgi, 2004
2. V.L. Mote, Samuel and G.S.Gupta, “Managerial Economics – Concepts and cases”, Tata McGraw Hill Publishing Coimpany Ltd, New Delhi, 1981.
3. A.Nag, :Macro Economics for Management Students” MacMillan India Ltd., New Delhi, 1999.
4. Jawaharlal, Cost Accounting, Tata McGraw Hill,

IL8004 HUMAN FACTORS ENGINEERING L T P C
3 0 0 3

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 PERIODS

REFERENCES:

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.

IL8005 INDUSTRIAL AUTOMATION L T P C
3 0 0 3

UNIT I AUTOMATION 5

Types of production – Functions – Automation strategies – Production economics – Costs in manufacturing – Break-even analysis.

UNIT II AUTOMATED FLOW LINES 10

Transfer mechanism - Buffer storage – Analysis of transfer lines - Automated assembly systems.

UNIT III NUMERICAL CONTROL AND ROBOTICS 10

NC-CNC – Part programming – DNC – Adaptive control – Robot anatomy – Specifications – End effectors – Sensors - Robot cell design – CAD/CAM.

UNIT IV AUTOMATED HANDLING AND STORAGE 10

Automated material handling systems – AGV- AS/RS – carousel storage – Automatic data capture – bar code technology- RFID

UNIT V MANUFACTURING SUPPORT SYSTEMS 10

Product design and CAD, CAD/CAM and CIM, Computer aided process planning- variant and generative approaches, Concurrent engineering and design for manufacture, Lean production, Agile manufacturing.

TOTAL: 45 PERIODS

REFERENCES:

1. Mikell P.Groover, “Automation, Production Systems and Computer Integrated Manufacturing” PHI, 2003.
2. Weatherall, “Computer Integrated Manufacturing – A total company strategy”, 2nd edition, 1995.

IL8006 KNOWLEDGE ENGINEERING AND MANAGEMENT L T P C
3 0 0 3

UNIT I INTRODUCTION 9

The value of Knowledge – Knowledge Engineering Basics – Knowledge Economy – The Task and Organizational Content – Knowledge Management – Knowledge Management Ontology.

UNIT II KNOWLEDGE MODELS 9

Knowledge Model Components – Template Knowledge Models –Reflective Knowledge Models– Knowledge Model Construction – Types of Knowledge Models.

UNIT III TECHNIQUES OF KNOWLEDGE MANAGEMENT 9

Knowledge Elicitation Techniques – Modeling Communication Aspects – Knowledge Management and Organizational Learning.

UNIT IV KNOWLEDGE SYSTEM IMPLEMENTATION 9

Case Studies – Designing Knowledge Systems – Knowledge Codification – Testing and Deployment – Knowledge Transfer and Knowledge Sharing – Knowledge System Implementation.

UNIT V ADVANCED KM 9

Advanced Knowledge Modeling – Value Networks – Business Models for Knowledge Economy – UML Notations – Project Management.

TOTAL: 45 PERIODS

REFERENCES:

1. Guus Schreiber, Hans Akkermans, Anjo Anjewierden, Robert de Hoog, Nigel Shadbolt, Walter Van de Velde and Bob Wielinga, "Knowledge Engineering and Management", Universities Press, 2004.
2. Elias M.Awad & Hassan M. Ghaziri, "Knowledge Management", Pearson Education, 2004.

IL8007 MAINTAINABILITY ENGINEERING L T P C

3 0 0 3

UNIT I MAINTENANCE CONCEPT 6

Maintenance definition –Need for maintenance –Maintenance objectives and challenges – Tero technology – Maintenance costs - Scope of maintenance department.

UNIT II MAINTENANCE MODELS 12

Proactive/Reactive maintenance – Imperfect maintenance – Maintenance policies – PM versus b/d maintenance – PM schedule and product characteristics – Inspection models-Optimizing profit/downtime – Replacement decisions.

UNIT III MAINTENANCE LOGISTICS 11

Human factors – Maintenance staffing: Learning curves – Simulation – Maintenance resource requirements: Optimal size of service facility – Optimal repair effort – Maintenance planning and scheduling – Spare parts planning..

UNIT IV MAINTENANCE QUALITY 8

Maintenance excellence –Five Zero concept –FMECA –Root cause analysis – System effectiveness – Design for maintainability – 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 – Autonomous maintenance – TPM implementation

TOTAL: 45 PERIODS

REFERENCES:

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.

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Centre For Academic Courses
Anna University, Chennai-600 025.

IL8008 SCHEDULING ALGORITHMS L T P C
3 0 0 3

UNIT I SCHEDULING THEORY 7

Scheduling background – Scheduling function – Sequencing – Ready time – Flow time – Tardiness - Weighted flow time – Inventory – Regular measures of performance – Dominant schedules – SPT, EDD, WSPT sequences – Scheduling Theorems.

UNIT II SINGLE MACHINE SCHEDULING 10

Pure sequencing model – Hodgson's algorithm – Smith's rule – Wilkerson Irwin algorithm – Neighborhood search – Dynamic programming technique – Branch and Bound algorithm – Non simultaneous arrivals – Minimizing $\overline{T}$ and $\overline{F}$ for dependent jobs – Sequence dependent set up times.

UNIT III PARALLEL MACHINE SCHEDULING 8

Preemptive jobs: McNaughton's algorithm – Non preemptive jobs – Heuristic procedures – Minimizing $\overline{F_w}$: H_1 & H_m heuristics – Dependent jobs: Hu's algorithm – Muntz Coffman algorithm.

UNIT IV FLOW SHOP SCHEDULING 10

Characteristics – Johnson's algorithm – Extension of Johnson's rule – Campbell Dudek Smith algorithm – Palmer's method – Start lag, stop lag – Mitten's algorithm – Ignall Schrage algorithm - Despatch index heuristic.

UNIT V JOB SHOP SCHEDULING 10

Characteristics –Graphical tools – Jackson's algorithm – Feasible, Semi-active and Active schedules – Single pass approach – Non delay schedule – Priority dispatching rules – Heuristic schedule generation – Open shop scheduling.

TOTAL: 45 PERIODS

REFERENCES:

1. Kenneth R.Baker, "Introduction to sequencing and scheduling", John Wiley & Sons, New York, 2000.
2. Richard W. Conway, William L.Maxwell and Louis W. Miller, "Theory of Scheduling", Dover Publications, 2003.

IL8009 SYSTEMS SCIENCE AND ENGINEERING L T P C
3 0 0 3

UNIT I SYSTEMS SCIENCE CONCEPTS 9

System as a function of system-hood and thing-hood, Systems thinking, Evolution of systems movement, Framework of deductive and inductive approaches, classification systems models, Methodological paradigms, Laws of systems science, Organized complexity, Systems simplification.

UNIT II SYSTEMS ENGINEERING PROCESSES 9

Life cycles-Phases-Steps, Formulation of Issues: Problem Identification – Scoping – Bounding, Problem definition – Identification of needs, alterables, constraints; Value System Design: Objectives and objective measures; Generation of Alternatives/ system synthesis – Identification of activities and activity measures; Functional decomposition and analysis.

UNIT III ANALYSIS OF ALTERNATIVES 9

Uncertain/ Imperfect information; Cross-impact analysis, Hierarchical inference, logical reasoning inference; Structural modeling; System Dynamics.

UNIT IV INTERPRETATION OF ALTERNATIVES AND DECISION MAKING 9

Types of decisions – descriptive, prescriptive, normative; Decision assessment efforts types – under certainty, probabilistic uncertainty, probabilistic imprecision, information imperfection, conflict and cooperation; Prescriptive normative decision assessments; Utility theory; Group decision making, Game Theory.

UNIT V SYSTEMS ENGINEERING MANAGEMENT CONCEPTS 9

Organizational structures, SE management plan; Network based systems planning and management methods; Cognitive factors in SE.

TOTAL: 45 PERIODS

REFERENCES:

1. Andrew P Sage and James E Armstrong, Introduction to Systems Engineering, Wiley Series, 2000.
2. George J Klir, Facets of Systems Science, Kluwer Publishers, 2001.

IL8071 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++ Basics 15

Expression and statements, operators, precedence, type conversion, control statements, loops, Arrays structures, functions, argument passing, reference argument, overloaded function.

UNIT III C++ CLASS 5

Definition, class objects, member functions, , class argument, , operator overloading, user defined conversions.

UNIT IV CLASS DERIVATION 10

Derivation specification, public and private base classes, standard conversions under derivation, class scope, initialization and assignment under derivation.

UNIT V APPLICATION 10

OOP's applications in Industrial Engineering.

TOTAL: 45 PERIODS

REFERENCES:

1. Robert Lafore, "Object oriented programming in C++", Sam Publishing, 2002.
2. E. Balagurusamy, Object oriented programming with C++, Tata McGraw Hill, 2003
3. Stanley B.Lippman, C++ Printer, Addison – Wesley Pub. Co., 2003.
4. Nabajyoti Barkakati, Object Oriented Programming in C++, Prentice Hall of India, 2001

IL8072 BUSINESS EXCELLENCE MODELS L T P C

3 0 0 3

UNIT I BUSINESS EXCELLENCE MODELS 8

Business Excellence Concepts – Need for BE models – Pioneers in the model MBNQA , EFQM and DEMING award

UNIT II MBNQA 12

Criteria :: LEADERSHIP, Strategic planning, Customer and Market focus, Measurement analysis and Knowledge Management, Human resource focus, process management, business results

UNIT III BUSINESS EXCELLENCE AWARDS IN INDIA 7
Models in Business excellence: RBNQA CII EXIM Award, Tata BE Model etc

UNIT IV IMPLEMENTING BUSINESS EXCELLENCE MODEL 10
Basic concepts – Training -Report writing – Internal audit-Report submission – Initial assessment - Site visit – Scoring – Criteria for Award, Award finalization

UNIT V CASE STUDY 8

TOTAL: 45 PERIODS

TEXT BOOK:
Mark Graham Brown, Baldrige Award Winning Quality, CRC press, 2008.

REFERENCES:
http://www.baldrige.nist.gov
http://www.baldrige21.com/
www.imc.org
http://www.quality.nist.gov/index.html
www.qimpro.com
www.imcrbnqa.com
www.efqm.org
www.juse.or.jp/e/deming/index.html

IL8073 DATA ANALYSIS TECHNIQUES L T P C
3 0 0 3

UNIT I STATISTICAL DATA ANALYSIS 9
Data and Statistics- Review of Basic Statistical Measures-Probability Distributions-Testing of Hypotheses-Non Parametric Tests

UNIT II DATA ANALYSIS I 9
Introduction – Basic concepts – Uni-variate, Bi-variate and Multi-variate techniques – Types of multivariate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation – Approaches to multivariate model building.

UNIT III DATA ANALYSIS II 9
Simple and Multiple Linear Regression Analysis – Introduction – Basic concepts – Multiple linear regression model – Least square estimation – Inferences from the estimated regression function – Validation of the model.
Factor Analysis: Definition – Objectives – Approaches to factor analysis – methods of estimation – Factor rotation – Factor scores - Sum of variance explained – interpretation of results.
Canonical Correlation Analysis - Objectives – Canonical variates and canonical correlation – Interpretation of variates and correlations.

UNIT IV DATA ANALYSIS III 9
Multiple Discriminant Analysis - Basic concepts – Separation and classification of two populations - Evaluating classification functions – Validation of the model.
Cluster Analysis – Definitions – Objectives – Similarity of measures – Hierarchical and Non – Hierarchical clustering methods – Interpretation and validation of the model.

UNIT V DATA ANALYSIS IV 9
Conjoint Analysis – Definitions – Basic concepts – Attributes – Preferences – Ranking of Preferences – Output of Conjoint measurements – Utility - Interpretation.

Multi Dimensional Scaling – Definitions – Objectives – Basic concepts – Scaling techniques – Attribute and Non-Attributes based MDS Techniques – Interpretation and Validation of models.

Advanced Techniques – Structural Equation modeling

TOTAL: 45 PERIODS

REFERENCES:

1. Joseph F Hair, Rolph E Anderson, Ronald L. Tatham & William C. Black, Multivariate Data Analysis, Pearson Education, New Delhi, 2005.
2. Richard A Johnson and Dean W. Wichern, Applied Multivariate Statistical Analysis, Prentice Hall, New Delhi, 2005.
3. David R Anderson, Dennis J Sweeney and Thomas A Williams, Statistics for Business and Economics, Thompson, Singapore, 2002.

IL8074 DECISION SUPPORT SYSTEMS L T P C
3 0 0 3

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.

TOTAL: 45 PERIODS

REFERENCES:

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.

IL8075 INDUSTRIAL SAFETY AND HYGIENE L T P C
3 0 0 3

UNIT I OPERATIONAL SAFETY 9

Hot metal operation, boiler, pressure vessels – heat treatment shop – gas furnace operation – electroplating – hot bending pipes – safety in welding and cutting, Cold – metal operation – safety in machine shop – cold bending and chamfering of pipes- metal cutting – shot blasting, grinding, painting – power press and other machines. Management of toxic gases and chemicals – industrial fires and prevention – road safety – highway and urban safety – safety of sewage disposal and cleaning – control of environmental pollution – managing emergencies in industries – planning security and risk assessments, on – site and off site. Control of major industrial hazards.

UNIT II SAFETY APPRAISAL AND ANALYSIS 9

Human side of safety – personal protective equipment – causes and cost of accidents. Accidents prevention program – specific hazard control strategies – HAZOP training and development of employees – first aid – fire fight devices – accident reporting, investigation. Measurement of safety performance, accident reporting and investigation – plant safety inspection, job safety analysis – safety permit procedures. Product safety – plant safety rules and procedures – safety sampling – safety inventory systems. Determining the cost effectiveness of safety measurement.

UNIT III OCCUPATIONAL HEALTH 9

Concept and spectrum of health functional units and activities of operational health service – occupational and related disease – levels of prevention of diseases – notifiable occupational diseases Toxicology Lead – Nickel, chromium and manganese toxicity – gas poisoning (such as CO, Ammonia Chlorise, So2, H2s.) their effects and prevention – effects of ultra violet radiation and infrared radiation on human system.

UNIT IV SAFETY AND HEALTH REGULATIONS 9

Safety and health standards – industrial hygiene – occupational diseases prevention welfare facilities. The object of factories act 1948 with special reference to safety provisions, model rules 123a, history of legislations related to safety – pressure vessel act – Indian boiler act – the environmental protection act – electricity act – explosive act.

UNIT V SAFETY MANAGEMENT 9

Evaluation of modern safety concepts – safety management functions – safety organization, safety department- safety committee, safety audit – performance measurements and motivation – employee participation in safety - safety and productivity.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John.V .Grimaldi and Rollin. H Simonds, “Safety Management”, All India traveler book seller, New Delhi – 1989.
2. Krishnan N.V, “Safety in Industry”, Jaico Publisher House, 1996.

REFERENCES:

1. Occupational Safety Manual BHEL.
2. Industrial Safety and the law by P.M.C Nair Publishers, Trivandrum.
3. Managing emergencies in industries, loss prevention of India Ltd., proceedings, 1999.
4. Safety security and Risk management by U.K singh & J.M Dewam, A.P.H. publishing company, New Delhi, 1996.
5. Singh, U.K and Dewan, J.M., “Safety, Security And Risk Management”, APH publishing company, New Delhi, 1996.
6. John V Grimaldi, Safety Management. AITB publishers, 2003.
7. Safety Manual. EDEL Engineering Consultancy, 2000.

IL8076 LEAN MANUFACTURING AND SIX SIGMA L T P C

3 0 0 3

UNIT I INTRODUCTION TO LEAN MANUFACTURING AND SIX SIGMA 9

Introduction to Lean- Definition, Purpose, features of Lean ; top seven wastes, Need for Lean, Elements of Lean Manufacturing, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six sigma, origin of six sigma, Six sigma concept, Critical success factors for six sigma.

UNIT II LEAN SIX SIGMA APPROACH 9

Evolution of lean six sigma, the synergy of Lean and six sigma, Definition of lean six sigma, the principles of lean six sigma, Scope for lean six sigma, Features of lean six sigma, The laws of lean six sigma, Benefits of lean six sigma, Introduction to DMAIC tools.

UNIT III INITIATION FOR LEAN SIX SIGMA 9

Top management commitment – Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition, Infrastructure tools, structure of transforming event, Launch preparation.

UNIT IV PROJECT SELECTION FOR LEAN SIX SIGMA 9

Resource and project selection, Selection of Black belts, Selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Balanced score card for project identification, project suitable for lean six sigma.

UNIT V THE DMAIC PROCESS AND INSTITUTIONALIZING THE LSS 9

Predicting and improving team performance, Nine team roles, Team leadership, DMAIC process, Institutionalizing lean six sigma, Design for lean six sigma, Case study presentations.

TOTAL: 45 PERIODS

REFERENCES:

1. Michael L. George, Lean Six Sigma, McGraw-Hill, 2002.
2. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business, 2003.
3. Forrest W. Breyfogle III, Implementing Six Sigma: Smarter solutions Using Statistical Methods, 1999.
4. Ronald G.Askin and Jeffrey B.Goldberg, Design and Analysis of Lean Production Systems, John Wiley & Sons, 2003.
5. Rother M. and hook J., Learning to See: Value Stream Mapping to add value and Eliminate Muda, Lean Enterprise Institute, Brookline, MA.

IL8077 LOGISTICS AND DISTRIBUTION MANAGEMENT L T P C
3 0 0 3

UNIT I CONCEPTS OF LOGISTICS AND DISTRIBUTION 9

Introduction to logistics and distribution- Integrated logistics and the supply chain- Integrated logistics and the supply chain- Customer service and logistics- Channels of distribution - Key issues and challenges for logistics.

UNIT II PLANNING FOR LOGISTICS 9

Planning framework for logistics -Logistics processes -Supply chain segmentation- Logistics network planning - Logistics management and organization - Manufacturing and materials management

UNIT III WAREHOUSING AND STORAGE 9

Principles of warehousing Storage and handling systems (palletized and non-palletized) - Order picking and replenishment- Receiving and dispatch - Warehouse design- Warehouse management and information

UNIT IV FREIGHT TRANSPORT 9

International logistics: modal choice - Maritime transport - Air transport - Rail and intermodal transport- Road freight transport: vehicle selection, vehicle costing and planning and resourcing- International transportation systems in Global perspective.

UNIT V OPERATIONAL MANAGEMENT 9

Cost and performance monitoring- Benchmarking- Information and communication technology in supply chain- Outsourcing: services and decision criteria, the selection process - Outsourcing management- Security and safety in distribution - Logistics and the environment.

TOTAL: 45 HOURS

REFERENCES:

1. Alan Rushton,Phil Croucher and Peter Baker(Eds.)The Handbook of Logistics and Distribution Management,Kogan Page,4th Edition,2010.
2. Jean-Paul Rodrigue, Claude Comtois and Brian Slack, "The geography of transport systems" (2009), New York: Routledge,.

IL8078 MANAGEMENT ACCOUNTING AND FINANCIAL MANAGEMENT L T P C
3 0 0 3

UNIT I FINANCIAL ACCOUNTING 10

Trading Account, Profit and Loss Account, Balance sheet 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 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, Type of investment proposals, Investment appraisal techniques – Payback 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 PERIODS

REFERENCES:

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.

IL8079 MULTIVARIATE DATA ANALYSIS L T P C
3 0 0 3

UNIT I REGRESSION 9

Simple Regression and Correlation – Estimation using the regression line, Correlation analysis, Multiple regression and Correlation analysis – Finding the Multiple Regression equation, Modelling techniques, Making inferences about the population parameters.

UNIT II MULTIVARIATE METHODS 9

An overview of Multivariate methods, Multivariate Normal distribution, Eigen values and Eigen vectors.

UNIT III FACTOR ANALYSIS 9

Principal Component Analysis – Objectives, Estimation of principal components, Testing for independence of variables, Factor analysis model – Factor analysis equations and solution.

UNIT IV DISCRIMINANT ANALYSIS 9

Discriminant analysis – Discrimination for two multivariate normal Populations – Discriminant functions.

UNIT V CLUSTER ANALYSIS 9

Cluster analysis – Clustering methods, Multivariate analysis of Variance.

TOTAL: 45 PERIODS

REFERENCES:

1. Dallas E Johnson, Applied Multivariate methods for data analysis, Duxbury Press (1998).
2. Richard I Levin, Statistics for Management, PHI(2000).

IL8080 PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING L T P C
3 0 0 3

UNIT I PRODUCTIVITY 9

Productivity Concepts – Macro and Micro factors of productivity – Dynamics of Productivity - Productivity Cycle Productivity Measurement at International, National and Organisation level - Productivity measurement models

UNIT II SYSTEMS APPROACH TO PRODUCTIVITY MEASUREMENT 9

Conceptual frame work, Management by Objectives (MBO), Performance Objectivated Productivity (POP) – Methodology and application to manufacturing and service sector.

UNIT III ORGANISATIONAL TRANSFORMATION 9

Elements of Organisational Transformation and Reengineering-Principles of organizational transformation and re-engineering, fundamentals of process re-engineering, preparing the workforce for transformation and re-engineering, methodology, guidelines, LMI CIP Model – DSMC Q & PMP model.

UNIT IV RE-ENGINEERING PROCESS IMPROVEMENT MODELS 9

PMI models, PASIM Model, Moen and Nolan Strategy for process improvement, LMICIP Model, NPRDC Model.

UNIT V RE-ENGINEERING TOOLS AND IMPLEMENTATION 9

Analytical and process tools and techniques – Information and Communication Technology – Implementation of Reengineering Projects – Success Factors and common implementation Problem – Cases.

TOTAL: 45 PERIODS

REFERENCES:

1. Sumanth, D.J., 'Productivity Engineering and Management', TMH, New Delhi, 1990.
2. Edosomwan, J.A., "Organisational Transformation and Process Re-engineering", Library Cataloging in Pub. Data, 1996.
3. Rastogi, P.N., "Re-engineering and Re-inventing the Enterprise", Wheeler Pub. New Delhi, 1995.
4. Premvrat, Sardana, G.D. and Sahay, B.S., "Productivity Management – A Systems Approach", Narosa Publishing House. New Delhi, 1998.

IL8081 PROJECT MANAGEMENT L T P C
3 0 0 3

UNIT I STRATEGIC MANAGEMENT AND PROJECT SELECTION 9

Project selection models, Project portfolio process, Analysis under uncertainty, Project organization, Matrix organization

UNIT II PROJECT PLANNING 9

Work breakdown structure, Systems integration, Interface coordination, Project life cycle, Conflict and negotiation,

UNIT III PROJECT IMPLEMENTATION 12

Estimating Project Budgets, Process of cost estimation, Scheduling: Network Techniques PERT and CPM, Risk analysis using simulation, CPM- crashing a project, Resource loading, leveling, and allocation

UNIT IV MONITORING AND INFORMATION SYSTEMS 9

Information needs and the reporting process, computerized PMIS, Earned value analysis, Planning-Monitoring-Controlling cycle**,** Project control**:** types of control processes, design of control systems, control of change and scope

UNIT V PROJECT AUDITING 6

Construction and use of audit report, Project audit life cycle, Essentials of audit and evaluation, Varieties of project termination, the termination process, The Final Report – A project history

TOTAL: 45 PERIODS

TEXT BOOKS

1. R.Panneer selvam,P. Senthil Kumar, Project Management, PHI, 2010
2. Arun Kanada, Project Management A life cycle approach, PHI, 2011

REFERENCES:

1. Project Management – A Managerial Approach, by Jack R. Meredith, and Samuel J. Mantel Jr.John Wiley and Sons, 2006
2. Project Management – A Systems Approach to Planning, Scheduling and Controlling, by Harold Kerzner, John Wiley and Sons, 2006

IL8082 RELIABILITY ENGINEERING L T P C
3 0 0 3

UNIT I RELIABILITY CONCEPTS 9

Reliability definition – Quality and Reliability– Reliability mathematics – Reliability functions – Hazard rate – Measures of Reliability – Design life –A priori and posteriori probabilities – Mortality of a component –Mortality curve – Useful life.

UNIT II LIFE DATA ANALYSIS 11

Data collection –Non Parametric methods: Ungrouped/Grouped, Complete/Censored data – Time to failure distributions: Exponential, Weibull – Probability plotting – Goodness of fit tests.

UNIT III RELIABILITY ASSESSMENT 10

Different configurations – Redundancy – k out of n system – Complex systems: RBD – Baye's approach – Cut and tie sets – Fault Trees – Standby systems.

UNIT IV RELIABILITY MONITORING 8

Life testing methods: Failure terminated – Time terminated – Sequential Testing –Reliability growth monitoring – Reliability allocation – Software reliability-Human reliability.

UNIT V RELIABILITY IMPROVEMENT 7

Analysis of downtime – Repair time distribution – System repair time – Maintainability prediction – Measures of maintainability – Inspection decisions –System Availability.

TOTAL: 45 PERIODS

REFERENCES:

1. Charles E. Ebeling, "An introduction to Reliability and Maintainability engineering", TMH, 2000.
2. Roy Billington and Ronald N. Allan, "Reliability Evaluation of Engineering Systems", Springer, 2007.

IL8083 SERVICES OPERATIONS MANAGEMENT L T P C

3 0 0 3

UNIT I INTRODUCTION TO SERVICES 6

Manufacturing and Services, Definition of Service, Characteristic of Service, Nature of Services, Importance of Activity, Impact of technology

UNIT II GLOBALIZATION AND STRATEGY 7

Types of Globalized Services, Outsourcing, issues in Globalization, Service strategies

UNIT III OPERATIONS ISSUES 12

Forecasting, Inventory, capacity Planning, Scheduling

UNIT IV SERVICE QUALITY AND PRODUCTIVITY 10

Importance of Quality, Models for Service Quality, GAPS model, issues in productivity measurement, Work measurement

UNIT V TOOLS FOR SERVICES 10

Data Envelopment Analysis, Queuing models, Vehicle Routing models

TOTAL: 45 PERIODS

REFERENCES:

1. Fitzsimmons, J.A. and Fitzsimmons, M.J. Service Management, Tata McGraw Hill India, 2006.
2. Haksever C, Render B, Russell RA and Murdick RG ,Service Management and Operations, Prentice Hall International, USA, 2000

IL8084 SYSTEMS ANALYSIS AND DESIGN L T P C

3 0 0 3

UNIT I SYSTEMS ANALYSIS FUNDAMENTALS 9

Information systems analysis overview, Classification of information systems, Systems development life cycle, Role of systems analyst, and Role of case tools

UNIT II INFORMATION REQUIREMENT ANALYSIS 9

Sampling and investigating hard data, Interviewing, Using Questionnaires, Developing prototype, System requirements specification, Feasibility analysis

UNIT III ANALYSIS PROCESS 9

Data flow diagrams, Data dictionary, Process specifications, Presenting the systems proposal

UNIT IV ESSENTIALS OF DESIGN 9

Designing effective output, designing the database, designing the user interface, Designing data entry procedures

UNIT V SOFTWARE ENGINEERING AND IMPLEMENTATION 9

Quality assurance through software engineering, Implementation approaches, Implementing distributed systems, Object oriented systems analysis and design

TOTAL: 45 PERIODS

REFERENCES:

1. Analysis and Design of Information systems, Arthur M. Langer, Springer 2001
2. Systems Analysis and Design, Kendall and Kendall, Prentice hall, 2004
3. Analysis and Design of Information systems, V. Rajaraman, PHI, 2006

IL8085 TECHNOLOGY MANAGEMENT L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Technology management - Scope, components, and overview. Technology and environment, Technology and society, Technology Impact analysis, environmental, social, legal, political aspects, techniques for analysis - steps involved. Technology policy strategy: Science and technology Policy of India, implications to industry, The dynamics of technology change

UNIT II TECHNOLOGY FORECASTING 9

Need, methodology and methods - trend Analysis, Analogy, Delphi, Soft System Methodology, Mathematical Models, Simulation, and System Dynamics.

UNIT III TECHNOLOGY CHOICE AND EVALUATION 9

Issues in the development new high tech products, Methods of analyzing alternate technologies, Techno-economic feasibility studies, Need for multi-criteria considerations such as, social, environmental, and political, Analytic hierarchy method, Fuzzy multi-criteria decision making, and other methods.

UNIT IV TECHNOLOGY TRANSFER AND ACQUISITION 9

Import regulations, Implications of agreements like Uruguay Round and WTO, Bargaining process, Transfer option, MOU- Technology Adoption and Productivity - Adopting technology-human interactions, Organisational redesign and re-engineering, Technology productivity.

UNIT V TECHNOLOGY ABSORPTION AND INNOVATION 9

Present status in India, Need for new outlook, Absorption strategies for acquired technology, creating new/improved technologies, Innovations, Technology Measurement- Technology Audit, Risk and exposure, R&D portfolio management

TOTAL: 45 PERIODS

REFERENCES:

1. Joseph M. Putti, Management – A Functional Approach, McGraw Hill, 1997
2. Kenneth C. Lauden , MIS: Organisation and Technology, Prentice Hall, 1995
3. James A.Senn, Information technology in Business, Prentice Hall, 1995
4. Ronald J. Jordan, Security analysis and Portfolio Management, Prentice Hall, 1995
5. Irvin M. Rubin, Organisational behavior an experimental approach, Prentice Hall, 1995
6. Gerard H. Gaynor, Handbook of Technology Management, McGraw-Hill Professional, 1996
7. Richard C. Dorf, Technology Management Handbook, CRC, 1999.

MS8071 CELLULAR MANUFACTURING SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on planning, design, implementation, and control of group technology and cellular manufacturing.

OUTCOME:

- The students should apply the various tools, techniques and methodology used in planning, design, implementation, and control of group technology and cellular manufacturing.

UNIT I INTRODUCTION 8

Group Technology – Limitations of traditional manufacturing systems – Group machining concept – Principle of cellular manufacturing – Terminology associated with cellular manufacturing – Characteristics and perspectives of cellular manufacturing – Areas of applications of cellular manufacturing – Benefits and limitations of cellular manufacturing

UNIT II CMS PLANNING & DESIGN 10

Problems in GT/CMS – Design of CMS – Production flow analysis – Optimization models – Traditional approaches and heuristics – 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 & CONTROL 9

Evaluation of cellular manufacturing systems – Production control activities and scheduling in cellular manufacturing.

UNIT V ECONOMIC OF GT/CMS 8

Characteristics of cell – Economic Justification of cellular manufacturing – Use of computer models in GT/CMS – Human aspects of GT/CMS – Case studies.

TOTAL: 45 PERIODS

REFERENCES:

1. Nagendra Parashar, B. S., "**Cellular Manufacturing Systems: An Integrated Approach**" PHI Learning, 2010.
2. Askin, R. G., & Vakharia, A.J., "**GT planning and operation**", as in Cleland, D. I., & Bidanda, B., (Editors), "The Automated Factory – Hand Book: Technology and Management", TAB Professional & Reference Books, NY, 1990.
3. Shahrukh A. Irani, "**Handbook of Cellular Manufacturing Systems**", John Wiley & Sons, 1999.

QE8072 PRODUCT INNOVATION AND DEVELOPMENT L T P C

3 0 0 3

UNIT I PRODUCT DEVELOPMENT AND CONCEPT SELECTION 10

Product development process – Product development organizations- Identifying the customer needs – Establishing the product specifications – concept generation – Concept selection.

UNIT II PRODUCT ARCHITECTURE 7

Product architecture – Implication of the architecture – Establishing the architecture – Related system level design issues.

UNIT III INDUSTRIAL AND MANUFACTURING DESIGN 10

Need for industrial design – Impact of industrial design – Industrial design process. Assessing the quality of industrial design- Human Engineering consideration -Estimate the manufacturing cost – Reduce the component cost – Reduce the assembly cost – Reduce the support cost – Impact of DFM decisions on other factors

UNIT IV PROTOTYPING AND ECONOMIC ANALYSIS 9

Principles of prototyping – Planning for prototypes - Elements of economic analysis – Base case financial model – Sensitivity analysis – Influence of the quantitative factors

UNIT V MANAGING PRODUCT DEVELOPMENT PROJECTS 9

Sequential, parallel and coupled tasks - Baseline project planning – Project Budget- Project execution – Project evaluation- patents- patent search-patent laws-International code for patents.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Karal .T. Ulrich, Steven D.Eppinger, Product Design and Development, McGRAW- HILL International Fifth Editions, 2012.

REFERENCES:

1. S.Rosenthal, Effective product design and development, Irwin 1992.
2. Charles Gevirtz, Developing New products with TQM, McGraw – Hill International editions, 1994

QE8151 TOTAL QUALITY MANAGEMENT L T P C

3 0 0 3

UNIT I INTRODUCTION 9

Defining Quality, Basic approaches of TQM, Gurus of TQM - Shewart, Ronald Fisher, Deming, Juran, Feigenbaum, Ishikawa, Crosby, Taguchi – TQM Framework – Historical review, Obstacles, Benefits of TQM

UNIT II TQM PRINCIPLES 9

Leadership, Customer Satisfaction, Employee Involvement, Continuous Process Improvement, Supplier Partnership, Performance Measures, Cost of Quality.

UNIT III TOOLS ANDTECHNIQUES–1 9

Benchmarking, Information Technology, Quality Management Systems and environmental management systems.

UNIT IV TOOLS AND TECHNIQUES - 2 9

QFD, FMEA, Quality Circles, TPM, Traditional Quality Tools and Management tools.

UNITV IMPLEMENTATION OF TQM 9

Steps in TQM implementation, national and international quality awards, case studies.

TOTAL: 45 PERIODS

REFERENCES:

1. Dale H.Besterfiled, “Total Quality Management”, Pearson Education Asia, (Indian reprint 2011).
2. John Bank, The essence of total quality management PHI 2000.
3. Greg Bounds, Lyle Yorks et al, Beyond Total Quality Management, Mcgraw Hill, 1994
4. Takashi Osada, The 5S’s The Asian Productivity Organization, 1991.
5. Masaki Imami, KAIZEN, McGraw Hill, 1986.

QE8251 SOFTWARE QUALITY ENGINEERING L T P C

3 0 0 3

UNIT I SOFTWARE QUALITY 5

Definition of Software Quality, Quality Planning, Quality system – Quality Control Vs Quality Assurance – Product life cycle – Project life cycle models.

UNIT II SOFTWARE ENGINEERING ACTIVITIES 10

Estimation, Software requirements gathering, Analysis, Architecture, Design,development, Testing and Maintenance.

UNIT III SUPPORTING ACTIVITIES 10

Metrics, Reviews –SCM – Software quality assurance and risk management.

UNIT IV SOFTWARE QUALITY MANAGEMENT TOOLS 10

Seven basic Quality tools – Checklist – Pareto diagram – Cause and effect diagram – Run chart – Histogram – Control chart – Scatter diagram – Poka Yoke – Statistical process control – Failure Mode and Effect Analysis – Quality Function deployment – Continuous improvement tools – Case study.

UNIT V QUALITY ASSURANCE MODELS 10

Software Quality Standards, ISO 9000 series – CMM, CMMI – P-CMM – Case study.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Software Engineering: A Practitioners Approach, 5th Edition Roger S. Pressman Mcgraw – Hill International Edition, 6th Edition, 2006.
2. Ramesh Gopalswamy, Managing global Projects ; Tata McGraw Hill, 2002.

REFERENCES:

1. Norman E – Fenton and Share Lawrence P flieger, Software metrics, International Thomson Computer press, 1997.
2. Gordan Schulmeyer. G. and James .L. Mc Hanus, Total Quality management for software, International Thomson Computer press, USA , 1990.
3. Dunn Robert M., Software Quality: Concepts and Plans, Englewood clifts, Prentice Hall Inc., 1990.
4. Metrics and Models in Software Quality Engineering, Stephen, Stephen H. Kan, Pearson education, 2006, Low price edition.