UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025

REGULATIONS - 2009

CURRICULUM I TO IV SEMESTERS (FULL TIME)

M.E. INDUSTRIAL ENGINEERING

SEMESTER: I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MA9105	Probability and Statistical methods	3	1	0	4
2	IE9111	Work Design	3	0	0	3
3	IE9112	Applied Operations Research	3	1	0	4
4	IE9113	Production and Inventory Decisions	3	0	0	3
5	E1	Elective I	3	0	0	3
6	E2	Elective II	3	0	0	3
PRACTICAL						
7	IE9114	Work Design Lab	0	0	2	1
		TOTAL	**18**	**2**	**2**	**21**

SEMESTER: II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IE9121	Manufacturing Systems Modeling	3	0	0	3
2	IE9122	Simulation Modeling and Analysis	3	0	0	3
3	IE9123	Quality Engineering	3	0	0	3
4	IE9124	Supply Chain Management	3	0	0	3
5	E3	Elective III	3	0	0	3
6	E4	Elective IV	3	0	0	3
PRACTICAL						
7	IE9125	Computer Applications Lab	0	0	3	2
8	IE9126	Seminar	0	0	2	1
		TOTAL	**18**	**0**	**5**	**21**

SEMESTER: III

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IE9131	Design and Analysis of Experiments	3	1	0	4
2	E5	Elective V	3	0	0	3
3	E6	Elective VI	3	0	0	3
PRACTICAL						
4	IE9132	Project - 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	IE9141	Project - Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

Total number of credits to be earned for award of the degree: 70

UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025

REGULATIONS - 2009

CURRICULUM I TO VI SEMESTERS (PART TIME)

M.E. INDUSTRIAL ENGINEERING

SEMESTER I

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MA9105	Probability and Statistical methods	3	1	0	4
2	IE9111	Work Design	3	0	0	3
3	IE9112	Applied Operations Research	3	1	0	4
PRACTICAL						
4	IE9114	Work Design Lab	0	0	2	1
		TOTAL	**9**	**2**	**2**	**12**

SEMESTER II

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IE 9121	Manufacturing Systems Modeling	3	0	0	3
2	IE 9122	Simulation Modeling and Analysis	3	0	0	3
3	IE 9123	Quality Engineering	3	0	0	3
PRACTICAL						
4	IE9125	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	IE9113	Production and Inventory Decisions	3	0	0	3
2	E1	Elective I	3	0	0	3

3	E2	Elective II	3	0	0	3
		TOTAL	**9**	**0**	**0**	**9**

SEMESTER IV

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IE9124	Supply Chain Management	3	0	0	3
2	E3	Elective III	3	0	0	3
3	E4	Elective IV	3	0	0	3
PRACTICAL						
4	IE9126	Seminar	0	0	2	1
		TOTAL	**9**	**0**	**2**	**10**

SEMESTER V

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	IE9131	Design and Analysis of Experiments	3	1	0	4
2	E5	Elective V	3	0	0	3
3	E6	Elective VI	3	0	0	3
PRACTICAL						
4	IE9132	Project - 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	IE9141	Project - Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

Total number of credits to be earned for award of the degree: 70

ELECTIVES FOR M.E. INDUSTRIAL ENGINEERING

SL. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	IE9150	Facilities Planning and Design	3	0	0	3
2	SO9127	Advanced Optimization Techniques	3	0	0	3
3	IE9152	Reliability Engineering	3	0	0	3
4	IE9153	Scheduling Algorithms	3	0	0	3
5	QE9155	Product Innovation and Development	3	0	0	3
6	IE9154	Productivity Management and Re-Engineering	3	0	0	3
7	IE9155	Total Quality Management and systems	3	0	0	3
8	IE9156	Maintainability Engineering	3	0	0	3
9	IE9157	Human Factors and Ergonomics	3	0	0	3
10	QE9123	Software Quality Engineering	3	0	0	3
11	QE9160	Engineering Economics	3	0	0	3
12	QE9156	Lean Six Sigma	3	0	0	3
13	IE9159	Decision Support Systems	3	0	0	3
14	IE9160	Design and Analysis of Algorithms	3	0	0	3
15	IE9161	Applied Object oriented programming	3	0	0	3
16	IE9162	Management Accounting and Financial Management	3	0	0	3
17	IE9163	Industrial Automation	3	0	0	3
18	IE9164	Business Excellence Models	3	0	0	3
19	IE9165	Knowledge Management	3	0	0	3
20	IE9166	System Science and Systems Engineering	3	0	0	3
21	IE9167	Industrial Safety and Hygiene	3	0	0	3
22	IE9168	Logistics and Distribution Management	3	0	0	3
23	IE9169	Project Management	3	0	0	3
24	IE9170	Service Operations Management	3	0	0	3
25	IE9171	Industrial Psychology	3	0	0	3
26	IE9172	Multi Variate Data Analysis	3	0	0	3
27	IE9173	Technology Management	3	0	0	3
28	IE9174	Data Analysis	3	0	0	3
29	IE9175	Systems Analysis and Design	3	0	0	3
30	IE9176	Design of Cellular Manufacturing Systems	3	0	0	3

MA9105 PROBABILITY AND STATISTICAL METHODS L T P C
3 1 0 4

UNIT I ONE DIMENSIONAL RANDOM VARIABLES 9

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

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

UNIT III ESTIMATION THEORY 9

Unbiased Estimators – Method of moments – Maximum likelihood Estimation – Curve fitting by principle of least squares – Regression lines.

UNIT IV TESTING OF HYPOTHESIS 9

Sampling distributions- Type I and Type II errors – Tests based on normal, t, χ^2 and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V MULTIVARIATE ANALYSIS 9

Covariance matrix – Correlation Matrix – Multivariate Normal density function – Principal components – Sample variation by principal components – Principal components by graphing.

L+T: 45+15 TOTAL: 60 PERIODS

REFERENCES:

1. Richard Johnson, Miller & Freund's Probability and statistics for Engineers, 7th Edition, Prentice –Hall of India, Private Ltd., New Delhi (2007).
2. Richard A.Johnson and Dean W, Wichern, Applied Multivariate Statistical Analysis, 5th Edition, Pearson Education, Asia (2002).
3. Gupta, S.C and Kapoor, V.K. "Fundamentals of Mathematical Statistics, Sultan and Sons, New Delhi (2001).
4. Jay L.Devorer, Probability and Statistics for Engineering and the Sciences, Thomson and Duxbbury, Singapore (2002).
5. Dallas E Johnson et al., Applied multivariate methods for data analysis, Thomson and Duxbbury Press, Singapore (1998).

IE 9111 WORK DESIGN **L T P C**
3 0 0 3

UNIT I PRODUCTIVITY **9**

Productivity and living standards – work design and Productivity – Productivity measurement-Productivity models.

UNIT II METHOD STUDY **9**

Total work content, Developing methods – operation analysis, motion & micro motion study, graphic tools.

UNIT III WORK MEASUREMENT **9**

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

UNIT IV APPLIED WORK MEASUREMENT **9**

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

UNIT V ERGONOMICS **9**

Human factors Engineering, human performance in physical work, anthropometry, design of workstation, design of displays and controls.

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. Bridger R.S. Introduction to Ergonomics, McGraw Hill, 1995.
5. Productivity Management- A systems approach, Prem Vrat, Narosa publishing, 1998

IE9112 APPLIED OPERATIONS RESEARCH 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

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

UNIT III NETWORKS 9

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

UNIT IV DYNAMIC-INTEGER PROGRAMMING 9

Dynamic Programming-Concepts, formulation, recursive approach; Integer Programming – concepts, TSP

UNIT V WAITNG LINES 9

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

L= 45&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

IE9113 PRODUCTION AND INVENTORY DECISIONS L T P C
3 0 0 3

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

The forecasting process, Time series forecasting models – moving averages, exponential smoothing- multi-item forecasting- regression models, qualitative methods, forecasting system controls

UNIT III PLANNING ACTIVITIES: 10

Capacity planning, aggregate production planning strategies and methods, Master Production Schedule, MRP, MRP II, CRP, ERP.

UNIT IV CONTROL ACTIVITIES: 10

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

UNIT V INVENTORY MANAGEMENT: 10

Classification of Inventory - Inventory costs - deterministic and probabilistic models – Inventory control systems.

TOTAL: 45 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, 2005.
3. Lee J.Krajewski, Larry P.Ritzman, “Operations Management”, Pearson Education, 2000
4. Mahadevan,B. Operations- Theory & Practice, Pearson Education, 2007.

IE 9114 WORK DESIGN LAB L T P C
0 0 2 1

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

LIST OF EXPERIMENTS

1. Peg board experiment
2. Stop watch time study
3. Performance rating exercise
4. Graphic tools for method study
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

TOTAL: 30 PERIODS

LABORATORY EQUIPMENTS REQUIREMENTS

1. Time study Trainer
2. Peg board
3. Stop watches
4. Tread mill
5. Ergo cycle

IE 9121 MANUFACTURING SYSTEMS AND MODELING **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.

L= 45&T=15
Total=60 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

IE 9122 SIMULATION MODELLING AND ANALYSIS **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. Kelton, W. David, Simulation with Arena ,McGraw-Hill,2006

IE 9123 QUALITY ENGINEERING L T P C
3 0 0 3

UNIT I QUALITY CONCEPTS 5

Quality Dimensions – Quality definitions - Quality control – Quality Assurance – Quality planning - Quality costs – Economics of quality – Quality loss function.

UNIT II STATISTICAL PROCESS CONTROL 10

Process variability – Control charts for variables, Warning control limits – process capability, machine capability and gauge capability studies – Statistical tolerance.

UNIT III OTHER CONTROL CHARTS 8

Control charts for attributes, Demerit control chart, control charts for individual measurement, moving range chart, multi-variate chart, cum-sum chart.

UNIT IV ACCEPTANCE SAMPLING 10

Economics of sampling – Acceptance sampling by variables and attributes – Single, double and sequential plans – OC curves – ATI, ASN, AOQL – Standard sampling tables-IS2500, Dodge- Roaming and MIL- standards.

UNIT V TOTAL QUALITY MANAGEMENT AND SIX SIGMA 12

TQM concepts, Quality system, Seven tools of quality, 5S, QFD, KAIZEN, POKAYOKE, Six sigma concepts – DMAIC/ DMADV approach.

TOTAL: 45 PERIODS

REFERENCES:

1. Douglas, C. Montgomery, Introduction to Statistical Quality Control, IInd Edition, John Wiley & Sons, 2001.
2. Grant, E.L. and Leavenworth, R.S., Statistical Quality Control, TMH, 2000.
3. Dale H.Besterfiled, Total Quality Management, Pearson Education Asia, 2002.

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

UNIT I INTRODUCTION **6**

Definition of Logistics and SCM: Evolution, Scope, Importance& Decision Phases – Drivers of SC Performance and Obstacles.

UNIT II LOGISTICS MANAGEMENT **10**

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

UNIT III SUPPLY CHAIN NETWORK DESIGN **10**

Distribution in Supply Chain – Factors in Distribution network design –Design options-Network Design in Supply Chain – Framework for network Decisions - Managing cycle inventory and safety.

UNIT IV SOURCING, AND PRICING IN SUPPLY CHAIN **9**

Supplier selection and Contracts - Design collaboration - Procurement process. Revenue management in supply chain

UNIT V COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN **10**

Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work. E Business & SCM. Metrics for SC performance – Case Analysis

TOTAL: 45 PERIODS

REFERENCES:

1. Supply Chain Management, Strategy, Planning, and operation – Sunil Chopra and Peter Meindl- PHI, Second edition, 2007
2. Logistics, David J.Bloomberg, Stephen Lemay and Joe B.Hanna, PHI 2002
3. Logistics and Supply Chain Management –Strategies for Reducing Cost and Improving Service. Martin Christopher, Pearson Education Asia, Second Edition
4. Modeling the supply chain, Jeremy F.Shapiro, Thomson Duxbury, 2002
5. Handbook of Supply chain management, James B.Ayers, St.Lucle Press, 2000

IE 9125 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.

UNIT IV **9**

Development of Random number generator, Testing of random number generator. Non-uniform Random varieties generation and testing.

UNIT V **9**

Program for Simulation of Single server Queueing 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

IE 9131 DESIGN AND ANALYSIS OF EXPERIMENTS 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 model.

UNIT II SINGLE FACTOR EXPERIMENTS 9

Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests.

UNIT III MULTIFACTOR EXPERIMENTS 10

Two and three factor full factorial experiments, 2^K factorial Experiments, Confounding and Blocking designs.

UNIT IV SPECIAL EXPERIMENTAL DESIGNS: 10

Fractional factorial design, nested designs, Split plot design, Introduction to Response Surface Methodology, Experiments with random factors, rules for expected mean squares, approximate F- tests.

UNIT V TAGUCHI METHODS 10

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

TOTAL: 45 PERIODS

REFERENCES

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

IE 9150 FACILITIES PLANNING AND DESIGN **L T P C**
3 0 0 3

UNIT I INTRODUCTION **5**

Facilities requirement, need for layout study – types of layout.

UNIT II PLANT LOCATION **10**

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

UNIT III LAYOUT DESIGN **10**

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

UNIT IV GROUP TECHNOLOGY AND LINE BALANCING **10**

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

UNIT V MATERIAL HANDLING **10**

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

SO9127 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

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 **10**

Over view of Genetic algorithms, Simulated Annealing, neural network based optimization, Optimization of Fuzzy Systems

UNIT V NP-COMPLETE PROBLEMS **5**

The classes P and NP, Polynomial time reductions, Introduction to NP- Hard problems

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

IE9152 RELIABILITY ENGINEERING **L T P C**
3 0 0 3

UNIT I RELIABILITY CONCEPT 9

Reliability definition – Reliability applications – Reliability mathematics – f(t), F(t), R(t) functions – Hazard rate function – Reliability parameters – Measures of central tendency – Design life –A priori and posteriori probabilities – Component mortality – Mortality curve – Useful life.

UNIT II LIFE DATA ANALYSIS 11

Data classification –Nonparametric methods: Ungrouped, Grouped, Complete, Censored data – Time to failure distributions – Probability plotting: Exponential, Weibull –Goodness of fit tests – Survival graphs.

UNIT III RELIABILITY MODELLING 10

Series parallel configurations – Parallel redundancy – k out of n system – Complex systems: RBD method – Baye's approach – Minimal path and cut sets – Fault Tree Analysis – Standby system – Physical reliability models.

UNIT IV RELIABILITY MANAGEMENT 8

Reliability testing: Failure terminated test – Time terminated test – Upper and lower MTBFs –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 – Availability definitions –System Availability – Replacement decisions – Economic life.

TOTAL: 45 PERIODS

REFERENCE:

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.

IE9153 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 **9**

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 **9**

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

REFERENCE:

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.

QE9155 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 Editions.2003.

REFERENCES:

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

IE 9154 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.

IE9155	TOTAL QUALITY MANAGEMENT AND SYSTEMS	L T P C 3 0 0 3

UNIT I CONCEPTS AND PHILOSOPHY 9

Basic concepts, need for TQM, principles of TQM, Quality philosophies of Deming, Crosby, Juran, Ishikawa and Feigenbaum, TQM models.

UNIT II TQM PROCESS 9

QC tools, problem solving methodologies, new management tools, quality circles, bench marking, strategic quality planning.

UNIT III TQM SYSTEMS 9

Quality policy deployment, quality function deployment, introduction to BPR and FMEA.

UNIT IV QUALITY SYSTEM 9

Need for ISO 9000 system, advantages, clauses of ISO 9000, Implementation of ISO 9000, QS9000 systems, introduction to EMS, quality costs, quality auditing, case studies.

UNIT V IMPLEMENTATION OF TQM 9

KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods, 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 2002)
2. Rose, J.E. Total Quality Management, Kogan Page Ltd. 1993.
3. John Bank, The essence of total quality management, PHI 1993.
4. Greg Bounds, Lyle Yorks et al, Beyond Total Quality Management, McGraw Hill, 1994.
5. Takashi Osada, The 5S’s The Asian Productivity Organisation, 1991.
6. Masaki Imami, KAIZEN, McGraw Hill, 1986.

IE9156 MAINTAINABILITY ENGINEERING L T P C
3 0 0 3

UNIT I MAINTENANCE CONCEPT 6

Need for maintenance – Maintenance definition – Maintenance objectives – Challenges of Maintenance management – Tero technology – Scope of maintenance department – Maintenance costs.

UNIT II MAINTENANCE MODELS 12

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

UNIT III MAINTENANCE LOGISTICS 11

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

UNIT IV MAINTENANCE QUALITY 8

Maintenance excellence –Five Zero concept –FMECA –Root cause analysis – System effectiveness – Design for maintainability – Maintainability allocation – CMMS – Reliability Centered Maintenance.

UNIT V TOTAL PRODUCTIVE MAINTENANCE 8

TPM features – Chronic and sporadic losses – Equipment defects – Six major losses – Overall Equipment Effectiveness – TPM pillars –TPM implementation – Autonomous maintenance.

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.

IE 9157 HUMAN FACTORS AND ERGONOMICS 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.

QE 9123 SOFTWARE QUALITY ENGINEERING L T P C
3 0 0 3

UNIT I SOFTWARE QUALITY 5

Concepts & Costs of quality – Quality Control Vs Quality Assurance – Defect Prevention vs. Defect Prediction Product Life Cycle- Project Life Cycle Models.(Traditional and Agile)

UNIT II SOFTWARE ENGINEERING ACTIVITIES 10

Estimation , Requirements , Analysis , Architecture , Design , development Testing and Maintenance

UNIT III SUPPORT ACTIVITIES 10

Reviews- Auditing – Risk Management – Software Quality Assurance- Software Configuration 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 – Poke Yoke – Statistical Process Control – Failure Mode and Effects Analysis (FMEA)- Quality Function Deployment- Continuous Improvement tools – case study.

UNIT V QUALITY ASSURANCE MODELS 10

Software Quality standards, ISO 9000 series – CMMI– P-CMM – case study.

TOTAL: 45 PERIODS

TEXT BOOK

Software Engineering: A Practitioners Approach, 5th Edition Roger S. Pressman McGraw- Hill International Edition, 6th Edition,2006

REFERENCES:

1. Norman E-Fenton and Share Lawrence Pflieger, Software Metrics, International Thomson Computer Press, 1997.
2 . Ramesh Gopalswamy, Managing Global Projects; Tata Mcgraw Hill, 2002.
3 Gordon Schulmeyer.G. and James.L.McHanus, Total Quality Management for Software, International Thomson Computer Press, USA, 1990.
4 Dunn Robert M., Software Quality: Concepts and Plans, Englewood Clifts, Prentice Hall Inc., 1990.
5. Metrics and Models in Software Quality Engineering, Stephen, Stephen H. Kan ,Pearson Education, 2006, Low Price Edition.

QE 9160 ENGINEERING ECONOMICS 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 10

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 10

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 07

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

UNIT V NATIONAL INCOME AND POLICY 08

National Income – Accounting – Consumption and investment – Business Cycle and unemployment – Inflation and deflation, Balance of Payments – Monetary and Fiscal policies.

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.

QE 9156	LEAN SIX SIGMA	L T P C 3 0 0 3

UNIT I EVOLUTION OF LEAN SIX SIGMA 5

Introduction to Lean Principles and Six Sigma Concepts-Similarities and differences – Synergy-Evolution of Lean Six Sigma

UNIT II LEAN SIX SIGMA APPROACH 8

Lean Six Sigma Methodology- Phases of Lean Six Sigma Method, Managing Lean Six sigma Project ,Six sigma Methodologies (DMAIC, DMADV , DFSS)

UNIT III SIX SIGMA TOOLS AND TECHNIQUES 12

Advanced Statistical Tools - Statistical Process Control-Process Capability Analysis Sigma computation -Hypothesis Testing-ANOVA-Design of Experiments- chi-square test, Regression analysis –Case studies

UNIT IV LEAN TOOLS 10

Value Stream Mapping – Poka Yoke-5S-Cycle Time Analysis-Push-Pull Systems-Waste Elimination- Total Productive Maintenance- Failure Mode Effect Analysis-Standard Work Practices-Control Plans, SMED , Kanban , Visual control , Kaizen – Case studies

UNIT V LEAN SIX SIGMA IMPLEMENTATION 10

Identifying Lean Six Sigma Projects, Define Scope, Planning for Implementation, Selection of tools and techniques for each phase, Measuring the Benefits

TOTAL: 45 PERIODS

REFERENCES:

1. Michael L. George, David Rowlands, Bill Kastle ,What is Lean Six Sigma, McGraw-Hill, 2003
2. Thomas Pyzdek,The Six Sigma Handbook ,McGraw-Hill, 2000
3. James P. Womack , Daniel T. Jones ,Lean Thinking, Free press business, 2003.

4 Forrest W. Breyfogle III ,Implementing Six Sigma: Smarter Solutions Using Statistical Methods ,1999.

5. Liker, Jeffrey; Meier, David ,Toyota Talent , Tata Mcgraw Hills

IE 9159	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.

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.

IE 9160	DESIGN AND ANALYSIS 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.
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.

IE 9161 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 Mc Graw 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

IE 9162 MANAGEMENT ACCOUNTING & FINANCIAL MANAGEMENT L T P C
3 0 0 3

UNIT I FINANCIAL ACCOUNTING 10

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

UNIT II COST ACCOUNTING 10

Cost accounting systems: Job costing, Process costing, Allocation of overheads, Activity based costing, differential cost and incremental cost, Variance analysis, Software costing.

UNIT III BUDGETING 10

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

UNIT IV FINANCIAL MANAGEMENT 10

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

UNIT V FINANCIAL DECISIONS 5

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

TOTAL: 45 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.

IE 9163 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 – AS/RS – carousel storage – Automatic data capture – bar code technology

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.

IE 9164 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

IE 9165 KNOWLEDGE 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.

IE 9166 SYSTEMS SCIENCE AND SYSTEMS ENGINEERING **L T P C**
3 0 0 3

UNIT I SYSTEMS SCIENCE CONCEPTS 10

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 10

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

Tools: Objectives hierarchies – trees, cross interaction matrix; Functional analysis approaches – SADT, DFD, CFD, FFBD, ICOM, Node tree, Context diagram, decomposition; BPR, QFD, Brain storming, Brain writing, Groupware, Delphi, Morphological box

UNIT III ANALYSIS OF ALTERNATIVES 10

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

Tools: Coupled uncoupled events – Baye's model – event trees, Causal loop diagram, probability trees; Structural models – Tree structures, reachability graph and matrix, Causal loop diagrams, influence diagrams, decision trees; System Dynamic Models – population models, urban dynamics, world dynamic models; Economic models

UNIT IV INTERPRETATION OF ALTERNATIVES AND DECISION MAKING 10

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 5

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

TOTAL: 45 PERIODS

REFERENCES:

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

IE 9167 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 APPRAISA L 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 Managenent”, 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., “Sagety, Security And Risk Management”, APH publishinf company, New Delhi, 1996.
6. John V Grimaldi, Safety Manageemnt. AITB publishers, 2003.
7. Safety MaNUAL. EDEL engineering Consultancy, 2000.

IE 9168 LOGISTICS AND DISTRIBUTION MANAGEMENT L T P C
3 0 0 3

UNIT I INTRODUCTION TO LOGISTICS MANAGEMENT 5

Logistics Management: Definition of logistics and the concepts of logistics. Logistics Activities: Functions of the logistics system – transportation, warehousing, order processing, information handling and procurement

UNIT II DISTRIBUTION MANAGEMENT 10

Distribution Management, Outbound logistics, Facility location, Classical location problems, Strategic planning models for location analysis, location models, multi objective analysis of location models.

UNIT III TRANSPORTATION MANAGEMENT 10

Transportation alternatives and technologies; transportation performance analysis; total transportation cost analysis; fleet development and management; fleet performance indicators; routing and scheduling; shipment planning; vehicle loading; transportation management and information systems requirements.

UNIT IV LOGISTICS MODELLING 10

Logistics Customer Service, Modeling logistics systems, Simulation of logistic systems, cost effective distribution strategies, Value of information in logistics, E-logistics, risk pooling effect, International and global issues in logistics, Integrated functional activities in logistics, Role of government in international logistics and Principal characteristics of logistics in various countries and regions

UNIT V LOGISTICS IN DIFFERENT INDUSTRIES 10

Logistics in different industries: Third party, and fourth party logistics, Reverse logistics,Airline Schedule Planning, Railway Networks, Postal services, the maritime industries, health care industry and other service industries

TOTAL: 45 PERIODS

REFERENCES:

1. David Bloomberg, Stephen LeMay, Joe Hanna: Logistics, Prentice Hall 2002
2. Thomas Teufel, Jurgen Rohricht, Peter Willems: SAP Processes: Logistics, Addison-Wesley, 2002.
3. Julien Bramel, David Simchi-Levi. “The logic of logistics: theory, algorithms, and applications for logistics management", Springer,2006
4. Murphy, G.J. "Transport and Distribution", 2nd Edition, Business Books
5. Ballou, R.H., Business Logistics Management/Supply Chain, 5th edition, 2004, Prentice-Hall

IE9169 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

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

IE 9170 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 Mc Graw Hill India, 2006.
2. Haksever C, Render B, Russell RA and Murdick RG ,Service Management and Operations, Prentice Hall International, USA, 2000

IE 9171 INDUSTRIAL PSYCHOLOGY L T P C

3 0 0 3

UNIT I INTRODUCTION 8

Definition-development-scope-objectives-importance of individual behavior-causes-Role of learning in shaping behavior- the influence of thinking and perception.

UNIT II GROUP BEHAVIOR 12

Group Behavior-Groups- Contributing factors- Group Norms, Communication-Process-Barriers to communication-Effective communication, leadership-formal and informal characteristics-Managerial grid-Leadership styles-group Decision making-Leadership Role in Group Decision, Group Conflicts-Types-Causes-Conflict Resolution-Intergroup relations and conflicts –Organization centralization and decentralization-formal and informal- organizational structures- organizational change and development- change process-resistance to change-culture and ethics

UNIT III MOTIVATION 9

Motivation and motivators-The hierarchy of needs theory-the motivation-hygiene approach to motivation-Expectancy-equity-reinforcement-McClelland's needs theory of motivation-special motivational techniques-job enrichment- a systems and contingency approach to motivation.

UNIT IV TRAINING AND DEVELOPMENT 9

Training & Development: Training – Need and Importance – Steps in Training Programme – Evaluation of Training Programmes – Concept of Management Development Programme – Techniques of Training and Development – Group Discussion- Conferences and Seminar – Case Studies – Role Playing – Business Games – Sensitivity Training – Stages of Career Development.

UNIT V INDUSTRIAL FATIGUE 7

Definition-concept-Nature-Effects-causes-Elimination- Safety management practices-Effect of environment-Hazard control Technology-Working conditions-environmental conditions

TOTAL: 45 PERIODS

REFERENCES:

1. Herald Knottz and Heinz Weihrich, 'Essentials of management'; Mcgraw Hill Publishing Company, Singapore International Edition, 1980.
2. Ties, AF stoner, and R.Edward Freeman, 'Management', PHI Pvt ltd, New Delhi, 1992.
3. Joseph J, Massie, 'Essentials of Management', PHI, Ltd, 1985.
4. Nicky Hayes, Foundations of Psychology and Introductory Text, Routledge, UK, 1994.

IE 9172 MULTI VARIATE 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, modeling techniques, making inferences about 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 components 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 multi variate normal populations

UNIT V CLUSTER ANALYSIS **9**

Cluster analysis – clustering methods, Multivariate analysis of variance

TOTAL : 45 PERIODS

REFERENCES

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

IE 9173 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

IE9174 DATA ANALYSIS

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UNIT I INTRODUCTION **9**

Modern data analytic tools, Stastical concepts: Sampling distributions, resampling, statistical inference, prediction error

UNIT II LINEAR SYSTEMS ANALYSIS **9**

Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics

UNIT III RULE INDUCTION **9**

Rule induction: rule learning as search, learning first order rules, evaluating quality of rules, ILP systems at work

UNIT IV TOOLS FOR DATA MODELLING **9**

Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods

UNIT V VISUALIZATION-INTERACTION **9**

Visualization: Visual data analysis techniques, interaction techniques; Systems and applications: Diversity of IDA applications

TOTAL: 45 PERIODS

REFERENCES:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer (2007)
2. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons (2007)

IE 9175 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 THE ANALYSIS PROCESS 9

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

UNIT IV THE 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

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

IE9176 DESIGN OF CELLULAR MANUFACTURING SYSTEMS L T P C
3 0 0 3

UNIT I INTRODUCTION 5

Introduction to Group Technology, limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.

UNIT II CMS PLANNING AND DESIGN 12

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

UNIT III IMPLEMENTATION OF GT/CMS 10

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

UNIT IV PERFORMANCE MEASUREMENT AND CONTROL 10

Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP - framework.

UNIT V ECONOMIC OF GT/CMS 8

Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS - cases.

TOTAL: 45 PERIODS

REFERENCES:

1. Burbidge, J.L, Group Technology in Engineering Industry, Mechanical Engineering pub. London, 1979.
2. Askin, R.G and Vakharia, A.J., GT planning and operation, in "The automated factory - Hand book: Technology and Management", Cleland, D.I and Bidananda, B (Eds), TAB Books, NY, 1991.
3. Irani, S.A, Cellular Manufacturing Systems - Hand book
4. Kamrani, A.K,, Parsaei, H.R and Liles, D.H. (Eds), Planning, design and analysis of cellular manufacturing systems, Elsevier, 1995.
5. Askin**,** R.G., and Strandridge**,** C.R., Modelling and Analysis of Manufacturing Systems, John Wiley and Sons. 1993.
6. Askin, R. G. and J. B. Goldberg, Design and Operation of Lean Production Systems, John Wiley & Sons, New York, 2002.