Scheme of teaching and examination for Master of Engineering (Industrial Engineering) Three Years Part Time Course

OSC-5

SEMESTER I								
Subject Code	**Subject**	Hours per week			Scheme of Examination			
		L	T	P	Theory (Hrs)	Marks/ Credits		
						Theory	TW/O	Total
MIE 1.1	Principle of Industrial Engineering & Management	4	2	-	3	100/4	50/2	150/6
MIE 1.2	Engineering Statistics	4	2	-	3	100/4	50/2	150/6
MIE 1.3	Seminar I	-	2	8	-	----	150*/6	150/6
	TOTAL	8	6	8	-	200/8	250/10	450/18

OSC-6

SEMESTER II								
Subject Code	**Subject**	Hours per week			Scheme of Examination			
		L	T	P	Theory (Hrs)	Marks/Credits		
						Theory	TW/O	Total
MIE 2.1	Applied Operations Research	4	2	-	3	100/4	50/2	150/6
MIE 2.2	Operations Management	4	2	-	3	100/4	50/2	150/6
MIE 2.3	Computer Methods in Industrial Engineering	4	0	2	3	100/4	50/2	150/6
	TOTAL	12	4	2		300/12	150/6	450/18

OSC-7

SEMESTER III								
Subject Code	**Subject**	Hours per week			Scheme of Examination			
		L	T	P	Theory (Hrs)	Marks/Credits		
						Theory	TW/O	Total
MIE 3.1	Elective I	4	-	2	3	100/4	50/2	150/6
MIE 3.2	Work System Design	4	2	-	3	100/4	50/2	150/6
MIE 3.3	Quality and Reliability	4	2	-	3	100/4	50/2	150/6
	TOTAL	12	4	2		300/12	150/6	450/18

OSC-8

SEMESTER IV								
Subject Code	**Subject**	Hours per week			Scheme of Examination			
		L	T	P	Theory (Hrs)	Marks/Credits		
						Theory	TW/O	Total
MIE 4.1	Elective II	4	-	2	3	100/4	50/2	150/6
MIE 4.2	Maintenance Engineering & Management	4	2	-	3	100/4	50/2	150/6
MIE 4.3	Seminar II	-	2	8	-	----	150*/6	150/6
	TOTAL	8	4	10		200/8	250/10	450/18

SEMESTER V								
Subject Code	**Subject**	Hours per week			Scheme of Examination			
		L	T	P	Theory (Hrs)	Marks/Credits		
						Theory	TW/O	Total
MIE 5.1	Elective III	4	-	2	3	100/4	50/2	150/6
MIE 5.2	Project	-	2	8	-	---	150*/6	150/6
MIE 5.3	Seminar III	-	2	8	-	---	150*/6	150/6
	TOTAL	4	4	18		100/4	350/14	450/18

OSC-9

OSC-10

SEMESTER VI								
Subject Code	**Subject**	Hours per week			Scheme of Examination			
		L	T	P	Theory (Hrs)	Marks/Credits		
						Theory	TW/O	Total
MIE 6.0	Dissertation	-	4	28	-	-	450**/18	450/18
	TOTAL	-	4	28	--	--	450/18	450/18

Grand total of all the four semester	44	26	68	---	1100/44	1600/64	2700/108

Note:

* 50(from guide for report) +100(from examination panel for defense) =150
(Examination panel: guide and another examiner preferably from outside)

** 200(from guide for work & report) +250(from examination panel for defense) =450
(Examination panel: Chairman Head of Mechanical Engineering department or his nominee if Head is the guide or cannot be present, the guide and another examiner preferably from outside)

The grades for seminars, projects and dissertation are to be awarded by the corresponding panel of examiners, on the basis of total marks.

List of Electives for Master of Engineering (Industrial Engineering) Three Years Part Time Course

MIE 3.1 Elective I

1 Management Information System
2 Marketing Management
3 Energy Management
4 Demand Forecasting

MIE 4.1 Elective II

4.1.1 Facility Location and Layout planning
4.1.2 Supply Chain Management
4.1.3 Stochastic Modeling
4.1.4 Industrial Scheduling

MIE 5.1 Elective III

5.1.1 System Simulation and Modeling
5.1.2 Integer Programming
5.1.3 Advanced Operations Research
5.1.4 Advanced Maintenance Management

MIE 1.1 Principle of Industrial Engineering & Management

A. Concepts of work and productivity,
Work Study: Methods study and Work measurement
Concept of standard time
Learning curve, effect of learning on time study
Job evaluation: Point system, factor comparison and Decision matrix

B Value Engineering: concept, principles and methodology
Methods of functional analysis
Creativity
VE case studies

C Motivation studies
Leadership
Organizational structure and design
Communication
Systems approach to management
Management by objectives

REFERENCE TEXT BOOKS:

1. Introduction to Work study by ILO, Universal Book Corporation, 3rd edition, 1988
2. Measuring and enhancing productivity of service and government organization, Mundel Marvin E., Asian Productivity Organization, 1975
3. Mundel Marvin E., Improving productivity and effectiveness, Prentice Hall, NY, 1983
4. Compendium on Value Engineering, Harold G. Tuffy, The Indo American Society, Bombay, 1983
5. Essentials of Management, Koontz, Harold and Weihrich Heinz, Tata McGraw Hill, New Delhi, 1998
6. Management, Stoner James Freeman, Edward R and Gilbert R Daniel, Prentice Hall, New Delhi, 1999
7. Effective Managerial Communication, Rasberry R W and Lemoine L F, Kent Publishing Company, 1986

MIE 1.2 Engineering Statistics

Probability Statistics:

- Concept of probability, Conditional Probability, Bay's Theorem
- Random variable: Discrete and Continuous, probability law and probability density function, function of random variable, expectation and variance operator
- Discrete probability distributions: Bernoulli's trial, Binomial, Geometric, Pascal, Hyper-geometric, Poisson, Multi-nominal distribution
- Continuous probability distributions: Uniform, Exponential, Gamma, Weibull, Normal, Log-normal
- Two dimension random vector: joint, marginal and conditional probability distribution, function of two dimensional random vector, expectation and variance, conditional variance, covariance, correlation, independence, application of the concepts to multi-dimensional random variables

Inferential Statistics:

- Sampling Distributions: Normal, Student- t, Chi-square and F distribution
- Point estimation
- Interval estimation
- Testing of Hypothesis on Parameters and Independence
- Goodness of Fit test
- Linear Regression
- Analysis of Variance
- Design of Experiment

REFERENCE TEXT BOOKS:

1. Probability and Statistics for Engineers, Montgomery Douglas C. and George C. Runger, John Wiley and Sons, 1994
2. Probability and Statistical Inferences, Hogg R.V and E.A. Tanis, 2nd edition, Macmillan, 1983
3. Probability and Statistics for Engineers, Miller Irwin and John E Freund, Prentice Hall of India, 1977
4. Design and Analysis of Experiments, Montgomery Douglas C., 3rd edition, John Wiley and Sons, 1991

MIE 1.3 Seminar I

This shall be comprehensive study of any one topic of interest and current relevance in the field of industrial engineering, especially designed to encourage study on recent advances in the field. The seminar report shall be submitted for TW/Oral examination.

MIE 2.1 Applied Operations Research

Introduction to Operations Research and Modeling
Linear Programming: Formulation, Solution Methodologies, Simplex Method, Two Phase Method, Dual Simplex Method and Modified Simplex Method. Duality Theory
Post Optimal Analysis of LP models, Parametric Linear programming
Transportation models, Transshipment models and Assignment Models
Integer Programming: formulations, Cutting Plane method, Branch and Bound Algorithm, Additive algorithm for Zero one programming
Dynamic Programming: Stages, states, Principle of Optimality, recursive relationship. Capital Allocation model, Knap sack Model, Traveling salesmen's model and other related model
Decision Theory: Decision under Certainty, Risk and Uncertainty,
Game Theory: Two-Person Zero Sum Game, graphical method, Linear-programming formulation of Game
Queuing theory: characteristics, Single server and multi-server models, Self-service system, Finite Population
Network models: Minimum spanning tree, shortest path model, Maximal Flow
Introduction to Goal Programming

REFERENCE TEXT BOOKS:

1. Operations Research, R. Paneerselvan, Prentice Hall of India, 2003
2. Operations Research An Introduction, Hamdy A. Taha, Prentice Hall of India, 1992
3. Introduction to Operations Research, Hiller Frederick and Lieberman G. J., Tata McGraw Hill, 2001
4. Introduction to Operations Research- A computer Oriented Algorithmic approach, Billy E. Gillett, Tata McGraw Hill, 1976

MIE 2.2 Operations Management

Concepts of operations Planning and control for various systems in manufacturing and non-manufacturing sectors.

- Demand Forecasting: objectives, qualitative and quantitative techniques
- Aggregate planning and Master scheduling: Concept, objectives. Various implementation strategies, comparisons
- Capacity Planning, Location Planning and Layout analysis
- Assembly Line Balancing and Material Handling
- Group Technology
- Inventory Control: need, Systems, EOQ and various other deterministic models, probabilistic models
- Material Requirement Planning: Dependent demand, Lot Sizing, CRP and ERP
- Concepts in JIT, Push Pull system
- Production Scheduling: Single Processor, Two Processor Flow and Job shop, Three Processor Flow shop model
- Project Scheduling: Gantt Chart, network models like CPM and PERT

REFERENCE TEXT BOOKS:

1. Operations Management, J.G Monks., McGraw Hill,1985
2. Operations Management, Roger G. Schroder, International Students Edition, McGraw Hill, 1985
3. The Management of Operations, Jack P. Meredith, John Wiley and Sons, 1987
4. Production and Operations Management, S.N. Chary, Tata McGraw Hill, 1988
5. Supply Chain Management, Chopra Sunil and Peter Meindl, Pearson Education Inc., 2004

MIE 2.3 Computer Methods in Industrial Engineering

Non- linear programming, numerical methods, classification.
Single variable optimisation: Region elimination methods, interpolation methods. Unrestricted search, Dichotomous method, Interval halving method, Golden section, Fibonacci search, Bisection method, Secant method, Newton –Ralph son method, Quadratic search method.
Multivariable optimisation without constraints: Uni-variate method, Conjugate direction, Steepest descent method, Newton's method, Marquardt' method and Simplex method.
Constraint optimisation: Random search techniques, Cutting Plane method and Penalty based methods, Kuhn-Tucker conditions
Genetic Algorithm, Simulated Annealing and Tabu Search

Basic Tools of C++ : Types, declarations, pointers, Arrays, structures, expressions, statements, functions and exceptions
Object Oriented programming: concept and need
Classes: member functions and data members; public, private and public functions. Constructors, static members, self-reference, constant members, mutable, overloading functions. Destructors, Operator overloading, friend function.
Inheritance: concept and need
Derived classes: Member function, construction, destruction, copying, Virtual function, and Abstract classes
Function templates and template class
Casting: static and dynamic, Run time type information.
Standard Template Library: Iterators, Standard library algorithms
Implementation of various industrial engineering applications in Oops

REFERENCE TEXT BOOKS:

1. Optimization Concepts and Applications in Engineering, Ashok Belegundu and Tirupathi R. Chandrupatla, Pearson Education, 2002
2. Optimization for Engineering Design, Kalyanmoy Deb, Prentice Hall of India, 1995
3. Optimization Theory and application, S.S. Rao, Wiley Eastern Limited, 1998
4. Object Oriented Programming with C++, E. Balagurusami, Tata McGraw Hill, 1987
5. Object Oriented Programming in C++, Robert Lafore, Galgotia Publication, 1999

MIE 3.1 Elective I

3.1.1 Management Information System

Introduction to Information Systems, Growth of Hardware, Classification of software and hardware, Basics of networking topology, intranet, Internet and extranet, domain classification systems in Internet. Introduction to Gnu/ Linux OS, Free software, open software and proprietary software

Various Storage media, files storages, file organization. Various database structures, Logical and Physical modeling of data, Data Flow diagram, tools for analysis and modeling of processes. Tools for logical modeling of databases-Entity Relationship diagram, Relational Databases Management Systems- definition, data manipulation and query, Structured Query Language (SQL), comparisons of various RDBMS packages.

Concepts in Decision-making, Simon's model of decision-making. Concept of Payoff matrix, Decision making under certainty, risk and uncertainty, decision trees, utilities, ranking, weighing.

Concept of systems- Classification, coupling and decoupling, negative entropy, handing of system stress

Expert Systems-basic, classification and development, MIS development –life cycle and prototype approach, Information system audit, long term MIS Planning.

REFERENCE TEXT BOOKS:

1. Management Information Systems, S. Sadagopan , Prentice Hall of India, 1999
2. Management Information Systems, Effy O. Z., Galgotia Publications Pvt. Ltd, 1999
3. Management Information Systems, Gorden Davis and Margrethe Oleson, McGraw Hill International, 1974
4. Management Information Systems, Uma G. Gupta, Galgotia Publications Pvt. Ltd, 1997

MIE 3.1 Elective I

3.1.2 Marketing Management

Marketing Philosophy of Business

Consumer Behaviour and consumer a decision process

Marketing strategies and positioning products

Planning markets and positioning products

Management of existing product and development of new products

Distribution Management

Market oriented pricing

Designing the promotion mix and scale promotion

Managing the advertisement program

Scale management

Controlling the marketing function

Introduction to service marketing, marketing in non-profit organization

Social marketing and global marketing

Latest trends in marketing

REFERENCE TEXT BOOKS:

1. Marketing Management, Philip Kutter, Prentice Hall, 2003
2. Marketing Management, Ran Jan Saxena, Tata McGraw Hill, 1997
3. Marketing Management, V. S. Ramaswamy and S. Nama Kumar, Mac Millan India Ltd, 1990

MIE 3.1 Elective I

3.1.3 Energy Management

Elements of energy management, National energy scene with special reference to industry sector, Energy economy relationship, future energy supply and demand scenario and integrated energy planning, Physical aspect of energy: Classification, efficiency and effectiveness of utilization in industry. Energy demand management at plant level, creation of energy manager, modes of energy savings, Energy auditing, opportunities with reference to waste heat recovery, cogeneration. Latest trends in energy auditing and energy conservation

REFERENCE TEXT BOOKS:

1. Industrial energy conservation, Reay A., Pergaman Press, 1977
2. Energy Management, Murphy and Mckay, Butterworths, 1982
3. Energy System Engineering, Wilbur ED, Wiley Inter-science, 1985

MIE 3.1 Elective I

3.1.4 Demand Forecasting

- Need and uses of forecasting
- The features of forecasting techniques
- Accuracy of forecasting techniques
- Time series methods
- Smoothing and decomposition methods
- Regression and econometric methods
- Box Jenkins method
- Adaptive models
- Integrated forecasting and planning

REFERENCE TEXT BOOKS:

1. Statistical Methods for forecasting, Bovos Abraham and Johannes Lodolter, John Wiley and Sons, 1983
2. Forecasting methods of Management, S Makridakis , Steven Wheelwright & Victor McGee, John Wiley and Sons, 1983
3. Econometric Models and Economic Forecast, Robert S. Pindyck and Daniel L. Rubinfield, McGraw Hill International Book Company, International Students Edition, 1981

MIE 3.2 Work System Design

Ergonomics:

- Introduction to ergonomics and Human factor engineering
- Physiological basis of Human performance
- Biomechanics
- Psychology of work and workload perception
- Physical work environment
- Basis of ergonomics, problem identification and safety

Predetermined Motion and Time standards

- Elemental motions, THERBLIGS
- Principles of Motion economy
- MTM system
- Application of MTM to office and Maintenance work
- Standard data

Incentive schemes

- Concept, reasons
- Individual and group
- Different type of incentive schemes

REFERENCE TEXT BOOKS:

1. Introduction to Ergonomics, R.S. Bridger, McGraw Hill, 1997
2. Engineered work measurement, Karger D.W and Bahar F.H, 3rd edition, Industrial Press INC, NY, 1977
3. Human Factor Engineering and Design, Saunders M.S. and McCormic E.J., McGraw Hill, 1987
4. Handbook of Industrial Engineering, Gabriel Salvandy, John Wiley and Sons, 1982
5. Fitting the task to the man, E. Grandjean, Taylor and Francis, 1980

MIE 3.3 Quality and Reliability

Definition and meaning of quality and its importance, eight dimensions of quality, concept and scope of total quality, quality systems, quality assurance and ISO quality standards, quality costs and economics of quality
ISO 9000 and its impact on quality, Six-sigma quality,

Constant cause system and assignable cause
Process Control: using control charts for variables and attributes
($\bar{X}$, R) control charts, ($\bar{X}$, s) control charts, charts with modified control limits, warning limits and trend. p-chart, np-chart, c-chart and u-chart

Acceptance Sampling:
Analysis of Single Sampling Plans, Double Sampling Plans, Multiple Sampling Plans, Item-by-item Sampling plans
Design of Sampling Plans: single sampling plan using Cameron's table, using Dodge-Romig Tables, MIL STD plans

Reliability: basic concept, reliability measures, bathtub curve, Hazard rate models, constant hazard, linear increasing/decreasing and non-linear hazard rate. System reliability models: series, parallel, series-parallel and complex system. Use of redundancy in design: low level and high level. K out of n system. Reliability estimation, Reliability allocation and optimization. Life testing. Fault tree analysis, FMEA and FMECA
Introduction to maintainability and availability

REFERENCE TEXT BOOKS:

1. Statistical Quality Control, Grant E.L.& Levenworth R.S., McGraw Hill, 1988
2. Quality Planning and Analysis, Juran J.M. & Gyrna F.M., McGraw Hill, 1980
3. Total Quality Control, Armand V. Feigenbaum, McGraw Hill,1986
4. Practical Reliability Engineering, P. D. T. O'Connor, John Wiley & Sons, 1990

MIE 4.1 Elective II

MIE 4.1.1 Facility Location and Layout Planning

Facility Planning and Industrial Engineering, facility location problems-application of transportation model, decision theory and other analytical approaches, single/multiple facility location problems, quadratic assignment problems minimax location and covering problems, use of simulation for location problems
Facility design problems – structural design, types of production, types of layout, comparisons layout design including computerized layout planning and handing system design warehouse management, application of classical industrial engineering concepts to facilities planning, facility planning and technology management, application of concepts and techniques in operation research –Goal programming and integer programming in facility layout

REFERENCE TEXT BOOKS

1. Facility Planning, J.A. Tomkins and J.A. White, John Wiley and sons , 1984
2. Manufacturing systems Engineering, K. Hitomi, Viva Books Pvt.Ltd., 1996
3. Facility layout and location –an analytical approach, Francis R.L.and J.A. White Prentice Hall Inc, 1974
4. Plant Layout and Material Handling , J.M. Apple, McGraw Hill, 1972

MIE 4.1 Elective II

MIE 4.1.2 Supply Chain Management

Introduction to Supply Chain Management, classification of inventory systems, managing supply chain inventory, planning demand and supply in supply chains, managing Economics *of* scale and uncertainty in supply chains, lead-times, understanding impact of Uncertainty of demand and supply in supply chains

Supply chain design for mass customization, design of localization and design of customization, managing transportation in supply-chains, links between transportation and inventory costs, in design of transportation networks, issues in facility location in supply chains.

Network design in supply chains, framework for facility location decisions, operational issues in supply chains, effect of demand and lead-times uncertainty on total costs of supply chain, Beer distribution game, information distortion and Bullwhip effect, performance measures of supply chains.

Information technology and E-Business in supply chains management, impact of Sourcing of raw materials, distributions, case studies in supply chain management

REFERENCE TEXT BOOKS

1. Supply Chain Management- Strategy, Planning and Operations, Sunil Chopra, *Peter* Meihdl Pearson Education Asia. 2001

2. Design and Managing the Supply chain , Simchi- Levi. Kaminsky, McGraw Hill International Edition. 2000

3.Logistic Management , Lambart Dougart, James Stock and Lisa Ellram, Irwin McGraw Hill International Edition" 1998

4 Logistics and Supply Chain Management -cases and concepts, Raghuram G, and N.Rangaraj, McMilan India Pvt Ltd, New Delhi,. 2000

MIE 4.1 Elective II

MIE 4.1.3 Stochastic Modelling

Review of probability concepts and distributions.
Introduction to stochastic processes, sample paths and finite dimensional distributions, Kolmogorov's consistency conditions
Renewal Process, reward and cost models, cumulative processes, Poisson process and stopping times, regenerative processes, relation between a time average and mean of limiting distribution, Wald's equation, renewal theorem
Discrete time Markov chains, connection with renewal theory, communication classes and class properties, irreducible and positive recurrent chains, frequency and relative frequencies for ergodic chains, costs and reward for ergodic chains, transient behavior.
Continuous time Markov chains, pure- jump chains , regular chains birth death process, time and transition average for positive recurrent irreducible chains, backward and forward equations, uniformalizable chains
Various applications of stochastic models

REFERENCE TEXT BOOKS

1. Modeling and analysis of Stochastic Systems, V.G. Kulkarni, Chapman and Hall London, 1995
2. Probability and Random Processes , G.R. Grimmett and D.R.Stizaker, Oxford University Press, Oxford, 1982
3. An Introduction to Stochastic processes, E. Cinlar, Prentice Hall Inc, Englewood Cliffs, 1975
4. Stochastic Processes, S.M.Ross, joihn Wiley and sons, New York, 1983

MIE 4.1 Elective II

MIE 4.1.4 Industrial Scheduling

Importance of scheduling in implementation of production planning, scheduling function, common measure of performance
Exact solution in some one and two processor system, heuristics in job shops and flow shop problems, scheduling of jobs with limi9ted resources, dynamic flow systems, use of priority rules
Scheduling, balancing in mixed model assembly lines and flow lines, scheduling in process industries with no wait or limited work in process
Parallel processor, bin pacing heuristics, GT as decomposition of job shops Vehicle scheduling problems, LP formulation of various scheduling situations, recent development in scheduling

REFERENCE TEXT BOOKS

1. Operation Research, R.Paneerselvan, Prentice Hall of India, 2003
2. Theory of Scheduling, R.W.Conway, W.L Maxwell and L.W.Miller, Addison Wiley. 1987
3. Machine Scheduling Problems, Classification complexity and computations , A.H G. Rinnoooy Kan, Martums Nijhoff, The Hague, 1976
4. Introduction to sequencing, K.R.Backer, Wiley, 1974

MIE 4.2 Maintenance Engineering & Management

Maintenance Management: Objectives, benefits and policies, Organizational and structure of maintenance system, mechanics of maintenance system, planning and scheduling of maintenance activities.
Types of Maintenance: breakdown, preventive maintenance, predictive maintenance, Total productive maintenance, codification and classification, replacement policies, replacement models
Reliability models, system reliability for parallel, complex system, time dependant failure rates, Reliability testing: non-parametric methods, censoring and acceleration, parametric methods, redundancy: single, multiple, common mode failure, redundancy allocation: high level, low level, reliability optimization, reliability allocation.
Maintained system: idealized maintenance, imperfect maintenance, age maintenance, availability and maintainability, revealed failures.
Failure interaction: state transition diagram, reliability and availability calculations using Markov analysis of multiple components, load-sharing system and standby system.
Safety analysis, various tools of analysis.
Computerized maintenance system, design implementation and operation of integrated maintenance system.

REFERENCE TEXT BOOKS:

1. Introduction to Reliability Engineering, E. E. Lewis, John Wiley and Sons,1987
2. Practical Reliability Engineering, P. D. T. O'Connor, John Wiley and Sons,1990
3. Failure Modes and Effect Analysis, P. Paul, P. T. Publications, Inc. Suite C.,1995
4. An introduction to machinery Reliability Assessment, H. P. Bloch and F. K. Geitner, Van Nostrand reinhold Inc., New York, 1993

MIE 4.3 Seminar II

This shall be comprehensive study of any one topic of interest and current relevance in the field of industrial engineering, especially designed to encourage study on recent advances in the field. The work should be analytical in nature. The seminar report shall be submitted for TW/Oral examination.

MIE 5.1 Elective III

MIE 5.1.1 System Simulation and Modeling

Definition, need, modeling concepts. Types of system studies. Random numbers: Need, Importance and desirable properties,Generation of random numbers with Bernoulli's Trial, Binomial, Geometric, Pascal, Exponential, Uniform, Normal , Erlang distribution. Testing the random numbers for the various distributions.
Estimation of parameters
Next event approach, Fixed time increment approach and Process oriented approach for system simulation.
Simulation of inventory system, queuing system, project network and other discrete system, Application of simulation for solving deterministic model like evaluation of definite integral, finding value of root, area of circle etc., Application of simulation in simple simulation of simple management games.
GPSS: Introduction to various block statements and control statements: GENERATE, ADVANCE, SEIZE, RELEASE, QUEUE, DEPART, ENTER, DEPART, TRANSFER, MARK, TABULATE, TERMINATE, SAVEVALUE, PRIORITY, ASSIGN, GATE, LOGIC, FUNCTION, START, RESET, JOB, SIMULATE. Standard Numeric attributes. Modeling of systems using GPSS.
Introduction to continuous simulation and CSMP
Analysis of simulation output: determining the length of simulation, effect of initial bias, effect of auto-correlation, Variance Reduction techniques.

REFERENCE TEXT BOOKS:

1.System Simulation , Geoffrey Gorden, Prentice Hall of India, New Delhi.
2. Digital computer simulation, Fred J. Maryanski, CBS Publishers and Distributors
3. Digital Simulation by Narsingh Deo, PHI

MIE 5.1 Elective III

MIE 5.1.2 Integer programming

Classification and application, capital budgeting, multi-commodity. Distribution, airline crew scheduling, truck delivery problems
Cutting plane methods, dual fractional integer and mixed integer programming, dual and primal all integer algorithms, Brach and Bound approach, surrogate constraints,
Zero one programming, Model formulation using binary variables in either or constraints K out of N Constraints, functions with several values etc. Balas Addition algorithm
Binary representation of general integer, recursions for knapsack problems, group knapsack problems, set covering and set partitioning
Genetic algorithm for integer programming

REFERENCE TEXT BOOKS

1. Integer Programming, H.M.Salkin , Addison Wiley, 1975
2. Integer Programming, R.S.Garfinkel and G.L.Nemhauser Wiley inter –science 1972
3. Integer Programming,H. Taha , Academic Press , 1971
4. Optimization for engineering design –algorithms and examples , K .Deb , Prentice Hall of India Pvt. Ltd,. New Delhi, 1998.

MIE 5.1 Elective III

MIE 5.1.3 Advanced Operations Research

Review of LP, Parametric Linear Programming, Upper Bound Technique, Interior point algorithm, Quadratic programming and linear Complementary Problem
Transshipment model, Solid Transportation model, Fixed Charge model, three dimensional assignment model,
Review of basic Queuing models, analysis of advanced queuing models, application of queuing theory
Multi- objective programming: need, efficient solution, Concept of Pareto optimality generation, compromise solution and solution methodologies.
Non traditional techniques for non linear optimization like Simulated annealing, Genetic Algorithm
Introduction to Geometric programming, Recent advances in optimization.

MIE 5.1 Elective III

MIE 5.1.4 Advanced Maintenance Management

Probability theory- A review: probability space, Random variables – one dimensional and multi-variate- conditional probability and expectation, Moments and E and V-operators. Introduction to stochastic Process: sample path, finite dimensional distributions-renewal process, Markov chains – applied to failure interactions and Reliability, Availability and Maintainability (RAM) analysis
Analytical tools: reliability measures and assessment using inferential statistics and probability plots, Ranking methods –AHP with reciprocal matrix analysis, FMEA, FTA, event tree analysis –Brinbaum's reliability important measure. Multi-attribute analysis (MAA) – Criticality importance through inter-correlation (CRITIC) method. Nonlinear optimization, Multi objective optimization, tools to deal with conflicts – Pareto optimality.
Recent trend in Maintenance: conventional classification of maintenance, replacement policy – selection of optimal period in PM using multi-criteria. Reliability Centered Maintenance (RCM) –need, historical development – Bath Tub fallacy, road map to develop RCM system, benefits and pitfalls, global status with case studies. Total Productive Maintenance (TPM) –development, philosophy, success with cases. Diagnostic Maintenance – condition monitoring – development of signatures and their analysis, debris analysis – benefits and limitations, application potentials with cases – tribology.

References:

1. An Introduction to Machinery Reliability Assessment, Bloch, H. P. and Geitner, F. K., Van Nostrand Reinhold Inc., New York, 1993
2. Design Reliability Fundamentals and applications, Dhillon B. S., CRC Press, 1999
3. New Assurance Technologies – Principles and practices, Raheja, D. G., Mc Graw Hill Inc., New York, 1991
4. Reliability Centered Maintenance, Smith, A. M., Mc Graw Hill Inc., New York, 1993
5. Grimmet and Stizaker, Probability and Random Processes, Oxford university Press, Oxford, 1992.

MIE 5.2 Project

This shall include a detailed compilation of work leading to formulation of research work topic for dissertation in semester VI

MIE 5.3 Seminar III

This shall be comprehensive study of any one topic of interest and current relevance in the field of industrial engineering, especially designed to encourage study on recent advances in the field. The seminar report shall be submitted for TW/Oral examination.

MIE 6 Dissertation

This shall include a detailed and exhaustive research study on that shall contribute more towards the field of industrial engineering. The work may be analytical or experimental. Typed and three softbound project report shall be submitted for TW/Oral examination. After successful defense, the copies with correction (if any) are to be submitted in hard bound form.