

DEPARTMENT OF MECHANICAL ENGINEERING

**M TECH. (INDUSTRIAL ENGINEERING)
(Full Time and Evening Course)**

**SCHEME OF INSTRUCTION AND EXAMINATION
(with effect from 2015-16 academic year)**

I – SEMESTER

Code No.	Course title	Scheme of Instruction			Scheme of Examination			Total	Credits
		Lec.	Tut.	Total	Duration of Exam. (hrs)	Theory /Lab./ Viva	Sess.		
IE 1.1	Probability and Statistics	4	--	4	3	70	30	100	4
IE 1.2	Total Quality Management	4	--	4	3	70	30	100	4
IE 1.3	Management Principles & Perspectives	4	--	4	3	70	30	100	4
IE1.4	Methods Engineering and Work Design	4	--	4	3	70	30	100	4
IE 1.5	Elective Subject 1 A) Advanced Optimization Techniques B) Maintenance Management C) Product Design Management	4	--	4	3	70	30	100	4
IE 1.6	Elective Subject 2 A) Engineering & Managerial Economics B) Project Management B) Designing and Managing the Supply Chain	4	--	4	3	70	30	100	4
IE 1.7	Work Study Lab	--	3	3	Viva-Voce	50	50	100	2
IE 1.8	Industrial Engineering Lab		3	3	Viva-Voce	50	50	100	2
Total		24	6	30		520	280	800	28

Note : The viva-voce for the labs / seminars shall be held with the course instructor/ faculty member and an external examiner nominated by the university from any academic institution / industry / R & D organization.

II – SEMESTER

Code No.	Course title	Scheme of Instruction			Scheme of Examination			Total	Credits
		Lec.	Tut.	Total	Duration of Exam. (hrs)	Theory Lab./ Viva	Sess.		
IE 2.1	Quality Control Engineering	4	--	4	3	70	30	100	4
IE 2.2	Operations Planning & Control Systems	4	--	4	3	70	30	100	4
IE 2.3	Facility Planning and Design	4	--	4	3	70	30	100	4
IE 2.4	Human Resource Development & Industrial Relations	4	--	4	3	70	30	100	4
IE 2.5	Elective Subject 1 A) Management Information Systems B) Human Factor Engineering C) Logistics Engineering and Management	4	--	4	3	70	30	100	4
IE 2.6	Elective Subject 2 A) Energy Management B) Reliability Engineering C) Materials Management	4	--	4	3	70	30	100	4
IE 2.7	Computer Applications Lab	--	3	3	Viva-Voce	50	50	100	2
IE 2.8	Seminar		3	3	Viva-Voce	50	50	100	2
Total		24	6	30		520	280	800	28

Note : The viva-voce for the labs / seminars shall be held with the course instructor/ faculty member and an external examiner nominated by the university from any academic institution / industry / R & D organization.

III – SEMESTER

Code No	Course title	Scheme of Examination	Total Marks	Credits
DXX3.1	Dissertation (Preliminary)	Viva-voce	100	12

Note : The Dissertation shall be evaluated through Viva–Voce examination by a committee with HOD, Chairman, Board of studies and Research Guide as members. The marks shall be awarded in the ratio of 30, 30, and 40 percent by the members respectively.

IV – SEMESTER

Code No	Course title	Scheme of Examination	Total Marks	Credits
DXX4.1	Dissertation (Final)	Viva-voce	100	12

Note: The Dissertation shall be evaluated through Defence and Viva–Voce examination by a committee with an External Examiner nominated by University, HOD, Chairman, Board of studies and Research Guide as members. The marks shall be awarded in the ratio of 20, 20, 20, and 40 percent by the members respectively.

IE 1.1 PROBABILITY AND STATISTICS

Periods per week : 4
Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30
Credits : 4

Discrete and Continuous random variables, Mathematical Expectations- Moments and moment generating functions.

Binomial distribution, Poisson distribution-Normal distribution, Uniform distribution, Weibull distribution.

Population and samples-sampling distributions of mean (known and unknown) proportions-sums and differences. Estimation-types of estimation-properties of good estimator-maximum likelihood estimation- interval estimation.

Introduction to statistical hypothesis -testing of hypothesis – Large sample tests for testing of mean and proportions - small sample tests for testing of mean and variance- Tests for independence of attributes and goodness of fit.

Introduction to ANOVA- Analysis of variance one way and two way classifications.

Introduction to time series- components of time series- measures of trends by least square method. Introduction stochastic process - classification-ergodic process-Markov process and Markov chains

Principle of least squares –curve fitting – simple regression and correlation – partial and multiple correlations.

References:

1. Introduction to Mathematical Statistics by Hogg, R.V. and Craig, A.T.
2. Elements of Probability Theory by Cramer, K.
3. Statistics for Management by Levin and Rubin, PHI, 2001.
4. Mathematical Statistics by John E. Freund, 5th Ed. PHI.
5. Probability & Statistics for Engineers and Scientists by Ronald E. Walpole, Pearson Education Asia Edition.

IE 1.2 TOTAL QUALITY MANAGEMENT

Periods per week : 4

Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30

Credits : 4

Concepts of TQM: Philosophy of TQM, Quality philosophies of Deming, Crosby, Juran Trilogy, Customer focus, Organization, Top management commitment, Team work,.

TQM process: QC tools, Problem solving methodologies, New management tools, Work habits, Quality circles, Bench marking, Strategic quality planning.

TQM systems: Quality function deployment, Standardization, Designing for quality, Manufacturing for quality, Failure Mode Effect Analysis.

Quality system: Need for ISO 9000 system, Advantages, Clauses of ISO 9000, Implementation of ISO 9000, Quality costs, Quality auditing, Case studies.

Implementation of TQM: Steps, KAIZEN, 5S, JIT, POKAYOKE, Case studies.

Text Books:

1. Total Quality Management by Besterfield et al., Pearson Education, India, 2009
2. The Essence of Total Quality Management by John Bank, PHI, 1993.
3. Total Quality Management by Rose, J.E., Kogan Page Ltd., 1993

IE 1.3 MANAGEMENT PRINCIPLES AND PERSPECTIVES

Periods per week : 4
Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30
Credits : 4

Management principles, Management functions, Roles & Skills - History of management thought - Various theories and approaches to management, Management by objectives - Formal and informal organizations - Organisation structure and design - Organization principles of line and staff authority and span of control – Concept of Motivation, Maslow Need Hierarchy theory, Herbergs Motivation Hygiene theory, McGregor’s Theory X and Theory Y and Theory Z, Motivational applications.

Planning process, tools and techniques – Fundamentals of Directing- Decision making process, approaches and aids Concept of Leadership, Leadership theories, Leadership Styles, Concept of Power and Concept of Authority and Responsibility, Delegation, decentralization and autonomy Concept of Communication, types of communication, aids and Barriers in communication, Conflict and Coordination. - Managerial control-need and principles - Role of information in control - Control methods and techniques - Managerial ethics and social responsibility.

Text Books:

1. Principles and Practice of Management by L.M. Prasad.
2. Introduction to Management by Plankett, W.R. and Attner, R.F., Kent Publishing Company.

IE 1.4 METHODS ENGINEERING AND WORK DESIGN

Periods per week: 4
Examination (Theory): 3hrs.

Examination: 70; Sessionals: 30
Credits: 4

Work study: Concept of work and productivity – Productivity measurement - Methods study - Charting techniques – Elemental motions, THERBLIGS and principles of Motion Economy - Work measurement - Timing techniques - Introduction to predetermined motion time standards.- Concept of standard time and bench mark jobs.

Human factors engineering: Introduction to ergonomics and human factors Engineering - physiological basis of human performance - Biomechanics - Psychology of work and work load perception - Physical work environment - Basis of ergonomic problem identification - Safety.

Organization and methods: Procedure, analysis and developing office standards - MTM application to office work - Forms design and control - Records management.

Value engineering: VE concepts, Principles, Methodologies and standards - Methods of functional analysis.

Job evaluation and incentive scheme: Job description and job analysis - Job evaluation - different methods - Individual and group incentive concepts and implications - Different types of incentive schemes.

Text Books:

1. Introduction to Work Study, I.L.O., 3rd Revised Edn., 1986.
2. Methods, Standards and Work Design, Benjamin W. Niebel and Andris Freivalds, WCB McGraw Hill (1999).
3. Improving Productivity and Effectiveness by Mundel, Marvin, E., Prentice Hall, 1983.
4. Human Factors Engineering & Design by Sounders, M.S. and McCornic, E.J., McGraw Hill, 1983.
5. Fitting the Task to the Man by Grandjean, E., Taylor and Francis, London, 1989.
6. Compendium on Value Engineering by Tufty, H.G., The Indo-American Society, Bombay, 1983.
7. Compensation Administration by Belchar, David, W., Prentice Hall, N.J.

IE 1.5 Elective – I
A) ADVANCED OPTIMIZATION TECHNIQUES

Periods per week : 4

Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30

Credits : 4

INTRODUCTION: Statement of an optimization problem, Engineering Applications, Classification of optimization problems

Geometric programming (G.P): Solution of an unconstrained geometric programming, differential calculus method and arithmetic method. Primal dual relationship and sufficiency conditions. Solution of a constrained geometric programming problem (G.P.P). Complementary geometric programming (C.G.P), Simple applications of G.P

Dynamic programming (D.P): Multistage decision processes. Concepts of sub optimization, computational procedure in dynamic programming calculus method and tabular methods. Linear programming as a case of D.P. Continuous D.P, simple applications of D.P

Integer programming (I.P): Graphical representation. Gomory's cutting plane method. Bala's algorithm for zero-one programming problem. Branch-and-bound method.

Stochastic programming (S.P): Basics concepts of probability theory, stochastic linear programming

Unconventional optimization techniques: Multi-objective optimization - Lexicographic method, Goal programming method, Genetic algorithms, A.N.N, Simulated Annealing

References:

1. Operations Research- Principles and Practice, Ravindran, Phillips and Solberg, John Wiley
2. Introduction to Operations Research, Hiller and Lieberman, Mc Graw Hill
3. Engineering Optimization - Theory and Practice by Rao, S.S., New Age International (P) Ltd. Publishers.
4. Goal Programming and Extensions by James P. Ignizio, Lexington Books.
5. Genetic Algorithms - In Search, Optimization and Machine Learning by David E. Goldberg, Addison-Wesley Longman (Singapore) Pvt. Ltd.

IE 1.5 Elective – I
B) MAINTENANCE MANAGEMENT

Periods per week : 4
Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30
Credits : 4

Characteristics, Benefits, Objectives and Policies of maintenance, Organization and structure of maintenance system, Mechanics of maintenance system - Planning and scheduling maintenance activities, Types of maintenance: Preventive maintenance - Development of preventive maintenance schedule - Planned prevention of breakdowns, Predictive maintenance, Condition monitoring, Equipment codification and classification, Maintenance budgeting and cost control, Production maintenance integration, Replacement - Policies and models, Maintenance manpower planning, spare parts management, Maintenance downtime analysis, Computerized maintenance system, Application of simulation technique, Design - Implementation and Operation of an integrated maintenance system.

Reliability models, State transition diagrams for maintained and non-maintained systems, Reliability measurement and life testing application of reliability. Maintenance strategies, Maintainability and availability and criteria.

Text Books:

1. Maintainability Principles and Practices by Blanchard, B.S., McGraw Hill, NY, 1969.
2. Maintenance Management by Carder, A.S., McGraw Hill, NY, 1976.
3. Maintenance Engineering and Management by Mishra, R.C. and Pathak, K., PHI, 2002.

IE 1.5 Elective – I
C) PRODUCT DESIGN MANAGEMENT

Periods per week : 4

Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30

Credits : 4

Introduction to design, Product design, Design management, Product management. Traditional & modern design, Design process, Organizational objectives.

Need related intelligence, Identification of latent needs, Technology related intelligence, Development of technological competence.

Organizational strength & weakness, Criteria for a new product, New product management, Forward planning, Coordination and communication.

Innovation, creativity and diffusion, Techniques for creative idea generation. Evaluation of new products ideas, Functions- technological, Ecological, Legal.

Investigating user behaviour - User habits, Expectations, Perception, Techniques for investigating user behaviour.

Stating objectives, Product formulation, Development of business analysis, Analysis for development, Boundary search and functional innovation.

Product design and design methods, Selection of methods appropriate to design stage. Design evaluation - Analysis for fault, Value and Reliability. Ergonomic analysis, Analysis for maintenance and useful life.

Market preparation vendor search, Sales promotion, Test marketing product and introduction strategy.

Organizational structure for effective product innovation and role of product manager.

Text Books:

1. Corporate Strategy and product Innovation by Rothberg, Robert, R., The Free Press, 1976.
2. Design Methods, Seeds of Human Future by Jones, J.C., John Wiley, 1970.
3. New Product Development by Grunwald, G., Business Books, Illinois, 1985.
4. Product Design and Manufacturing, A. K. Chitale and R. C. Gupta, PHI (2002)

IE 1.6 Elective – II
A) ENGINEERING AND MANAGERIAL ECONOMICS

Periods per week : 4

Examination : 70 ; Sessionals : 30

Examination (Theory): 3hrs.

Credits : 4

Introduction to Engineering Economy- principles of Engineering Economy, Nature and Scope of Managerial Economics- Basic principles , Elements of demand analysis – Forecasting- Methods of Forecasting, Cost concepts - Classification –Cost output relationship-Long run and short run - Learning curves –Cost functions - Economies of scale, Production function, Supply Analysis, Market structure- perfect competition- Monopoly- Monopolistic and oligopoly, Replacement analysis , Depreciation –Methods of depreciation- Depletion, Capital budgeting-Importance- Techniques of capital budgeting , Break-Even analysis.

Text Books:

1. Engineering Economy, William G. Slivan, James A. Bontadelli and Elin M. Wicks, Pearson Education Asia(2001)
2. Fundamentals of Managerial Economics, Marle Hirschey/James L Pappas, Dryden Pub.
3. Financial Management, I.M. Pandey, Vikas Publishing House, 2007.
4. J.C. Van Horne, Financial Management and Policy, Prentice Hall of India, New Delhi, 1977.
5. Managerial Economies, D.N. Dwivedi, Vikas Publishing House, 2002.
6. Managerial Economies, R.L. Varshney and K.L. Maheswari, Sultan Chand & Sons, New Delhi.

IE 1.6 Elective – II
B) PROJECT MANAGEMENT

Periods per week : 4

Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30

Credits : 4

Industrial development - Corporate growth and business development. Product innovation research and development - Formulation and implementation of R&D projects. Project identification and formulation - Needs analysis - Resource surveys - Market research - Feasibility analysis. Technical feasibility - Technology forecasting - Choice of technology - Choice of process technology assessment technology - Transfer - Techno economic analysis - Appropriate technology.

Analysis of infrastructures: Inputs transports - Elements of economic geography - Location - Site selection. Investment analysis principles. Industrial policy - Incentives and regulations. Cost estimating - Cost-benefit analysis - Financial analysis - Economic analysis - Social-cost benefit analysis - UNIDO - World Bank and OECD methodologies. Project financing - Source of finance - Cost of capital - Capital structure - Internal finance and foreign exchange regulation - Projects and contracts planning and co-ordination - Project scheduling and monitoring tools and techniques - Project management information systems and documentation - Computer applications in project management.

Text Books:

1. Project Management, David I. Cleland, Mc Graw Hill(1999)
2. Managing Construction Contract by Colier Kint, Reston Publishing Co.
3. Engineering and Construction Project Management by Kerridge, A.E. and Verveelin, C.H., Gulf Pub. Co., Houston, 1986.
4. Project Formulation and Evaluation Series, No.1, No.2 and No.3, U.N.I.D.O., Oxford and IBH Publishing Co.

IE 1.6 Elective - II
C) DESIGNING AND MANAGING THE SUPPLY CHAIN

Periods per week: 4

Examination : 70 ; Sessionals : 30

Examination (Theory): 3hrs.

Credits : 4

Role of supply chain management in Economy and Organization- Introduction to SCM, Evolution, Key concepts, Decisions and Importance of SCM.

Supply chain strategy and Performance Measures- Competitive supply chain strategies, CRM strategy, Supplier relationship strategy- Performance Measures (Financial, Productivity, Quality and cycle time).

Supply chain drives- Introduction, Facilities, Inventory, Transportation and Information.

Supply chain design- Network design and operation models.

Sourcing and Transportation- Role of sourcing, Supplier selection and contracts, Procurement process, Role of Transportation, Design options for transportation network.

Planning and Managing Inventories-Introduction, cycle/safety/seasonal stock, Inventory for short life cycle products, Multi echelon inventory.

Information Technology in SCM- Role of IT, E-business and future trends.

Supply chain innovations- Introduction, Supply chain integration, Restructuring, Agile supply chains.

Text Books:

1. Designing and Managing the Supply Chain: David Simchi-Levi, Philip Kaminsky, Edith Simchi – Levi, Ravi Shankar, Mc Graw Hill Education, 2008
2. Supply chain management text and cases: Janat Shah, Pearson Education, 2009.
3. Supply chain management strategy, planning and operation, Sunil Chopra, Peter Meindl, PHI.
4. Supply chain management: Chopra, Pearson Education, 2009.
5. Business logistics/ Supply chain management, 5/e: Ballou, Pearson Education.

IE 1.7 WORK STUDY LAB

Periods per week : 3

Examination: 50 Sessionals : 50

Credits : 2

List of Experiments:

1. To measure the skill and dexterity in the movement of Wrist and Fingers using pin board.
2. To determine the cycle time using MTM.
3. To draw two handed process charts for
 - i. Bolt, washer and nut assembly
 - ii. Assembly of electric tester.
4. To draw Multiple Activity chart using an electric toaster.
5. To determine the percentage utilization using work sampling.
6. To draw flow process charts on activities in Workshop/ Laboratory/Office.
7. To determine the time required to perform motion sequence using work factor system.
8. To draw SIMO charts for
 - i. Ball point pen assembly
 - ii. Electric plug assembly.
9. To conduct time study of the bulb holder assembly operation of the existing method.
10. Performance rating

IE 1.8 INDUSTRIAL ENGINEERING LAB

Periods per week : 3

Examination: 50 Sessionals : 50
Credits : 2

1. To study the changes in heart rate for different subjects using Tread mill.
2. To measure the Heart rate during working and recovery periods of the subjects under different loads, using Bicycle ergometer.
3. Control Charts for Attributes
4. Control Charts for Variables
5. To draw OC Curves
6. Normal Distribution
7. Rectangular Distribution
8. Computation of sales forecasting techniques and validation
9. Computation of lot sizing methods used in MRP
10. Development of Bill of Materials for MRP

IE 2.1 QUALITY CONTROL ENGINEERING

Periods per week: 4
Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30
Credits : 4

Introduction: Quality – Definition – Difference between Quality control and inspection – variables– attributes – assignable and non-assignable causes.

Control charts for variables: \bar{X} , R and sigma control charts, Process Capability Analysis

Control charts for attributes: Control charts for fraction non conforming, Control chart for Nonconformities (defects)

Control charts for detecting small shifts: CUSUM chart, V-mask procedure, EWMA chart, Moving average control chart.

Control charts for short runs: \bar{X} , R and attribute control charts for short production runs.

Experiments for Process Design and Improvement: Guidelines for design of experiments, factorial experiments, 2^k factorial design, addition of centre points, blocking and confounding.

Taguchi's Quality Engineering: Loss function, Orthogonal Arrays, Signal-to-Noise (S/N) ratio.

Text Books:

1. Introduction to statistical quality control, 4th Edition by Douglas C Montgomery, John Wiley & Sons, Inc.
2. Taguchi methods explained by Tapan P Bagchi, PHI.
3. Total Quality Management by Besterfield et al., Pearson Education, India, 2009

References:

1. Fundamentals of quality control and improvement by Amitava Mitra, Pearson Education Asia.

IE 2.2 OPERATIONS PLANNING AND CONTROL SYSTEMS

Periods per week : 4
Examination (Theory): 3hrs.

Examination : 70 ; Sessionals: 30
Credits: 4

Concept of operation planning and control for various operational systems in manufacturing and non-manufacturing sector – Types of operation and process systems – Functions of operation planning and control – Forecasting - Aggregate planning - Master production scheduling - Material requirement planning, MRP-II – Job shop production activity planning and control – Scheduling, sequencing, priority rules for dispatching jobs – Line of Balance. Capacity planning and control, Concepts of just-in-time - Pull and push system, Kanban systems. Inventory planning and control – Types of inventory, Inventory cost, Inventory systems, Inventory control techniques – Project planning, Monitoring and control. Maintaining and improving operations – Maintenance management. Spare parts management, Continuous improvement of operations.

Text Books:

1. Production Planning and Inventory Control, Narasimhan, Mc Leavy, Billington, PHI(1999)
2. Operation Management- Strategy and Analysis, Lee Krajewski and Larry P. Ritzman, Addison- Wesley (2000).
3. Operations Management: Theory and Problems by Monk, J.G., McGraw Hill, NY, 1985.
4. Operation Management for Competitive Advantage, by Chase R.B., Jacobs F.R. and Aquilano, N.J., TMH, 2003.
5. Operations Management Theory and Practice by B. Mahadevan.
6. Manufacturing Planning and Control Systems by Vollmann, Thomas, E. and Others, Richard D., Irwin, Illinois, 1984.

IE 2.3 FACILITIES PLANNING AND DESIGN

Periods per week : 4

Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30

Credits : 4

Weberian location theory Evolution of Location including Quantitative and qualitative methods and factors effecting plant location Introduction to layout design process – Objectives and principles of plant layout, Process of plant layout, types of plant layout Systematic layout planning- Line Balancing - Computerized layout planning - ALDEP, CORELAP, CRAFT, Single and multi-facility location problems(with coordinate decent method only) - Quadratic assignment location problems - Minmax layout and location problems - Discrete plant location.

Introduction to Material handling Objectives and principles of Material handling, unit load containerization, types and classification of material handling equipments. Plant services and Auxiliary departments and factory building

Text Books:

1. Facilities Planning, James A. Tompkins and John A. White, John Wiley
2. Facility Layout and Location- An Analytical Approach, Richard L. Francis, Leon F Mc Ginnes and John A. White, PHI(1999)
3. Plant Layout and Material Handling by G.K.Agarawal

IE 2.4 HUMAN RESOURCE DEVELOPMENT & INDUSTRIAL RELATIONS

Periods per week : 4

Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30

Credits : 4

Personnel function: Its evolution, Objective principles, Philosophies, Duties and responsibilities of the personnel management in India. Manpower planning: Its uses and benefits - Problems and limitations - Manpower inventory: Manpower forecasting - Manpower skills analysis and practices in Indian industry recruitment: Selection process, Psychological testing - Interviewing techniques, Transfer, Promotion and its policies - Induction placement and exit interview wage and salary administration.

Training and development: Its objective and policy planning and organizing the training department - Training manager and his job - On and off the job training - Techniques, Career planning, Objective of performance appraisal and its methods.

Industrial relations: Problems of labour management relations - Causes for poor industrial relations - Conditions of good industrial relations - Trade union act - Objectives and advantages of trade unions - Collective bargaining - Industrial disputes act - Disciplinary action and domestic enquires - Machinery for settlement of dispute - Grievance procedure and its handling - Counselling - Lay-off, Lockouts, Strikes, Retrenchment - Labour participation in management, Joint management councils, Factories act and other social security acts relevant to the course.

Text Books:

1. Personnel Management by Monappa Arun and Saiyadain, M.S., 5th Reprint, Tata McGraw Hill, New Delhi.
2. Industrial Relations by Saiyadian, M.S., 1st Edn., Tata McGraw Hill, New Delhi, 1987.
3. The Industrial Law by Malik, P.L., 5th Edn., Eastern Book Co., 1982.
4. Personnel Management by Tripathi.

IE 2.5 Elective – III

A) MANAGEMENT INFORMATION SYSTEMS

Periods per week : 4

Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30

Credits : 4

Concepts of MIS: Global factors responsible of growth of information systems, Types of Information systems Evolution of information theory, Characteristics of management information System, Richard Nolan MIS Stages theory , Information Resource Management, Management information system organization functions MIS Long range planning Meaning and role of MIS in an organization. Analysis and design of information systems; Conceptual modeling of data and process in organizations. System development life cycle model, Methods of collection of data, Tools for modeling and analysis of data: Concept of Data Base Data base management systems and its functions Data flow diagram, Data dictionary , Data banks.

Tools for modelling and analysis of processes: Flow charts, Decision tables, Decision trees. Transform analysis, Transaction analysis. Information systems audit. Impact of MIS on organizations. Usefulness of various industrial engineering techniques in the design of MIS.

Text Books:

1. Management Information Systems, Laudon and Laudon, PHI(1999)
2. Management Information Systems by Jerome kanter
3. Management Information Systems by Davis Gordon.

IE 2.5 Elective – III
B) HUMAN FACTORS ENGINEERING

Periods per week : 4

Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30

Credits : 4

Introduction to Human factors and systems.

Information Input: Information input and processing, Text, Graphics, Symbols, and Codes, Visual displays of dynamic information, Auditory, Tactual, and Olfactory displays, communications

Human Output and Control: Physical Work and Manual Materials Handling, Motor Skills, Human Control of Systems, Controls and Data Entry Devices, Hand Tools and Devices

Workplace Design: Applied Anthropometry, Work-Space Design and Seating, Arrangement of Components within Physical Space, Interpersonal Aspects of Workplace Design

Environmental Conditions: Illumination, Climate, Noise, Motion

Human Factors Applications: Human Error. Accidents, and Safety, Human Factors in Systems Design

Text Books:

1. Human Factors in Engineering and Design, by Mark S. Sanders and Ernest J. McCormic, Tata McGraw-Hill & McGraw-Hill International Editions.
2. Human Factors Methods: A Practical Guide for Engineering and Design by Paul M. Salmon, Neville A. Ashgate Publishing, Ltd.
3. Ergonomics at Work by David J. Osborne, John Wiley & Sons Ltd.
4. Fitting the Task to the Man – A Text Book of Occupational Ergonomics by Taylor & Francis.
5. A Guide to the Ergonomics of Manufacturing by Martin Helender, Taylor & Francis.
6. Human Factors in Product Design by William H. Cushman and Daniel J. Rosenberg, Elsevier.

IE 2.5 Elective – III
C) LOGISTICS ENGINEERING AND MANAGEMENT

Periods per week : 4
Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30
Credits : 4

Introduction to logistics

Scope and elements — Need for logistics Engineering — Related Terms and definitions.

Logistics in the design and Development phase

The design process related discipline — Design for maintainability — Design for Maintainability — Design for Human factors and safety — Design Integration — Configuration change control.

Logistics in the Production /Construction Phase

Industrial Engineering and operation analysis — quality control — production operations — Transition from Production to user operation.

Logistics in the utilization and Support Phase

Total Productive maintenance (TPM) — Data collection , Analysis and system evaluation — evaluation of Logistics support Elements.

Logistics Management

Logistics Planning — Work breakdown structure — cost estimating & controlling — Major Interfaces with other program activities — Management & Control.

Text Book:

Logistics Engineering and Management — Benjamin S. Blanchard.

IE 2.6 Elective - IV

A) ENERGY MANAGEMENT

Periods per week : 4

Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30

Credits : 4

Introduction: Energy Scenario – World and India, Energy Resource Availability in India, Energy Consumption, Energy intensive industries – an overview, Need for Energy Conservation, Role of Energy manager, Principles of Energy Management. Energy conservation Act 2003.

Instruments for Energy auditing: Instrument characteristics – sensitivity, readability, accuracy, precession, hysteresis, Error and Calibration, Measurement of Flow, Velocity, Pressure, Temperature, Speed, Lux, Humidity, Analysis of stack, Water quality, Fuel quality and Power
Energy Audit: Definition and Concepts, Types of Energy Audits – Basic Energy Concepts – Energy audit questionnaire, Data Gathering – Analytical Techniques. Energy Consultant: Need of Energy Consultant – Consultant Selection Criteria

Energy Conservation: Technologies for Energy Conservation – energy flow networks – critical assessment of energy usage – Boilers, Thermic fluid heater, Furnaces, Waste heat recovery systems, Thermal storage systems, Steam traps, Refractories, Insulation - Optimum thickness
Synthesis of alternative options and technical analysis of options, Process integration.

Economic Analysis: Scope, Characterization of an Investment Project – Types of Depreciation – Time Value of money – budget considerations, Risk Analysis.

Methods of Evaluation of Projects: Payback – Annualized Costs – Investor's Rate of return – Present worth – Internal Rate of Return – Pros and Cons of the common methods of analysis – replacement analysis.

Text Books:

1. Energy Management Hand book by W.C. Turner (Ed)
2. Management by H.Koontz and Cyrill O Donnell
3. Financial Management by S.C. Kuchhal
4. Energy Management by W.R.Murthy and G.Mc Kay
5. Hamies, Energy Auditing and Conservation. Methods and Measurements, Management and Case study, Hemisphere, Washington, 1980
6. Energy Management by Trivedi, PR, Jolka KR, Commonwealth publication, New Delhi
7. Guide book for National Certificate Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com)

REFERENCE:

1. Energy Management/W.R.Murphy, G.Mckay/Butterworths.
2. Energy Management Principles/C.B.Smith/ Pergamon Press.
3. Energy Economics/A.V.Desai/Wieley Eastern
Industrial Energy Management and Utilization/L.C. Witte, P.S. Schmidt, D.R. Brown/ Hemisphere Publication/Washingt

IE 2.6 Elective - IV
B) RELIABILITY ENGINEERING

Periods per week : 4

Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30

Credits : 4

Introduction: Concepts of quality and reliability, a brief history, terms, definitions, reliability function, MTTF, Hazard rate function, bath tub curve, conditional reliability.

Constant failure rate models: Exponential reliability, failure modes, failure modes with exponential distribution, applications, two parameter exponential distribution, Poisson process.

Time dependent failure models: Weibull distribution, burn-in screening for Weibull, three parameter Weibull distribution, Normal and Lognormal distributions

Reliability of systems: Series, parallel configurations, combined systems, k-out-of-n systems, complex configurations, common failure modes, minimal cuts and minimal paths.

State dependent systems: Markov analysis, load sharing, standby systems, degraded systems

Physical reliability models: Static models- random stress and random strength, dynamic models- periodic models, random loads.

Design for reliability: Reliability specification, Lifecycle costs, reliability allocation, design methods, failure analysis, FTA.

Reliability testing: Life testing, burn-in testing, acceptance testing-binomial acceptance testing.

Reliability growth testing: Reliability growth process, idealized growth curve, Duane growth model.

Text Book:

Introduction to Reliability and Maintenance engineering by Charles E Ebeling, Tata McGrawhill, India.

References:

Introduction to Reliability Engineering by E.E. Lewis, John Wiley & Sons, New York

Reliability based design by S.S.Rao, McGraw-Hill, New York

IE 2.6 Elective - IV
C) MATERIALS MANAGEMENT

Periods per week : 4
Examination (Theory): 3hrs.

Examination : 70 ; Sessionals : 30
Credits : 4

The role of Purchasing and materials management in the modern organization. The concept of integrated materials management. Purchasing - Basic procedures of purchasing. Specialized purchasing systems — Basic source selections procedures and related considerations in supplier selection.

Capital equipment purchases. Quality determination and control. Standardization, Simplification and Variety reduction. Make or buy analysis. Negotiation. Forward buying, speculation buying, import substitution, legal aspects of purchasing insurance buying. Buyer seller relationship, automatic and computer based systems evaluating purchasing performance.

Inventory Systems Introduction, types of inventory systems, ABC, VED and FSN analysis. Deterministic single item models with static demand. Multiple items and constraints. Quantity discounts. Stochastic single period models.

Receiving and Stores Responsibilities of receiving and stores. Receiving procedures and paper work. Codification of materials, stores systems and procedures — closed system, open system and random access storage system. Storing of materials — methods and equipment stores location and layout – Stores organization. Surplus Materials Primary sources of surplus. Organization for surplus. Disposal of surplus. Buying surplus materials.

Text Books:

1. Aijian, George, W., Purchasing Hand Book.
2. Gopalakrishnan, P. and Sundaresan, M., Materials Management — An integrated concept.
3. Johnson Lynwood, A., and Montgomery Douglass, C., Operations Research Production Planning Scheduling and Inventory Control.
4. Lee, JR, and Dobler Donald W., Purchasing and Materials Management Text and Cases.
5. Orlicky, J., Materials Requirement Planning Systems.
6. Zenz Carry, J., Purchasing and Management of Materials

IE 2.7 COMPUTER APPLICATIONS LAB

Periods per week : 3

Examination: 50 Sessionals : 50
Credits : 2

1. Data analysis: Statistical analysis of data with graphs - Linear regression - Multiple linear regression.
2. Operations research: Linear programming - Networks - Queuing.
3. Production management: Inventory - Layout/Line balancing - Forecasting - Scheduling.
4. Simulation Techniques.
5. MAT LAB

IE 1.1
M.Tech DEGREE EXAMINATION
MECHANICAL ENGINEERING
First Semester
PROBABILITY AND STATISTICS
(Effective from the Admitted Batch of 2015-2016)
MODEL PAPER

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** questions
All Questions carry equal marks

*Answer any FIVE questions.
All questions carry equal marks.*

1. a) A random variable X has the following probability function

x	0	1	2	3	4	5	6	7
$p(x)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$

Find (i) k (ii) $P(x \geq 6)$ (iii) distribution function of X (iv) Mean (v) Variance.

- b) Let X be a random variable with probability density function $f(x) = \begin{cases} \frac{1}{3}e^{-\frac{x}{3}} \sin x, & x > 0 \\ 0 & \text{, otherwise.} \end{cases}$

Find (i) Moment generating function of X (ii) $E(X)$ and $V(X)$.

2. a) Six dice are thrown 729 times. How many times do you expect at least three dice to show a five or a six?
- b) A manufacturer knows from experience that the resistance of resistors he produces is normal with mean 100 ohms and standard deviation 2 ohms. What percentage of resistors will have resistance between 98 ohms and 102 ohms?
3. a) The mean breaking strength of copper wire is 575 lbs, with a standard deviation of 8.3 lbs. How large a sample must be used in order that there will be one chance in 100 that the mean breaking strength of the sample is less than 572 lbs.
- b) What is estimation and explain the properties of a good estimator.
4. a) A manufacturer claimed that at least 95% of the equipment which he supplied to a factory conformed to specifications. An examination of a sample of 200 pieces of equipment revealed that 18 were faulty. Test his claim at 5% level of significance.
- b) 200 digits were chosen at random from a set of tables. The frequencies of the digits are shown below. Use chi-square test to assess the correctness of the hypothesis that the digits were distributed in equal number in the tables from which these were chosen.

Digit	0	1	2	3	4	5	6	7	8	9
Frequency	18	19	23	21	16	25	22	20	21	15

5. a) Explain the one way classification technique of analysis of variance.
 b) The price of a certain commodity was ascertained in each of the four towns A,B,C and D, in four quarters of a year. The prices are given below. Are the variations in prices between different towns and in different seasons significant?

Quarters	A	B	C	D
I	60	50	60	50
II	50	40	65	50
III	45	35	45	50
IV	65	45	60	70

6. Explain the components of Time series. Also fit a straight line trend by the method of least squares to the following data.

Year	1975	1976	1977	1978	1979	1980
Production (Rs. in crores)	7	10	12	14	17	24

7. a) Calculate the coefficient of correlation from the following data.

x	12	9	8	10	11	13	7
y	14	8	6	9	11	12	3

- b) Using the principle of least squares fit a curve $y = a b^x$ to the data.

X	1	2	3	4	5
y	151	100	61	50	8

8. Explain: (i) Weibull distribution
 (ii) Stochastic proces
 (iii) Partial and multiple correlation

IE 1.2
M.Tech DEGREE EXAMINATION
MECHANICAL ENGINEERING
First Semester
TOTAL QUALITY MANAGEMENT
(Effective from the Admitted Batch of 2015-2016)
MODEL PAPER

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** questions
All Questions carry equal marks

- 1 a) Explain the basic concepts of TQM
b) Explain the factors that contribute to the customer's perception on quality
- 2 a) Explain the QC tools
b) What do you mean by Quality function deployment? Explain
- 3 What do you mean by Quality circles? Discuss its role in manufacturing and service organizations
- 4 a) Explain in the steps involved in bench marking.
b) Explain the documentation procedure for ISO registration.
- 5 a) Discuss the different types of quality audits.
b) Explain briefly the various quality costs.
- 6 Explain Failure Mode Effect Analysis
- 7 Explain the following
a) POKAYOKE b) JIT
- 8 Write notes on any THREE of the following:
a) Team work b) Design for Quality
c) Kaizen d) Strategic quality planning

IE 1.3
M.Tech DEGREE EXAMINATION
MECHANICAL ENGINEERING
First Semester
MANAGEMENT PRINCIPLES AND PERSPECTIVES
(Effective from the Admitted Batch of 2015-2016)
MODEL PAPER

Time: 3 hours

Max.Marks : 70

Answer any **FIVE** questions (5x14 =70)

- 1 Explain the functions of management
- 2 a) What are ethics and how they are important from modern manager point of view
b) Discuss the merits and demerits of different organization charts
- 3 What do you mean by management skills? How does skill requirement differ at various levels of management?
- 4 a) Discuss the role of organization towards social responsibility
b) What are the basic elements of decision making?
- 5 What are the basic characteristics of formal and informal organization? How does informal organization differ from formal organization?
- 6 What are the essentials of effective control system? How will you design an effective control system?
- 7 Discuss in detail the classification of systems.
- 8 Explain in detail the objectives and constraints of system design

IE 1.4
M.Tech DEGREE EXAMINATION
MECHANICAL ENGINEERING
INDUSTRIAL ENGINEERING
FIRST SEMESTER
METHODS ENGINEERING AND WORK DESIGN
(Effective from the Admitted Batch of 2015-2016)

Time: 3 hours

Max.Marks : 70

Answer any **FIVE** questions
All Questions carry equal marks

- 1 a) How work study can help in improving the productivity?
b) What are the objectives of the work study?
- 2 How can the principles of motion economy be applied for design of workplace and design for tools and equipment? Explain
- 3 Explain in detail the Value engineering
- 4 a) How does the learning curve influence the rating? Explain.
b) What is the role of work study and its application in production?
- 5 a) Discuss various methods of job evaluation giving their advantages and limitations
b) What are incentives? How they help to raise the production?
- 6 a) Explain the procedure of O&M
b) The following data refers to a sampling study of production of one component.
Duration of data collection 5 days @ 8 hours per day
Number of operators = 10 Allowances given for the process = 15%
Production quantity in 5 days = 6000 components
Sampling data collected

Days	1	2	3	4	5
No. of observations	230	240	200	180	225
Occurrence of activity	200	190	170	150	210

Calculate standard time of production of the component if average performance rating of the operator is 120% and the entire operation is manual.
- 7 a) How ergonomics can help to improve the system performance? Explain
b) Mention the areas of application of ergonomics
- 8 Write notes on any THREE of the following
 - a) THERBLIGS
 - b) MTM
 - c) Application of work study in maintenance
 - d) Job description

IE 1.5 Elective-I
M.Tech DEGREE EXAMINATION
MECHANICAL ENGINEERING
INDUSTRIAL ENGINEERING
FIRST SEMESTER
ADVANCED OPTIMIZATION TECHNIQUES
(Effective from the Admitted Batch of 2015-2016)
MODEL PAPER

Time : 3 Hrs.

Max. Marks : 70

Answer any FIVE questions.
All questions carry equal marks.

1. a) What is arithmetic – geometric inequality?

b) Minimize the following function:

$$f(X) = \frac{1}{2}x_1^2 + x_2 + \frac{2}{3}x_1^{-1}x_2^{-1}$$

2. a) Explain the problem of Dimensionality in Dynamic programming.

b) Maximize $f(x_1, x_2) = 50x_1 + 100x_2$

Subjected to

$$10x_1 + 5x_2 \leq 2500$$

$$4x_1 + 10x_2 \leq 2000$$

$$x_1 + 1.5x_2 \leq 450$$

$$x_1 \geq 0, \quad x_2 \geq 0$$

3. Solve the following problem using Bala's method.

Minimize $f = 3x_1 + 2x_2 + x_3 + x_4$

Subjected to

$$x_2x_3 + x_4 \leq 1$$

$$2x_1 + x_2x_3 + x_4 \geq 3$$

$$x_i = 0 \text{ or } 1, \quad i = 1, 2, 3, 4.$$

4. A contractor plans to use four tractors to work on a project in a remote area. The probability of a tractor functioning for a year without a breakdown is known to be 82%. If X denotes the number of tractors operating at the end of a year, determine the probability mass and distribution function of X and also find the expected value and the standard deviation of the number of tractors operating at the end of one year.

5. Find the minimum of

$$f_1 = x_1^2 + x_2^2$$

$$f_2 = (x_1 - 2)^2 + x_2^2$$

Subject to

$$x_1 - x_2 - 1 \leq 0$$

6. a) Construct the objective function to be used in GAs for a minimization problem with mixed equality and inequality constraints.

b) Consider the following two strings denoting the vector X_1 and X_2

$X_1: \{1\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1\}$

$X_2: \{0\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 0\}$

Find the result of crossover at location 2. Also, determine the decimal value of the variable before and after crossover if each string denotes a vector of two variables.

7. a) What is a sigmoid function? How it is affected by weighted sum of inputs, explain.

b) How is a neuron modeled in neural network-based model, explain with one example.

8. Explain any Three of the following.

a) Simulated Annealing Algorithm

b) Continuous Dynamic programming

c) Branch – and - Bound method

d) Complementary Geometric programming

IE 1.6 Elective-II
M.Tech. DEGREE EXAMINATION
MECHANICAL ENGINEERING
INDUSTRIAL ENGINEERING
FIRST SEMESTER
ENGINEERING AND MANAGERIAL ECONOMICS
(Effective from the Admitted Batch of 2015-2016)
MODEL PAPER

Time: 3 hours

Max.Marks : 70

Answer any **FIVE** questions
All Questions carry equal marks

- 1 Discuss the basic tools of economic analysis
- 2 a) Distinguish between Risk and Uncertainty
b) What role does the managerial economist play in business? What are his responsibilities?
- 3 a) Enumerate the factors involved in demand forecasting.
b) State the purpose of forecasting, both short-term and long-term.
- 4 a) What is cross-elasticity of demand? Is it positive for substitutes or for complements?
b) Briefly mention different distinctions of demand
- 5 a) Explain the nature and managerial uses of production function
b) Discuss the various economies of scale. Do they result in monopolies?
- 6 a) What is meant by monopolistic competition?
b) How does a firm take its pricing and output decisions under it?
- 7 A machine costs Rs.6000. The running cost and the salvage value at the end of the is given in the table below.

Year	1	2	3	4	5	6	7
Running cost	1200	1400	1600	1800	2000	2400	3000
Salvage value	4000	2666	2000	1500	1000	600	600

If the interest rate is 10% per year, find when the machine is to be replaced.
- 8 a) Write notes on corporate tax
b) Explain various depreciation methods

IE 2.1
M.Tech.DEGREE EXAMINATION
MECHANICAL ENGINEERING
INDUSTRIAL ENGINEERING
SECOND SEMESTER
QUALITY CONTROL ENGINEERING
(Effective from the Admitted Batch of 2015-2016)
MODEL PAPER

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** questions
All Questions carry equal marks

- 1 a) What is process capability? How can it be determined?
b) 10 sub groups of each 5 were inspected. The diameter of each sub group i.e., $\sum X = 140.25$ mm ; $\sum R = 1.20$ mm. (a) determine the central line and control limits and estimate the value of σ assuming the process is in control (b) specifications on the part are 5.5 ± 0.05 mm. what proportion of the product does not meet these specifications ? Assume the distribution of measurements is approximately normal.
- 2 In a manufacturing process, the number of defectives found in the inspection of 15 lots of 400 items each are given below.

Lot No.	No. of defective	Lot No.	No. of defectives	Lot No.	No. of defective	Lot No.	No. of defectives
1	2	5	3	9	18	13	3
2	5	6	0	10	8	14	0
3	0	7	1	11	6	15	6
4	14	8	0	12	0		

- (a.) Determine the trial control limits for np chart and state whether the process is in control.
(b.) What will be new value of mean fraction defective if some obvious points outside control limits are eliminated. What will be the corresponding upper and lower control limits and examine whether the process is still in control or not.

3

The following data represents individual observations of molecular weight taken hourly from a chemical process

sample No	X	Sample No	X	sample No	X	sample No	X
1	1045	6	1008	11	1139	16	1125
2	1055	7	1050	12	1169	17	1163
3	1037	8	1087	13	1151	18	1188
4	1064	9	1125	14	1128	19	1146
5	1095	10	1146	15	1238	20	1167

The target value of the molecular weight is 1050 and process standard deviation is thought to be 25. setup a tabular CUSUM for the mean of this process. Design CUSUM to detect a shift of about 1.0 times standard deviation in the process mean.

4

Construct a Moving average control chart with $w = 5$, for the following data.

sample No	X	sample No	X	sample No	X	sample No	X
1	8.00	7	8.06	13	8.05	19	8.05
2	8.01	8	8.07	14	8.04	20	8.06
3	8.02	9	8.01	15	8.03	21	8.04
4	8.01	10	8.04	16	8.05	22	8.02
5	8.00	11	8.02	17	8.06	23	8.03
6	8.01	12	8.01	18	8.04	24	8.05

5 What do you mean by design of experiments? Explain the process of design of experiments.

6 What are orthogonal arrays? What orthogonal array is probably best choice for evaluation of 1 four level factors 5 and two level factors?

Explain the following

7 (i) DNOM control chart (ii) Group control chart

Write notes on any THREE of the following:

8

- a) Signal to Noise ratio
- b) Blocking and Confounding
- c) Taguchi's loss function
- d) 2^2 Factorial design
- e) V-mask procedure

IE 2.2
M.Tech.DEGREE EXAMINATION
MECHANICAL ENGINEERING
INDUSTRIAL ENGINEERING
SECOND SEMESTER
OPERATIONS PLANNING AND CONTROL SYSTEMS
(Effective from the Admitted Batch of 2015-2016)
MODEL PAPER

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** questions
All Questions carry equal marks

- 1 a) Differentiate between manufacturing and service sectors
b) What are the objectives of Operations Planning and Control systems?
- 2 a) Discuss the different types of production.
b) What are the steps involved in Aggregate Production Planning?
- 3 a) What is forecasting? What are the advantages and limitations of forecasting?
b) Consider the 4 jobs and 3 machines problem. Processing times (in hours) are given in the following table. Find the optimal makespan schedule

Job	:	1	2	3	4
Machine I	:	4	12	8	11
Machine II	:	5	2	10	11
Machine III	:	11	6	14	3

- 4 The annual demand of a product is 36,000 units. The average lead time is 3 weeks. The standard deviation of demand during the average lead time is 150 units/week. The cost of ordering is 500 per order. The cost of purchase of the product per unit is Rs. 15. The cost of carrying per unit per year is 20% of the purchase price. The maximum delay in lead time is 1 week and this probability of the delay is 0.3. Assume a service level of 0.95
 - a) What is the reorder level if Q system is followed?
 - b) If P system is followed, What is the maximum inventory level?
- 5 a) What do you mean by Bill of Materials? Explain
b) What are the basic inputs to MRP?
- 6 a) Explain various types of Maintenance

- b) Why is capacity planning important? Outline the steps involved in capacity planning
- 7
- a) Discuss the importance of scheduling in manufacturing organizations
 - b) What is the philosophy of JIT?
- 8
- Write notes on any THREE of the following:
- f) BPR
 - g) Computer Applications in OPCS
 - h) MPS
 - i) Project Management

IE 2.4
M.Tech. DEGREE EXAMINATION
MECHANICAL ENGINEERING
INDUSTRIAL ENGINEERING
SECOND SEMESTER
HUMAN RESOURCE DEVELOPMENT & INDUSTRIAL RELATIONS
(Effective from the Admitted Batch of 2015-2016)
MODEL PAPER

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** questions
All Questions carry equal marks

- 1 a) Define 'HRD'. State the objectives and benefits of HRD
b) Identify and discuss the managerial and operative functions of personnel management.
- 2 a) What do you understand by HRP? What is its importance?
b) Explain the qualities and the qualifications necessary for a good personnel manager.
- 3 a) Define recruitment. Bring out its purpose and importance.
b) What is selection? What is its importance?
- 4 a) Define the term 'training and development'. Bring out the importance of training and development.
b) Explain the terms 'placement' and 'induction'. Outline their objectives.
- 5 a) Define grievance and give its characteristics.
b) Define and explain the term Industrial Relations.
- 6 a) What is collective bargaining? Discuss its importance in Industrial relations.
b) What do you mean by 'strikes' and 'lock-outs'. Discuss the circumstances in which 'strikes' and 'lock-outs' are prohibited and become illegal.
- 7 a) What is an Industrial dispute? What are the causes of dispute?
b) Explain the objectives, advantages and pre requisitions of worker's participation in management.
- 8 Write notes on any THREE of the following:
 - a) Factories act
 - b) Performance appraisal method
 - c) Trade Union act
 - d) Psychological Tests

IE 2.5 Elective-III
M.Tech. DEGREE EXAMINATION
MECHANICAL ENGINEERING
INDUSTRIAL ENGINEERING
SECOND SEMESTER
MANAGEMENT INFORMATION SYSTEM
(Effective from the Admitted Batch of 2015-2016)
MODEL PAPER

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** questions
All Questions carry equal marks

- 1 a) Demonstrate how information systems can support different global business strategies.
b) What are the major challenges to the development of global systems?
- 2 How is it possible to combine features of different life cycle models into the approach for building any particular system?
- 3 a) List and briefly describe the major types of systems in organization.
b) What are the characteristics of DSS? How do they differ from those of ESS?
- 4 a) Why is a database generally a feature of an MIS?
b) Describe the main methods for controlling transaction processing.
- 5 Based on the Nolan stage theory, why can't an organization just skip over the first two stages?
- 6 a) Define the term data base. Name the basic components of data base application
b) Explain the difference between data processing and information processing
- 7 a) What are the characteristics of MIS?
b) What is the role of data flow diagrams in process modeling?
- 8 a) How is using a prototype different from using a traditional system life cycle?
b) What do you mean by Data Dictionary? Discuss

IE 2.6 Elective- IV
M.Tech DEGREE EXAMINATION
MECHANICAL ENGINEERING
INDUSTRIAL ENGINEERING
SECOND SEMESTER
Reliability Engineering
(Effective from the Admitted Batch of 2015-2016)
MODEL PAPER

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** questions
All Questions carry equal marks

1. (a) Derive the fundamental equation for reliability in terms of hazard rate function. (6)

(b) The reliability of a turbine blade can be represented by the following:

$$R(t) = \left(1 - \frac{t}{t_o}\right)^2 \quad 0 \leq t \leq t_o$$

where t_o is the maximum life of the blade.

- (i) Compute the MTTF as a function of maximum life.
(ii) If the maximum life is 2000 operating hours, what is the design life for a reliability of 0.90. (8)

2. (a) What do you understand by memorylessness? Show that a CFR model has this property. (7)

(b) A hydraulic system is comprised of five components having following constant failure rates (times are in days):

$$\lambda_1 = 0.001, \quad \lambda_2 = 0.005, \quad \lambda_3 = 0.0007, \quad \lambda_4 = 0.0025, \quad \text{and} \quad \lambda_5 = 0.00001$$

- (i) Find system MTTF and standard deviation
(ii) Find the system design life if a 0.99 reliability is desired. (7)

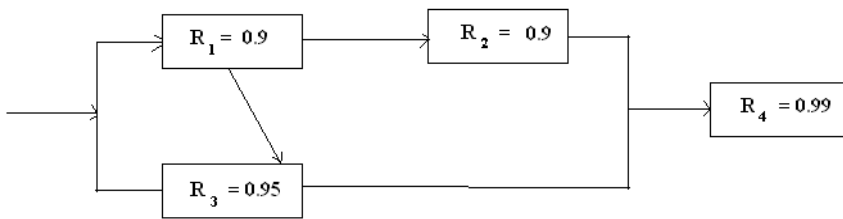
3. (a) Explain the suitability of log-normal distribution in reliability modeling. (6)

(b) A cutting tool wears out with time to failure that is normally distributed with a mean of 10 working days and a standard deviation of 2.5 days.

- (i) Determine its design life for a reliability of 0.99.
(ii) Determine the probability that the cutting tool will last one more day given it has been in use for 5 days. (8)

4. (a) Write short notes on k-out-of-n redundancy. (6)

(b) Determine the reliability of the following linked system using the decomposition method. (8)



5. (a) How do you model the static reliability for random stress and random strength case. (6)

(b) The strength of a concrete structure designed to support a fixed load of 464 N has the following probability density function:

$$f_y(y) = \frac{3}{10^9} y^2 \quad 0 \leq y \leq 1000N$$

(i) Compute the static reliability.

(ii) If the load is also random having the probability density given below, find the static reliability. (8)

$$f_x(x) = 2(0.001 - 0.000001x) \quad 0 \leq x \leq 1000N$$

6. (a) Discuss the AGREE method of reliability allocation. (6)

(b) Discuss different design methods used to incorporate reliability into a product.

(8)

7. (a) Explain the concept of accelerated life testing with examples. (6)

(b) Estimate the AMSAA parameters from the following failures times:

3, 15, 35, 58, 113, 187, 225, 465, 732, 1123, 1587, 2166, 5423, 8423 and 12035. (8)

8. Write short notes on any TWO of the following:

(a) Fault tree analysis

(b) Life-cycle costs

(c) Three parameter Weibull distribution.

IE 2.6 Elective-III
M.Tech. DEGREE EXAMINATION
MECHANICAL ENGINEERING
INDUSTRIAL ENGINEERING
SECOND SEMESTER
ENERGY MANAGEMENT
(Effective from the Admitted Batch of 2015-2016)
MODEL PAPER

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** questions
All Questions carry equal marks

- 1 a) Briefly discuss the Indian energy scenario and what is the need to integrate renewable and non renewable energy sources.
b) What are energy intensive industries and why there is a need for energy conservation, Discuss in brief?
- 2 a) Explain in detail, the desirable characteristics of any measuring instrument used in industry. Define types of error and how error can influence the measured value in any measuring instrument
b) instrument

What are different types of temperature measurement devices and what are their relative advantages and disadvantages
- 3 a) Describe the construction and working of stack analyser with a simple sketch and its limitations
b) limitations

What are the methodologies adopted in energy auditing, explain them in detail
- 4 a) What is an energy cell and why there is a need for an energy consultant - justify
b) A boiler is found to be inefficient and yielding only 60% efficiency, what are the avenues you will look into to improve its efficiency
- 5 a) What are thermal storage systems and how can they aid in energy conservation in an industry
b) industry
- 6 a) The surface of a furnace wall is found to be with a layer of 5 cm refractory brick ($k=2$ W/mK) and is to be placed between 4 mm thick steel ($k=40$ W/mK) plates. Both faces of the brick adjacent to the plates have rough solid to solid contact over 20% area, where the average height of asperities are 1mm. The outer surface temperature of steel plates are 400°C and 100°C respectively. Find the rate of heat flow per unit area and assume the cavity area is filled with air ($k=0.02$ W/mK)
b) furnace was found to be inefficient, What measures have to be taken to resolve the issue.
- 7 a) What is the importance of NPV and how does it help in financial decision making.
b) What is payback period and briefly explain importance of payback period for any retrofitting

8

Write short notes on

- a) Energy conservation act 2003
- b) Process integration
- c) Consultant selection criteria
