V. SYLLABUS

5.1. PRELIMINARY

IE 001 : BUSINESS COMMUNICATION

A. Essay : Descriptive type on themes such as scene, recollections, visits to factories and places, working of simple machines, instruments and apparatus, events of national significance.

B. Letter writing : Simple business correspondence dealing with aspects such as purchases, sales, credit, collection.

C. Precis : Passages for précis writing will be chosen from publications covering problems of industry, economic and technological developments.

D. Report Writing and Presentation: Covering situations in factory and day-to-day life. Substance of Reports-Categories of Reports, Preparing of Synopsis for approval Formats, Copy Ready, Proof Reading.

Text

1. Basic Business Communication, Lesikar, Flatley, TMH-2005
2. The principles and practice of Technical Reporting T.K.Chatterjee; Kitab Ghar
3. Business correspondence and Report writing Sharma R.C. and Krishna; Tata Mc Graw Hill
4. Result-Oriented Letter Writing- Shah G.P.; Shilgunj Prakashan, Baroda

IE 002 : ELEMENTS OF INDUSTRIAL ENGINEERING

A. Introduction: Resources for Business, Goals of business, Types of waste like information, motion, man, equipments, money, energy, etc, Need of optimization of resources.

B. Industrial Engineering: Evolution of Industrial Engineering, Industrial Engineering Functions, Role of Industrial Engineer, Qualities of successful Industrial Engineer.

C. Productivity: Concept of Production, Types of Production, Concept of Productivity, Types of Productivity, Production vs Productivity, factors influencing Productivity, Maslow's Theory of hierarchy of needs, Productivity vs Standard of Living.

D. Introduction to Work Study: Definition of Work Study, Work content, Definition of Method Study, Procedure of Method Study, Advantages and Limitations, Definition of Work Measurement, Techniques of Work Measurement (brief introduction only) like Work Sampling, Time Study, PMTS.

E. Ergonomics: Concept and history, importance, Principles of ergonomics, Areas of concern, Anthropometry

F. Operations: PPC, Layout, Maintenance, Value Analysis and Quality: Concept and functions.

G. Advances in Industrial Engineering: Concurrent Engineering, Design for Manufacturability and Assembly, Just in Time, Flexible Manufacturing Systems, Value Stream Mapping, Reengineering, Supply Chain Logistics

Text

1. Introduction to Work Study by ILO
2. Mahajan .M. “Industrial Engineering and Production Management”, Dhanpat Rai & sons, Delhi-2008.
3. Sharma S. K and Sharma Savitha “Work study and Ergonomics”, S.K Kataria & Sons Delhi -2007
4. Jhamb L.C., "Work Study & Ergonomics", Everest Publishing House, Pune.
5. Sheth Vijay, "Industrial Engineering Methods and Practices, Penram International Publishing (India) Pvt. Ltd.
6. Industrial Engineering and Management- O.P Khanna

Reference

1. Industrial Engineering Handbook, Maynard
2. Time & Motion Study, Ralph.M. Barnes

IE 003 : MATHEMATICS FOR ENGINEERS

A. i) Calculus, ii) Functions, derivatives and their applications, iii) Integration; applications of definite integrals, iv) Transcendental functions, v) Integration Methods

B. Analytical geometry Plane analytic geometry; hyperbolic functions; polar coordinates.

C. Multiple integrals; Laplace transforms, Application of Laplace Transforms, Fourier series.

D. Vector analysis.

E. Linear algebra; Matrices and Determinants.

Text

Calculus and Analytic Geometry- Thomas, G.B.and Finney R.L.Narosa Publ.House.

Reference

Advanced Engineering Mathematics- Kreyszig. E: John wiley.

Advanced Engineering Mathematics- Kreyszig, E: New Age Publish.

IE 004: COMPUTERS AND INFORMATION TECHNOLOGY

A. Computer Systems- Types, CPU- Memory input and Output devices, data storage devices, Printing devices.

B. Information technology- Introduction, Applications, The Internet & worldwide web

C. Software- User interface and operating systems- types, file management, word processing and Desktop publishing, spread sheet applications, database applications.

D. Programs- Programming languages, programming methods, programming techniques, system analysis and design.

E. Functions of modern networks-local area network, wide area networks, network applications voice and information services, person to person and group communications, exchanging files.

F. **IT in Business** -Information processing, transaction processing, computer for management control, management information systems, computer for design, manufacturing and production, Recent developments in IT, e-governance, applications etc.

Text

1. Computer data processing- Gardan Davis, Mcgraw Hill
2. Fundamentals of data base system-R. Elamsqri, S.M Navathi, Pearson 2006
3. Principles of computer programming-V. Rajaraman, Prentice Hall
4. Information Technology- The Breaking Wave- Tata Mcgraw Hill

IE 005 : ENGINEERING DRAWING AND COMPUTER GRAPHICS

A. **Geometrical Drawing**: Geometrical constructions and plane curves such as a parabola, ellipse, hyperbola, cycloid: Projections of points, Lines and planes placed in one/two planes: Projections of solids such as prism, cylinder: Sections and intersections of solids: Orthographic projections in first and third angles, isometric and oblique projections.

B. **Machine Drawing:** Unit assembly and detail drawing of simple engineering products having bearings, shafts, couplings, Keys, pulleys, Caps, Seals, fasteners such as screws, nuts, circlips, locking system, gears, pipes and joints, valves, jigs and fixtures, use of S Conventions for drawing practice and for specification of limits and fits.

C. **Computer Graphics**: Use of computer in drafting, input - output devices, parametric, dimension driven, constraint driven drafting: Use of libraries of components, Documentation management, standard packages.

D. **3-D Modeling:** Solid modeling Modeling approaches - Co-ordinate system - Basic Features Viewing / Visualization Introduction to Computer Aided Drafting and Analysis using software FEM Analysis Introduction to CAD / CAM Applications.

Text

1. Engineering Drawing and Graphics K.Venugopal, Wiley Eastern
2. Machine Drawing N.D.Bhatt and V M Panchal: Charotar Publ House, Anand.
3. Computer Graphics and Design Radhakrishna P and Kothandaraman C P Dhanpat Rai and Sons, New Delhi
4. P N Rao: CAD / CAM Principles and Applications, Tata McGraw Hill

Reference

1. Vera B Anand: Computer Graphics and Geometric Modeling for Engineers John Wiley and sons
2. Guide for Selection of Fits : IS:2079:Bureau of Indian Standards

IE 006 : MATERIALS SCIENCE

1. Crystal structures: Space lattice, Unit cell, crystal systems; Miller indices, Crystal defects, Allotropy.

2. Properties and testing of materials: Property spectrum, Factors affecting mechanical properties, factors considered for selection of materials, mechanical properties (Hardness, Strength, Ductility, Malleability, Toughness. Resilience, Creep, Fatigue etc.) technological properties (Castability, Machinability, Weldability)
3. Metallic Materials : Cast iron, Steels, non-ferrous metals and Alloys, Types, Composition, Properties and uses of above materials.
4. Non-Metallic materials: Plastic, Rubber Refractories, Ceramics, Abrasives, Glass, Adhesives, Composites and Insulating materials. Processing methods and application, Injection Molding, Extrusion, Calendering and Thermo-forming.
5. Heat treatment : Iron carbon system. TTT Diagram, Effect of carbon on properties, Principle, Process and Application of various heat treatments such as annealing, normalizing, hardening, tempering, nitriding, defects in heat treatment.
6. Non-destructive testing : Importance, Radiographic testing, Ultrasonic testing and Crack detection methods.
7. Powder metallurgy: Principles, Process, Advantages, Limitations and Applications.

Text

1. Materials Science and Engineering- V. Raghavan, Prentice Hall India, 1991
2. Frontiers in materials Science Aurther L.E.Murr, Charlestein : Marcel Dekkar Publications.
3. Material Science Anderson, J.C.K.D. Leaner, R.D.Rowling; J.M.Alexander, Chapman and Hall.

5.2 SECTION A

IEA 01 : PROBABILITY AND STATISTICAL METHODS

A. **Statistics in Engineering**, Treatment of data, Probability- sample space, Events, Baye's theorem, expectations, Variance, Distributions-Discrete, Binomial, Poisson, Geometric continuous, Exponential, Normal, Central limit theorem, Sampling distribution, Inferences concerning , Means/ Variances.

B. **Curve fitting**, Correlation analysis, applications, analysis of varience, design of experiments.

C. **Overview of statistical package :** SPSS

D. **Testing Hypothesis:** One sample test - introduction, concept basic to the hypothesis-testing procedures. Hypothesis testing of means when the population standard deviation is known and not known. Two sample test- Hypothesis testing for the difference between means & proportions, tests for difference between means.

E. **Chi- square test and analysis of varience:** Introduction, chi- square as a test of independence, chi-square as a test of goodness of fit, testing the appropriateness of a distribution, analysis of varience, inference about population varience.

F. **Regression analysis**: Review of concept of simple regressions and correletion with the help of simple examples the standard errors estimate, shot cut method to calculate standard errors estimate.

G. Time series methods and forecasting: Introduction, Variation in time series, trend analysis, cyclical variation, seasonal variation, irregular variation, time series analysis in forecasting.

Text

1. Statistics for Management: R.I Levis & D.S Rubin, Prentice Hall India.
2. Probability and statistics for Engineers- Miller I.R, Freud O.E and Jhonson .R Fu Prentice hall India.
3. Theory and problem of probability and statistics. M.R Spiegal Mcgraw Hill, Fundamentals of data base system
4. Probability & Statistics for engineers Hines and Douglas.C. Montogomery, Prentice Hall Publication.

Reference

1. Quantitative analysis for management applications (block 1 to 5) (Books for MS 8 course) IGNOU New Delhi.
2. Product Feature information for the statistical packages available on the web.

IEA 02 : OPERATIONS RESEARCH

A. Introduction to O.R.

The role of Operations Research in problem solving and productivity management Evolution of O.R.; Principles of modeling; Scope of O.R.,

B. Elementary Mathematics

Matrices : Matrix manipulations; solutions of linear equations; Convex sets, Euclidean space.

C. Linear Programming and its Extensions

Linear programming model and formulation exercises; Graphical representations, Simplex methods and Applications; Sensitivity analysis; Transportation Problem stepping stone method, Assignment problem-Hungarian method; Trans shipment problem.

D. Game Theory and Decision Theory

Two person Zero-Sun games; Pure and mixed strategy optima; Saddle points; Solution by linear Programming method.

Decisions under risk & uncertainty with relevant criteria in each case: Decision trees;

E. Waiting Line Models

Basic structure of Queueing Models: Distribution of arrival and service times; Steady State behavior of M/M/1 and M/M/C queues with limited/unlimited waiting space.

F. Simulation

Elements of Discrete Event Simulation; Simulation models and languages; (generation and testing of random numbers with uniform and general distributions: design of simulation experiments; applications; in production operations management problems. Overview of OR Packages.

Text

Operations Research : An introduction-Taha H.A.; Prentice Hall India Ltd.,1995

Reference

1. Introduction to Operations Research, - P.G.Hillier and G.Lieberman: TMH
2. Operations Research- A. Ravindran, D.T Phillips and J.J.Solbers.: John Wiley
3. Operations Research: An introduction- H.A.Maxwell, Macmillan International Editions.
4. Quantitative Techniques for Managerial Decisions- Srivastave, Shenoy and Sharma; Wiley Eastern Ltd.
5. Operations Research (1 to 6 Blocks)- (Booksfor MS 51 course); IGNOU, New Delhi
6. Quantitative Techniques by Saha, Shenoy and Srivastava.

IEA 03 : FINANCIAL ACCOUNTING AND COSTING

PART I : Financial Accounting

1. The accounting world the nature and purpose of accounting branches of accounting the accounting profession--how accounting provides tools and data required for engineering analysis
2. Financial accounting -- nature and functions users of financial accounting information -- fundamental accounting concepts the operation of the double entry system of recording accounting transactions completion of the accounting cycle --the accrual convention-- the asset expense controversy recognition of revenue --preparation and presentation of the basic financial statements (profit and loss account, balance sheet, cash flow statements) – concept of Generally Accepted Accounting Principles (GAAP) introduction to International Financial Reporting Standards (IFRS), Green Accounting
3. Accounting for fixed assets and depreciation
4. Accounting treatment of current assets inventories, receivables (debtors) and cash
5. Analysis and interpretation of financial statements analysis of liquidity, solvency and profitability-- tools and techniques of analysis

PART II : COST AND MANAGEMENT ACCOUNTING

1. Basic cost accounting procedures various cost concepts cost classifications cost accumulation
2. Cost determination systems product costs vs service costs process cost accounting, job and contract costing costing and pricing
3. Cost behavior and break even analysis, the problem of fixed costs break even formula limiting factors
4. Recent developments in cost accounting-- activity based costing --. target costing, life cycle costing, balanced score card
5. Budgetary control and standard costing budget procedures functional budgets master budget variance analysis
6. Capital investment appraisal project selections sources of funds and choices of financing

Recommended books

1. Accounting for Non-Accounting Students, J R Dyson, ***Pitman***
2. *Financial Accounting Tools for Business Decision Making*, Kimmel, Weygandt & Kieso's ***John Wiley & Sons, Inc., 2009.***
3. Introduction to Accounting for Business Studies, F. P. Langley, ***Butterworths***
4. Accounting, Meigs and Meigs, ***McGraw Hill***

IEA 04 : PRINCIPLES AND PRACTICES OF MANAGEMENT

A. Evolution of scientific management - Principles and functions of scientific management-Elements of management functions-Planning, Organising, staffing, directing, motivating, co-coordinating and controlling-levels and skills of management.

B. Organizational structures - Line, Staff, project and matrix organization, system concept of management, Authority, Responsibility and span of control.

C. Organizational culture - managerial ethics, corporate social responsibility, management of change.

D. Formation of companies - proprietary, partnership including LLP, and joint stock companies-private limited, public limited companies, co-operative organizations and public sector organizations.

E. Operations management Elements of Manufacturing systems, production planning and control, flexible manufacturing.

F. Human Resource Management - objectives and functions-recruitment selection-orientation and training-industrial safety and industrial Relations.

G. Marketing management-objectives and functions, forecasting of demand, Marketing concepts-Marketing environment, Market segmentation, marketing mix, product cycle.

H. Project Management-concepts and use of PERT and CPM, Cost as a function of time Determination of least cost duration, post project evaluation.

Text

1. Principles and Practices of management-T.N Chakra, Dhanpat Rai publications
2. Industrial engineering and management OP Khanna
3. Essentials of Management - H. Koontj H. Weibrich - Tata Mcgraw Hill.

Reference

1. Management, Robbins, Pearson Education
2. Management, Samuel Certo, Pearson Education

IEA 05 : WORK SYSTEMS DESIGN

A. Concept & need of productivity at operator level in any activity- Inputs- Process Output relationship, Work Study approach in improving Productivity; Factors affecting productivity. Necessity of standard method; good working condition and measuring work content.

B. Method Study Definition, scope and application of method study as a logical approach to problem solving in a wide range of activities; Basic procedure Select, record, Analyze and Examine, Develop New Method, Install, Maintain Report to management presentation, discussion: installation; Maintaining.

C. Work Measurement- Aims and objectives of work measurement, definitions of terms, tools, techniques. Manual work content estimation using May hard operation sequence Technique (MOST)

a) Stopwatch study: i) Equipments used, procedure for conducting a study. ii) Recording data-forms, timing methods, timing aids iii) Rating Concept scales, methods; Allowances-Concept, types and calculations; Standard time, standard production; Comments on stop-watch study.

b) Activity Sampling Definition, objectives scope of application, Statistical aspect sampling, confidence level, accuracy, number of observations, use for determination of standard time, idle time, standard production.

c) Production study definition. Scope of application, procedure, limitations; Predetermined Time Standard systems- i) Background of PTS ii) Detailed study of MTM-1

d) Job evaluation, Incentive system design, Theory of learning curve.

e) Ergonomics- Definitions and scope of ergonomics. Need of 'Fit the job Operator: Anthropometry-Definition and applications in work study; Environment Factors-noise, light heat vibration, humidity their sources, effect on human body, effect on productivity and corrective actions. Place of Ergonomics in work study and their interdependence.

Text

Introduction to Work study- Editor: George Kannawafy, Universal Publ.Co, Mumbai (ILO)

Motion & time study-Bames, R.M., John Wiley

Reference

1) Ergonomics, Murrd KFW Champan dltall

2) Human factors in Engineering and Design- Mc Carnick (TMH)

IEA 06 : MANUFACTURING TECHNOLOGY

A. Metal Casting

Patterns-materials allowances; Core-materials and making- Sand Preparation and mould making; Melting, Pouring, Feeding and solidification; Shell Moldings, Investment Casting Centrifugal Casting, Die Casting; Design of gating of gating and rising; Casting defects and inspections.

B. Metal Joining

Soldering, Brazing and Welding, Welding Processes-Gas, Shielded Metal Arc. TIG, MIG Submerged Arc, Electroslag, Thermite. Resistance, Pressure and Forged welding; Design of welded joints: Defects and inspections.

C. Metal Working

Stress-Strain in elastic and plastic deformation, Deformation mechanism; Hot and Cold Working-Forging, Rolling, Extrusion, Wiredrawing. High Energy rate Forming, Coining, Spinning Sheet Metal Working-Shearing, Punching, Blanking, Bending, Deep Drawing; Analysis of metal working processes, Types of Presses and press tool design.

D. Machining and Machine Tool Operations

Tool Materials, Geometry of Cutting Tools, Mechanics of Turning, Merchant's analysis, Tools wear and Tool life- Boring, Milling, Shaping, Planning, Slotting, Sawing, Broaching, Gear Generation methods: Finishing Processes-Grinding, Lapping, Super finishing; Nontraditional machining Processes- EUM, ECM, USM. LBM, EBM, AJM, PAM and Water Jet Machining: Selection of cutting parameters; Time of machining.

E. Metrology and Inspection

Limits, Fits and Tolerance, Surface finish; Angular Measurements by Mechanical and, Optical Methods; Comparators Mechanical, Electrical, Pneumatic; Gauge Design; Measurement of Screw threads and Gears: Alignment Testing.

F. Tools Engineering

Principles of Work holding-Location and Clamping; Jigs and Fixtures Design.

G. Computer Integrated Manufacturing

Basic concepts of NC, CNC and DNC, Simple CNC Programming: FMS, CAD, CAM, Group Technology, CAPP; Robitics Manipulator Geometry; Drivers/Control, Grippers and their Industrial Applications, CIM.

Text

1. Processes and Materials of manufacture- Lindberg; Prentice Hall of India, 1994.
2. Manufacturing Technology-Foundry, Forging and Welding- P.M.Rao; Tata Mc Graw Hill, New Delhi, 1995
3. Robotics Technology and Flexible Automation- S.R.Deb, Tata McGraw Hill, New Delhi, 1996

Reference

1. Element of Workshop Technology Vol I and II, S K Hajrs Choudhury, et al-Media Promoters and Publishers Pvt.Ltd.2004
2. Foundry Engineering- P.L. Jain
3. Manufacturing Technology- R.N.Rao
4. Fundamentals of Tools Design ASTME
5. Tools Design- Donaldson
6. Jigs & Fixtures P.H. Joshi
7. Production Engineering- R.C.Sharma; S.Chand & Co.
8. Materials and Processes in Manufacturing- E. Paul De Garma, J.Temple Black, Ronald A.Kotiser; Macmillan Publishing Co.

9. Manufacturing Processes- Begerman: John Wiley and Sons
10. Manufacturing Service and Technology Suresh Dalela, Vol.I, II & III; Umesh Publications Delhi.

IEA 07 : SYSTEMS APPROACH

A. Origin and evolution of System science
B. Open and closed Systems
C. Hard & soft systems, Systems and complexity
D. Systems view of management and organizations
E. Cybernetic view of management, and organization theory
F. Social- Technical Systems approach;
G. Systems approach to organizational problem solving

Text

1. Management information System-W S Jawadekar- TMH
2. Management information System- S Sadagopan- PHI
3. Systems Methodology in Practice- Chekland P; Wiley
4. Diagnosing the system for organization- Beer S; Wiley
5. Applied General Systems Theory- Van Gich; Wiley

Reference

1. Management Information Systems- J Obrien- TMH 2004
2. Systematics- A new approach to system analysis; PRI Books, New York, 1975
3. Management Planning and System Approach, Enrick N.L; TMH 1977
4. Project management, A System approach, Kerzner, H; Van Nostrand Reinhold, 1979
5. System Approach to Air Pollution Control- Bibbero R.J.; John Wiley, 1974
6. System Dynamic, a practical approach for managerial problems, Sushil; Wiley Eastern, 1993
7. Textbook of Industrial Engg.& Management System Suresh Daleia Standard Pub.1980
8. Industrial Engg. & Management Systems Suresh Daleia, 6th edition 2000; Standard Publishers
9. Management of Systems (3rd edition- 1999) Chauhan, Vaishavanan, Keswani; Jain Brothers, New Delhi.

IEA 08 : ECONOMICS AND INDIAN ECONOMIC ENVIRONMENT

A. Economics (Micro and Macro)

1. General concepts of Economics-Need hierarchy, wants, Production & consumption; Value, Price income and Wealth.
2. Concept of utility and Value; Law of diminishing marginal utility.
3. Demand and supply-Determination of demand, Law of demand, Demand curve and Analysis, Elasticity of demand and its measurement.

4. Market Categories-Perfect competition, Oligopoly, Monopoly, Molopolistic competition, Price equilibrium,
5. Macro Economics-Income determination, Consumption, Saving and Investment functions.
6. Employment-Full, Partial, under employment, Unemployment and its effect on economic stability.

B. Indian Economic Environment

1. Meaning of Economic Development; Various indicators of development; process of growth.
2. Basic features of Indian Economy: Natural resources of India; National level planning, Five year plans; Effect of population on economic growth.
3. Agricultural and Co-operative sector-Concept of Agriculture inputs and productivity; Co-operative movement and its impact on Agriculture and Agrobased industries.
4. Industrial Development, Public sector, Private sector; Large scale, Small and Medium scale industries and their characteristics.
5. Infrastructure in India- Transport, Communication, Power etc; Government policies, change in government policies, their impact on the economy

Text

1. Introduction to Economic Theory-NCERT; New Delhi
2. Indian Economy-Ruddar Datt and K.P.N.Sundharan; S Chand & Co.
3. Indian Economy S.K.Mishra and V.K.Puri, Himalaya Publications

Reference

1. Economic PA.- Samuelson and W.D.Nordhaus; Tata McGraw Hill Publishing Co.Ltd.
2. Indian Economy-A.N.Agrawal; Wishwa Publication, 1999
3. Centre for Monitoring Indian Economy- (CMIE) Publication (Recent edition)
4. Economics & Social Environment (Block 1 to 5) (Books for MS3 course); IGNOU, New Delhi.

5.2 SECTION-B (COMPULSORY SUBJECTS)

IEB 01 : FACILITIES PLANNING AND MANAGEMENT

A. Plant Location: Selection of site-factors to be considered-plant layout-process-group layout-layout planning-computerized planning techniques.

B. Plant Layout: Objectives, Topologies, Advantages & Disadvantages of each type. Plant Services- Capacity estimation, Plant Safety-Elements of Safety Engineering, Material Handling-Systems and equipments; Stores / Warehouses, Receiving / Despatch, Production flow systems.

C. Objectives in Location and Layout of Facilities : Planning for production flow systems -Activity relationships, Personnel and organizational factors; Developing

alternatives of layout for facilities for particular functions - Manufacturing, receiving and shipping, Storage and warehousing systems; Principles of factory layout; Quantitative and computer aided approaches to facilities layout. Environment aspects lighting, Ventilation, Dust control and Humidity. Plant services Steam, Compressed air ;

D. **Interaction of layout and flow system** - Design philosophies; Analysis of different types of assembly lines; Flexibility in assembly lines and flow lines; Automation and computer aids in warehousing operations.

E. **Location of multiple facilities**; Expansion of facilities; Strategic considerations and current trends, Group Technology- Production Flow Analysis (PFA) Rank Order Clustering (ROC), Line Balancing etc.

F. **Equipments Replacement -** Repair, Replacement based on technical and economic considerations, Use of DCF techniques.

Text

1. Plant layout and Materials handling - Apple J.M.; Wiley
2. Facilities Layout and Location - Francis R. L. and White J. A.; Prentice Hall

Reference

1. Making Equipment - Replacement Decisions- Hackamack Lawrence; American Management Association, N.Y. (1996).
2. Locational Analysis for Manufacturing - Karaska Gerald J. and D.F. Bramball; M.I.T.Press Cambridge Mass. (1969)
3. Computerized Layout : An Integrated Approach to Special Planning and Communication- Jacobs F., Robert, John Bradford and Larr P. Ritzman; Industrial Engineering (July 1980)
4. Facilities Management. Towards best practices -Ed. Peter Barrett; Blackwell Science (1998).

IEB 02 : SUPPLY CHAIN AND LOGISTICS MANAGEMENT

A. **Over View** of Supply Chain and Supply Chain Management.

B. **Materials Management:** Scope, importance, Classification of materials, Procurement, Purchasing Policies, Vendor development & evaluation, Inventory Control, EOQ and its derivative models.

C. **Frame work to analyze supply chains**: Understanding the supply chain, Supply Chain Performance and Profitability, Drivers of Supply Chain Performance - Inventory, Transportation, Facilities, and Information.

D. **Transportation and Logistics in a Supply Chain**: Role of Transportation in Supply Chain, Factors Affecting Transportation Decisions, Modes of Transportation and their Performance Characteristics, Design Options for Transportation Network, Multimodal Transportation.

E. **Facility Decisions-**Network Design in a Supply Chain : Role of Facility Decisions,

Factors Influencing Network Design Decisions, Frame Work for Network Design Decisions, Models for Facility / Warehouse locations and Capacity Allocation.

F. **Information Technology in a Supply Chain** : Role, Importance, and use of IT in a Supply Chain, Role and Impact of E-Business in a Supply Chain.

Text

1. Designing and Management of Supply Chain David Simchi Levi, Philip Kaminsky & Edith Simchi Levi TMH
2. Logistics and Supply Chain Management M Christopher Pearson Edn

Reference

1. Supply Chain Management - Strategy, Planning, and Operation - Sunil Chopra, Peter Meindl, Pearson Education Asia .
2. Materials Management and Purchasing - P. Gopalakrishnan, Tata McGraw Hill

IEB 03 : PRODUCTION AND OPERATIONS MANAGEMENT

A. Typology of Production systems & their characteristic features; Role of operations planning and control, Analysis for operations management systems.

B. Demand Forecasting (Moving Average & Exponential Smoothing and other statistical Methods)

C. Aggregate Planning, Desegregation & Master Production Scheduling; Capacity Requirement Planning.

D. Theory of Scheduling: Flow Shop & Job Shop in n/1, n/2 and n/m situations.

E. Project Planning and Control Techniques.

F. Elements of Cellular manufacturing systems, Just-in-time systems.

G. Introduction to Flexible manufacturing systems.

H. Information Analysis for Operations Management systems; Production Control & reporting; Performance evaluation.

Text

1. Operations Management- Mcclain J.O. and Thomas L.J.; Prentice Hall India, 1985
2. Production and Operations Management- N.G.Nair; Tata Mc Graw Hill, 1996.
3. CAD/CAM/CIM/- Radhakrishnan P and Subramanyan, S; Wiley Eastern, 1994.

Reference

1. OM Process and value Chains- L Krajewski, L P Ritzman- PHI 2005
2. Production/Operations Management (Block 1 to 6) (Books for MS-53 course) IGNOU, New Delhi
3. Operation Management- B.Mahadevan (Pearson)
4. Operation Management ES Buffar
5. Operation Management Monks JG

IEB 04 : TOTAL QUALITY MANAGEMENT

A. **Evolution of Quality**: Basic concepts, Policies and Objectives, Strategic planning for Quality and Competitiveness, Organization of Quality. Major contributions of Deming, Juran and Cross by to Quality Management. Juran trilogy, PDCA Cycle, 5S, Kaizen.

B. **TQM Principles**: Customer relation and customer satisfaction: Customer perception of Quality: Customer complaints and redressal: Product satisfaction index.

C. **Cost of Quality (COQ)** : Prevention, appraisal and failure aspects of cost of quality: Planning for Investment; Return on investment: Quality cost data acquisition; Performance indices, Use of COQ for improving quality and performance.

D. **Designing for Quality**: Quality of design and Quality of conformance; Selection of tolerance; Design reviews, Failure mode and fault free analysis; Evaluating design by test, reliability, availability, maintainability and safety in design.

E. **Quality of Conformance**: Manufacturing planning process design, tractability, process control flow charts, use of statistical tools, process capability; Inspection planning, self inspection operators, knowledge of "supposed to do" and "is doing".

F. **Quality Improvement**: Management controllable defects, Operator controllable defects, sporadic and chronic problems of Quality; Breakthrough sequence, Problem solving process and problem solving tools-Brain Storming, Check sheets, Pareto Diagram, Ishikawa Diagram, Control Charts, Continuous Improvement Strategies Deming Wheel, Zero defect concept, Six Sigma approach, Quality Circles.

G. **Vendor Relations** : Vendor assessment; Vendor development: Quality of bought- out components, managing Vendor Quality: Monitoring of Vendor Performance: Vendor appraisal, Vendor certification; Vendor Relationship.

H. **Quality Information Systems** : Purpose and objectives of Quality information, acquisition and storage, processing data presentation and documentation.

I. **Quality Standards** : Need for Standardization ISO 9000 series, ISO 14000 series, Other Contemporary standards.

Text

1. TQM-DH Besterfield et al Pearson Edn.
2. Quality Planning and Analysis - J.M.Juran, and F.M. Gryna; Tata McGraw Hill
3. Total Quality Control - Feigenbaum; Mcgraw Hill.
4. Total Quality Management, Ashok Rao,, John Wiley.

Reference

1. Structural Quality Control, Seventh Edition, - Grant Eugene, Heaven worth; McGraw Hill Pub.
2. 3rd edition, Quality Planning and Analysis, - Juran J.M., Gryna Jr. Fran. M. McGraw Hill Pub., 1993.
3. Quality Customers Needs, Customer Satisfaction, - Bergman B.O. and Klefsfo, McGraw Hill Pub., 1994.
4. Total Quality Control Reward, - Feignbaum A.V. McGraw Hill Pub., 1991.

5.4 SECTION-B (ELECTIVE SUBJECTS)

FOUR SUBJECTS ARE TO BE CHOSEN, ONE FROM EACH GROUP

GROUP I

IEE 01 : INNOVATION AND VALUE ENGINEERING

A. Brief over view of evolution of Human and other forms of life, Innovation as a built-in feature in nature; Need and challenges for survival and excellence, Biological, Physiological, Psychological and Social Motives, Entrepreneurial and business aspects.

B. Agricultural, Industrial and information revolution, innovations in diverse fields of arts and science, Major Landmarks, Contributors in Scientific, Industrial and Social (leadership) spheres.

C. Innovations in products, processes, services and procedures- product life cycles, favorable and unfavorable aspects in innovation; Human attitudes, risks, hardships, examples of failure, case studies of inventors; Inventions as intellectual property, patents and patent laws, procedures in India and developed countries; study of patents in different fields and their innovative content; motivating and encouraging innovative attitude in individuals and organizations; entrepreneurial qualities and skills, learning and training.

D. Value analysis and Value Engineering- Techniques, Historical perspective; Functions and Value-Basic functions, Secondary functions, Use value, Esteem value, Cost value and Exchange value.

E. Steps in Value Engineering process-preparation problem selection, information, evaluation, creation, selection and presentation, implementation and follow up; Approaches- Job plan, DARSIRI, FAST Diagram as a tool, examples on usage of these tools.

F. Behavioral and organizational aspects of Value Engineering; Benefits of Value Engineering.

Text

1. The fourth Eye-Excellence through Creativity- Khandwala, P.N.; Wheeler Publishing Company, 1988
2. Value Engineering- Iyer; New Age Publish, 1996
3. Techniques of Value Analysis and Engineering- Miles LD; McGraw Hill, 1961

Reference

1. Value Engineering for Cost Reduction and Product Improvement- M.S.Vittal; Systems Consultancy Service, Bangalore
2. getting more at less Cost- The Value Engineering way- G.Jagannathan; Tata McGraw Hill Publishing Co,Ltd,New Delhi.
3. Value Management, Value Engineering and Cost reduction- Edward Heller; Addison Publishing Co.;1971.
4. Value Engineering LD Miles (Mc Graw Hill)
5. Value Engineering- A.E.Mudge (Mc Graw Hill)

IEE 02 : STRATEGIC MANAGEMENT

A. Concept of Business, Corporate objectives, goals and policies-Process of corporate planning SWOT analysis- Gap analysis-Developing strategies and Communication Monitoring performance.

B Environmental scanning and analysis Technical forecasting-Economic and social environment- Business forecasting- market dynamics-Government policies Elements of Futurology-Strategies for growth and survival-Long range planning of R & D Strategies for technology based industries- Multinational operations.

C. Investment evaluation-Capital budgeting- Risk analysis-Computer modeling.

D. Competitive Advantages-Focused Strategy, Process of Strategic Planning.

E. Organizing for Corporate planning- Implementing corporate strategies-Business plans-Resources planning-Management controls-Information Systems.

Text

1. Strategic Planning System-Lorage & Vancil; Prentice Hall, 1990.
2. Implementation of Strategic Planning-Lorage; Prentice Hall, U.S.A.1992
3. Strategic Planning-and Control Techniques for Profit- Pitchard; Prentice Hall U.S.A.1990.

IEE O3 : ADVANCED OPERATIONS RESEARCH

A. Goal Programming and applications

B. Linear Programming related problems in Networks; Shortest Path problems, Maximal Flow problems, Minimal Cost network flow problems; Related problems in Project Management; Minimal Spanning Tree Problem.

C. Integer Programming and Combinatorial Models; formulations and applications; Cutting Plane algorithms; Branch and Bound Methods; Traveling Salesman Problem.

D. Non-linear Programming :- Unconstrained optimization with one or more variables; Fibonacci search; gradient production method; conjugate gradient method; Hooks and Jeevas method, constrained optimization; Lagrangian optimization; Kuhn- Tucker condition and Saddle Point of the Lagrangian; Convex Simplex method; penalty function approach: application to industrial problems: Geometric Programming; formulations and applications to Design Problems.

E. Dynamic Programming; Principle of Optimality, Recursive Algorithms: Policy Interaction; Applications to Deterministic industrial problems: Probabilistic Dynamic Programming Models; Dynamic Programming in Markov Chains, Industrial applications.

F. Simulation: Parameter estimation; Variance reduction methods, statistical inference based on outputs; organization of simulation programs; use of linked lists: maintenance of statistics concerning permanent and temporary entities; off-line simulation for interactive decision making; applications to real lite simulations.

Text

1. Operations Research: Principles and Practice- A Ravindran. D.R.Philips and J.J.Solberg, John Wiley and Sons, 1988

2. Optimization : Theory and Applicatins- S.S.Rao; Wiley Eastern., 1981
3. System Simulation with Digital Computer-Narsingh Deo; Prentice Hall India., 1981

Reference

Operations Research : An Introduction- H.Taha; Prentice Hall of India (P) Ltd., New Delhi, 1996. Principles of Operations Research- H.M.Wagner; Prentice Hall of India (P) Ltd., New Delhi. Mathematical Programming Techniques- N.S.Kamboo; East-West Press Ltd., New Delhi.

IEE 04 : KNOWLEDGE MANAGEMENT

A. Essentials of Knowledge management: Introduction, What is Knowledge? Data Information and Knowledge, Wisdom, Basic types of knowledge, Organizational knowledge management types, classification of knowledge, life cycle, Sources, Processes, Knowledge convertion Organizational knowledge progression Organizational Knowledge management Technology enablers, Organizational intellectual / human capital organizational meta knowledge.

B. Knowledge Management Techniques, Systems and Tools: Introduction, Organizational knowledge creation Knowledge networks, Organizational knowledge mapping techniques, core implementation issues, usage, Organizational knowledge spiral, Organizational knowledge / capture Implementation methodology, Knowledge Acquisition Tools, Organizational knowledge indexing, Processing, Document Management System, Database Management systems, Data warehouse, Knowledge Analysis Data mining, On-Line analytical processing Organizational knowledge dissemination.

C. Organizational knowledge Management Architecture and Implementation Strategies: Introduction, Developing a KM Framework, Implementation Phases, Architectural Components, KM Systems Requirements, Tools, KM Systems Components Implementation Strategies Awakening Phase, Actionable phase, Implementation phase, maintenance and measurement phase, Organizational Organic capabilities architecture business, Information, Data, Systems, Computer, Layered Knowledge. Organizational Knowledge management architecture Key considerations, Organizational knowledge repositories Structure, Life cycle, Organizational knowledge refineries, KM applications Integrative applications Interactive applications, Knowledge processing applicants management, composite applications, organizational Km context, Organizational platforms Enterprises information portals, competitive advantages, enterprise knowledge portal, characteristics, Organizational knowledge measurement framework Awakening stage, actionable phase, implementation phase, Support phase, Organizational deployment, Organizational knowledge measurement Techniques Intangible Assets measurement, intangible Assets Monitor, balanced Scorecard, Organizational implementation barriers.

Text :

1. Knowledge Management Sudhir Warier, Vikas Publishing House

2. The Knowledge Management Toolkit: Orchestrating IT, Strategy, and Knowledge Platforms By Amrit Tiwana; Pearson Publisher:

3. Introduction to Knowledge Management: KM in Business By Todd R. Groff and Thomas P. Jones; Butterworth Publisher

Reference

1. Management Toolkit : Practical Techniques for Building a Knowledge Management System, Prentice Hall, 1999

2. An Investigation of Knowledge Management CharacteristicsJoshi K exington, KY,1998

3. Hand Book on Knowledge management C W Holsapple, Springer, 2003 Porter M

4. Competitive Advantage , Free Press 1985

5. Managing knowhow Karl Erik Sveiby and Tom Lloyd

GROUP II

IEE 05 : MATERIALS HANDLING

A. Overview of Material Handling Principles of Material Handling, Principal groups of Material Handling equipments - General Characteristics and applications of Material Handling equipments Modern trends in materials handling.

B. Lifting Equipments Hoist Components of Hoist - Load Handling attachments hooks, grabs and clamps - Grabbing attachments for bulk materials - Wire ropes and chains.

C. Lifting tackle pulleys for gain of force and speed - Tension in drop parts - Drums, Shears and sprockets - Arresting gear and brakes - Block brakes, Band brakes, Thrust brakes - Safety and hand cranks. Principle operation of EOT, Gantry and jib cranes - Hoisting Mechanisms, Travelling mechanisms, lifting mechanisms - Slewng Mechanisms- Elevators and lifts.

D. Conveying Machines - Belt conveyors - Types, Principal components of a conveyor and their purpose - conveyor belts - Tractive elements - take up devices Special types of belt conveyors - Metal Belt conveyor - Apron conveyor Elevators, Passenger conveyor - Flight conveyor, Principal types and applications - Bucket flight conveyors - Cradle conveyor - conveyor elevators. Overhead conveyors - Overhead pusher conveyor Overhead load towing truck conveyors - Load carrying car conveyors - Load towing and walking beam conveyors - Bucket elevators - Cradle conveyors - Screw conveyors Oscillating conveyors - Roller conveyors Hydraulic and pneumatic conveyors - Chutes Bins.

E. Current trends in Material Handling, Computer Aided Systems for Material Handling

Text / References

1. Material Handling Equipments - Rudanko,.

2. Material Handling Equipment - Alexander V

3. Conveying Machines - A. Spivakvsky and V.Dyachkov

4. Plant layout & material Handling, James Apple

IEE 06 : INDUSTRIAL AUTOMATION

A. Automation: Definition- Concepts-where-what-How to apply; Automation of machining processes; Types of automation- Low/Medium/High Cost, flexible automation. Semi/fully automatic Machine tools; Special purpose machines Material Transfer devices.

B. Low cost automation using pneumatics-operational principles and uses of pneumatic power subsystem, compressors F-R-L units' storage tank. Control subsystem, direction control flow relief valves and actuating sub system, linear and rotary actuators; study of pneumatic circuits for conveying, feeding, clamping, indexing, linear & rotary cutting and noncutting operations, inspection and quality control.

C. Machine tool automation using Hydraulic: Operational principles and use of hydraulic power sub system: hydraulic pumps-rotary-vane-gear, lobe and reciprocating; Filters control subsystem; pressure control, direction control, flow control actuating subsystem; Liner, semi rotary and rotary actuators; Study of simple hydraulic for machine tools automation.

D. Control System Fundamentals; Control system concepts- automatic control open loop control, feed back control system; Elements of basic control actions and industrial automatic control; Logic gates and controls-Pneumatic logic gates-AND, Or, NAND and NOR; Applications of basic control circuits based on these gates; Basic concepts, Programming and applications of programmable Logic Controls.

E. Introduction to NC/CNC machines; NC system components; Automation and mechanization in production shop floor environment, inspection and quality control: CNC Programming-absolute and incremental programming, Principles and Working of Co-ordinate Measuring machine; Introduction to computer-aided manufacturing systems.

Text

1. Automation and Production System CIM Groover- PHI 2001
2. Pneumatic circuits and Low cost automation0 Fawcett J.H.
3. Fundamentals of Pneumatics- Festoseries, 1990
4. Industrial Hydraulics- Pippenger, 1988.
5. Automation, Production Systems, and CIM- M.Groover & Zimmers; Prentice Hall, 1987.
6. CAD/CAM-Computer Auded Design & Manufacturing- M.Groover & Zimmers; Tata McGraw Hill, 1994
7. Computer Numerical Control (CNC) machines- P.Radhakrishnan; Wiley Eastern 1990.

Reference

1. Vickers manual on Hydraulics.
2. Computer Numerical Control Concept and Programming- Seames W-S.
3. Computer Numerical Control of Machine Control- Thyer G.E.
4. Pneumatic Application- Deepert Warner & Stoll Kurt
5. Mechanization by Pneumatic Control Vol.1 and Vol.2 Deppert Warner & Stoll Kurt.
6. Hydraulic Valves and Control- Pippenger.

IEE 07 : INDUSTRIAL SAFETY ENGINEERING

A. Introduction History of development of industrial Safety Implementation of factories Act formation of various council safety and productivity Safety organizations Safety committees Safety committees structure roll of management and roll of Govt. in industrial safety Safety analysis.

B. Operational safety (Hot Metal Operation) : Safety in cutting Safety in welding - Safety in Boilers Pressure vessels Furnace (All types) Heat Treatment processes shops Electroplating Grinding Forming process Rolling Forging Surface hardening Casting Molding Coiling. Operational safety (Cold metal operation) : Safety in handling of portable power tools Hand grinder Machine shop Drilling Polishing machine - Safety in assembly shop Material handling Dock safety - Safety in generation and distribution of power Distribution and handling of industrial gases - Safety in Inspection - Safety in chemical laboratories Ammonia printing - Safety in power press - Safety in Sewage Disposal and cleaning. Safety in Industrial pollution and control working at height.

C. Accident prevention and protective Equipments : Personal protective equipment surveying the Plant for locations and hazards part of body to be protected. Education and training in safety Prevention of causes and cost of Accident. House keeping First Aid Fire fighting equipment Accident reporting Investigations. Industrial psychology in accident prevention safety trials, safety audit.

D. The Acts which deal the safety and industrial Hygiene: Features of Factory Act, Explosive act, Boiler Act, ESI Act, Workman's compensation Act.

E. Industrial Hygiene : Occupational Safety Diseases prevention ergonomics. Occupational Diseases, Stress, Fatigue. Health, safety and the physical environment. Engineering methods of controlling chemical hazards, safety and the physical environment: Control of industrial noise and protection against it - Code and regulations for worker safety and health.

Text

1. Ray Asfahl C., “Industrial Safety and Health Environment”, Fifth Edition, Prentice Hall, 2003 ISBN:0131423924
2. Willie Hammer, “Occupational Safety Management and Engineering”, Fifth Edition, Prentice Hall; Fifth Edition, 2000 ISBN:0138965153
3. “Occupational safety manual” - BHEL.

Reference

1. Safety in industry, N.V.Krishna, Jaico Publishers House
2. Industrial Safety and the Law, John Ridley,P.M.C Nair Publishers, Trivandrum, 1998
3. Safety Law for Occupational Health and Safety - John Channing Butterworth Heinemann; ISBN:075064559

IEE 08 : PLANT ENGINEERING AND MAINTENANCE

A. Introduction: General objectives, Functions; Organisation and administration of maintenance systems; Requirements, Concepts and structure of suitable organizations for maintenance systems.

B. Failure Analysis : Analysis for Source identification; Classification and selectivity of failure; Statistical and reliability concepts and models for failure analysis.

C. Classification of Maintenance System- Basis and Models for various maintenance systems; Decision Models for Maintenance Planning: Operation and Control; Optimum level of Maintenance; Replacement aspects- break down and preventive types, Group and individual types; Obsolete facility; Deteriorating and completely failing facilities, Replacement vs. reconditioning, Economic of overhaul, Addition replacement models- additive damage cases, Zero memory case, Partially observed situation, Planning horizon procedure.

D. Spares planning and Control- Static spares, Insurance spares with and without salvage value, slow moving spares.

E. Manpower Planning- Crew size, Allocation etc., Standby machines; Economical and operational aspects: Scheduling, planning of activities, Monitoring and updating; Resource allocation; Assigning priorities.

F. Cost Management for Maintenance: Cost estimates Recording, Summarizing and distributing cost data, Maintenance budget.

Text

1. Maintenance Management- P Gopalkrishnan, Banrerji- PHI 1991
2. Industrial Maintenance- Garg, H.P., Chand and Co., 1996.
3. Fundamentals of Mechanical maintenance- Nibarte; Skills Today Publ., 1988
4. Introduction to Total Productive Maintenance- S.Nikajina., Productivity Press, 1988
5. Operations Research in Maintenance- Jardine A.K.: Manchester University Press, 1970.

GROUP III

IEE 09 : MANAGERIAL FINANCE

A. Forms of Business Organizations- Proprietary, Partnership, Private Ltd. And Public Limited companies; their regulatory frame work.

B. Time Value of Money- Future and present values of single cash flow and annuity; Interest rate- nominal versus effective; Various types of borrowing and interest rates, cost of capital and its effect on Investment decisions, Economic comparisons of alternative investments.

C. Analysis of Balance sheet and profit and loss account; Cash flow and fund flow statements and their interpretation: Types of Financial Ratios- Liquidity ratio, turnover ratio, profitability ratio, leverage ratio etc.

D. Working Capital Management- Concepts and constituents of current assets and current liabilities; Operating cycle of Business and its effect on inventory; receivables and cash flow.

E. Working Capital Management- Concepts and constituents of current assets and current liabilities; Operating cycle of Business and its effect on inventory; receivables and cash flow.

F. Financing of business- Short term & long term, Assessment of requirements and means of financing; various types of short term financing; types of securities and their assessment; Long term financing of business; Sources of long term finance Equity. Preferential shares, debentures deposits, long term loan from financial institutions, Lease financing.

G. Tax framework and its effect on business policies; direct and indirect taxes, effect of sales tax, excise duty and customs duty on pricing in investment decision.

H. Project financing- Preparations of project feasibility report, Techno financial appraisal risk analysis of the project,. Sources of project, sources of project financing.

I. Money and Capital Market-its features, Liberalization and its effect on India's capital market.

Text / Reference

1. Financial Management: Text and problems- A Khan and P.K.Jain, Tata McGraw Hill, 2004.

2. Financial Management: Theory and Practice Prasanna Chandra: Tata McGraw Hill, 2005.

3. Financial Management: Text and problems- A Khan and P.K.Jain. Tata McGraw Hill, 1994

4. Financial Management: Theory and Practice- Prasanna Chandra: Tata McGraw Hill, 1996.

IEE 10 : TOTAL PRODUCTIVITY MANAGEMENT AND BUSINESS PROCESS RE-ENGINEERING.

A. Productivity conceptualization; Productivity mission and objectives; Productivity policies and strategies- need for integration and operation using a holistic approach; Productivity, trade union and role of government agencies.

B. Productivity management and monitoring at micro and macro levels; Organizing and planning for productivity- Strategic, corporate and Annual productivity plans.

C. Human resource development- strategies- Motivation for productivity, Skill development and training, sharing gains of productivity.

D. Models of Productivity Measurements; Productivity improvement techniques; Value engineering; Waste management; Quantitative and qualitative techniques of system analysis; Holistic models.

E. Elements of Business Process Re-engineering (BPR) definition, scope, methodology & process mapping.

Text

1. Productivity Engineering and Management- Summanth D.J.; McGraw Hill, New York 1994.

2. Business Process Reengineering- Jayaraman M.S.; Tata McGraw Hill, 1996.

IEE 11 : BUSINESS PROCESS SIMULATION

A. Role of Simulation, Scope and phases involved in simulation process.

B. Random number generation- methods and applications process generators.

C. Various Probability distributions (Continuous and discrete)

D. Simulation modeling.

E. Applications to inventory

queuing

corporate planning

marketing

scheduling

F. Simulation Programming Logic

G. Business games, introduction to simulation software's/simulators

Text

1. Simulation modeling and Analysis- Law A.M. and kelton W.D.; Tata McGraw Hill, 2000
2. Decrete event simulation- bank J and Carson J.S.Prentice Hall, 2005
3. System simulation G Gordon- PH 1978
4. Simulation modeling and Analysis- Law A.M. and kelton W.D.; McGraw Hill, 1982
5. Discrete event simulation- Banks J and Carson J.S.Prentice Hall, 1984.
6. Design and use Computer simulation models James R.E. and Sisson R.L.; Macmillan 1971.

IEE 12 : ENTREPRENEURSHIP DEVELOPMENT

A. Entrepreneurial perspectives understanding of entrepreneurship process entrepreneurial decision process - entrepreneurship and economic development - characteristics of entrepreneur entrepreneurial competencies

B. Process of business opportunity identification and evaluation Industrial policy environment market survey and market assessment project report preparation study of feasibility and viability of a project assessment of risk in the industry. Processes and strategies for starting a venture stages of small business growth.

C. Startup of SMES formalities to be completed for setting up a small scale unit forms of organizations for small scale units financing of project and working capital venture capital and other equity assistance available break even analysis and economic ratios technology transfer and business incubation.

Text :

1. Pandey G W., A complete Guide To Successful Entrepreneurship, Vikas Publishing.
2. Rao C R, Finance for Small Scale Industries
3. Rao T.V., Deshpande M.V., Prayag Metha & Nadakarni M.S., Developing Entrepreneurship A Hand Book, Learning Systems.

Reference :

1. Harold Koontz & Heinz Weihrich, Essentials of management, McGraw Hill International
2. Hrich R.D & Peters Iewin M.P. Entrepreneurship , McGraw Hill
3. Donald Kurado & Richard M Hodgelts , Entrepreneurship A Contemporary Approach, The Dryden Press
4. Dr Patel V G , Seven Business Crisis, Tata McGraw Hill
5. Patel J B ,Noid S S, A manual on Business opportunity Identification, Selections ,EDII
6. Timmons J A , New Venture Creation Entrepreneurship for 21st Century, McGraw Hills International

GROUP IV

IEE 13 : MATERIALS MANAGEMENT

A. Introduction to Materials management Importance of materials management and its role in industries. The need for the integrated approach in material management.

B. Demand forecasting Various quantitative methods of demand forecasting Different type of averaging , Exponentially weighed smoothening, Correction for fluctuations, Time series analysis ,Delphi and other group techniques.

C. Inventory control- Basic methods in Inventory control Assumptions used in deriving models. Inventory costs and EOQ model. Price beaks and quantities Effects of variations in lead-time and demand Effects of shortage cost on EOQ. Systems of Inventory control, Design of Inventory control systems.

D. Classification of systems and selective Inventory control ABC, VED, FSN, HML, Coverage analysis in material management.

E. Vendor rating and source selection. Techniques and materials. Strategic sourcing Use of Indian Standards for vendor rating. Make or buy decisions - Materials Requirements, Planning Concept, methods and illustration examples. Introduction to JIT Philosophy Features and impact in materials Management.

F. Purchasing Purchase organization - legal aspects of buying - Purchase Procedure - Store and Material control - Receipts and issues - Stores Record. Methods and principles of Storing and retrieving items.

G. Application of Computers in Materials Management Information Systems for Procurement and storage using computer.

Text :

1. Integrated Material Management : P.Gopalakrishnan
2. Materials Management : R.M.Shah

Reference :

1. Scientific Inventory Management : Buchan & Kbenigsberg
2. Inventory Management : Starr & Miller
3. Principles of Inventory Management : Tersine

IEE 14 : ENVIRONMENTAL MANAGEMENT

A. Environment Protection, Conservation, Preservation and Development.

B. Environment Economics-Standard Market Model, External Costs Public Goods impact Analysis; Cost-effectiveness analysis; Benefit cost analysis; Risk Analysis; Cost estimation techniques; Current policy.

C. Environment Analysis: Chemical Sensor Application; Mass Spectrometry, Optical Spectroscopy; other Analytical techniques; Estimation Methods.

D. Global Environment Change: Economic Growth; Population Growth; Povery and Environment degradation. Links in Graded Environment and Human Suffering water, land and habitat; Global Health Index.

E. Behaviourial dimensions of Environment Management.

F. Waste Management Planning.

G. Environmental Engg. Including Environmental Impact Assessment and incentives.

H. Carbon credits, Global climatic changes.

Text

1. Environmental Studies- B Joseph- TMH 2005
2. Environmental Studies- Miller TG- Thomson Singapur 2004
3. Environment Engineering- Kamala; Tata, McGraw Hill, 1990.
4. Man and the Environment- A S Boughey; Wiley, 1980

Reference

1. "Environmental Science- A Global Concern" (5th Edition) Cunningham, W.P. and B.W. and B.W.Saigo, McGraw- Hill Intl.Ed.,1999.
2. "Environmental Engineering", (2nd Ed.)- Davis. M.L. and D.A.Cornwell; McGraw- Hill Intl.Ed.1991
3. "Environmental Science- A Study of Interrelationships", (4th Ed.)- Enger E.D. and B.F. Smith; W.C.Brown Publishers 1992.

IEE 15 : HUMAN RESOURCE PLANNING AND DEVELOPMENT

A. Function

Evolution, Objectives, principles, philosophies and policies.

B. Manpower Planning

Uses and benefits : Problems and Limitations, organizational structures; Manpower Inventory: manpower forecasting, job descriptions, manpower skills analysis and practices in the Indian Industry, Succession Planning, System modeling.

C. Recruitment and Selection :

Job specification; Selection process psychological testing, Interviewing techniques, induction; Placement and Exit interview, transfers, promotion and its policies.

D. Performance Appraisal:

Internal Mobility-Purpose-Methods constraint Management; Compensation management, Fixing of wages, Job evaluation; Legislation and objectives of performance appraisal and its methods; Career Planning.

E. Training and Development

Objectives and Policies; Planning and organizing the Training Department; Training Manager and his job-On and Off job training, training techniques.

F. Organizational Behavior :

Group dynamics; Team Approach; Leadership; Theories of Motivation.

G. Understanding fundamentals of Management of Change.

Text

1. Human Resource Management- J Benardin- TMH
2. Human Resource Personnel Management- K Aswanthappa- TMH
3. Human Resource Management- MSayadain- TMH
4. Personnel/ Human Resource Management- Decenzo and Robbins; Prentice Hall India
5. Management of Human Resources C.B.Mamoria: Himalaya Publishing House, Mumbai
6. Excellence through Human Resource Development-Nair and Rao Tata Mc Graw Hill Delhi

IEE 16 : PROJECT MANAGEMENT

A. Concept of a project- classification of projects - importance of project management The Project life cycle- establishing project priorities (Scope-cost- time) Project priority matrix - work break down structure.

B. Capital budgeting process Planning - Analysis Selection - Financing - Implementation-Review

C. Generation and screening of project ideas- market and demand analysis - Demand forecasting techniques . Market planning and marketing research process - Technical analysis.

D. Financial estimates and projections: Cost of projects - means of financing estimates of sales and production - cost of production- working capital requirement and its financing profitability - Projected cash flow statement and balance sheet. Break even analysis.

E. Basic techniques in capital budgeting - non discounting and discounting methods- pay back period - Accounting rate of return - net present value Benefit cost ratio internal rate of return. Project risk. Social cost benefit analysis and economic rate of return. Non financial justification of projects.

F. Project Execution - Project planning, scheduling, use of Critical Path Method(CPM), Concepts and uses of PERT, cost as a function of time, Expenditure planning, Progress payments, PERT - Cost Systems. Determination of least cost duration, Post project evaluation.

G. Contract Management Procurement planning, selection of contractors, Awarding contractors, Monitoring contracts.

H. Introduction to major Project management Software MS Project

Text :

1. Project planning, analysis, selection, Implementation and review - Prasannachandra Tata McGraw Hills
2. Project Management - Gopalakrishnan - Mcmillan India Ltd.

Reference :

1. Project Management - the Managerical Process - Clifford F.Gray & Erik W Larson McGraw Hills
2. Project management : David I Cleland McGraw Hills International Edition.
3. Project Management - Harry Maylor Peason Publication.

IEE17 : ELEMENTS OF AUTOMOBILE ENGINEERING

CONTENT

a. **Introduction :** Classification of automobiles, Clutch : Details, Requirements of Clutches, Types of Clutches and Clutch materials, Design of clutch, Fluid coupling, Trouble shooting and remedies. Transmissions : Necessity of gear box, Sliding mesh, Constant mesh, Synchromesh and epicyclic gear box, Overdrives and hydrodynamic torque converter, Trouble shooting and remedies. Drive line: Propeller shafts and universal joints: Types and construction, Different types of universal joints and constant velocity joints. Live axle and differential: Final drive, spiral, bevel, Hypoid and worm drives, Types of live axles, semi, three quarter and full floating axles. Necessity of differential, Conventional and non-slip differential, Trouble shooting and remedies.

b. **Conventional and non-slip differential, Trouble shooting and remedies.**

Brakes: Requirement of brake, Classification of brakes, Mechanical, Hydraulic, Pneumatic, Electro and vaccum brakes. Disc brakes, Braking of front wheel, Rear wheel and four wheel brakes, Brake trouble shooting. Introduction to antilock braking system (ABS). Steering and Front axles : Steering geometry, Steering requirements, Steering linkages and steering gears, over steer and under steer, Cornering power, Reversibility of steering gears, Types of front axles and their constructions. Trouble shooting and remedies.

c. **Suspension:** Objects of suspension, Basic requirements, Springs- Leaf and Coil springs, Air suspension and its features, Independent suspension, Forces acting in independent suspension, Sprung and un-sprung mass, Pitching, rolling and bouncing, Shock absorbers. Wheels and Tyres: Requirements of wheels and tyres, Constructional features, Types of tyres, Inflation Pressure and its importance, Application to ride and stability, Trouble shooting and remedies.

d. **Electrical system:** Battery, Types of battery, Lead-Acid, Alkaline, ZEBRA, Sodium Sulphur and Swing, Ratings, charging, Maintenance and testing of Lead-Acid battery. Electronic Ignition System: Capacitor Discharge Ignition System, Distributor less ignition System, Direct Ignition

system. Hall effect pulse generator, Inductive pulse generator, Constant dwell system, Constant energy system. Charging System : Dynamo: Principle of operation, Construction, Working, Regulators, combined current and voltage regulator, etc. Alternator : Principle of operation, Construction, Working, Rectification from AC to DC. Starting system: Dynamo: Principle of operation, Construction, Working, Regulators, combined current and voltage regulator, etc. Alternator : Principle of operation, Construction, Working, Rectification from AC to DC. Starting system: Requirements, Various torque terms used, Starter motor drives; Bendix, Follo through, Barrel, Rubber compression, Compression Spring, Friction Clutch, Overrunning Clutch, Dyer. Starter motor solenoids and switches, Glow plugs.

e. **Body Engineering:** Importance of Body design, Materials for body construction-Styling forms-Coach and bus body style, layouts of passenger cars, Bus and truck bodies. Aerodynamic drag- Aerodynamic lifts and pitching moments, Side force, Yawing moments and rolling moments. Basic dimensions : Geometrical relations to drivers seat, Dimensions of foot and pedal control, Passenger seats, Vehicle dimensions and visibility. Overall Criteria for vehicle comparison. Chassis types and structure types : Open, Semi integral and integral bus structure. Frames : functions and types of frames, Loads on frames, Load distribution of structure, Location of power plant.

f. **Recent trends in Automobiles:** Electronic Control module (ECM), operating modes of ECM (closed loop and open loop) Inputs required and output signals from ECM, Electronic Spark control, Air Management system, Idle speed control. Multipoint fuel injection system and single point fuel injection. Electronic fuel injectors. Principle of operation, Construction, working & application of temperature sensors, inductive sensors, Position sensors (rotary, linear), Pressure sensors, Knock sensors, Hot wire and thin film air flow sensors, vortex flow/turbine fluid sensors, Optical sensor, Oxygen sensors, Light sensors, methanol sensors, Rain sensor, New developments in the sensor technology.

Reference

1. Automotive Mechanics, Donald L Anglin, William H Crouse, TMH,2006
2. Automotive Mechanics: Principles & Practices : Principles and Practices, Joseph Heitner, CBS Publisher,2004
3. Automobile Engineering, T.R. Banga & Nathu Singh, Khanna Publications, 1993
4. The Automobile, Harbans Singh Reyat,S. Chand Limited,2004
5. Automobile Engineering (Volume -1 & 2),Kirpal Singh, Standard Publishers Distributors,2011
6. Automobile Electrical and Electronic Systems,Tom Denton,Taylor & Francis,2004
7. Vehicle Body Engineering, J. Pawlowski, Janusz Pawłowski, Business Books, 1969
8. Computerized Engine Controls,Steve V. Hatch, Dick H. King,Thomson/Delmar Learning, 2004
9. Automotive Technology: A Systems Approach,Jack Erjavec,Cengage Learning,2009
10. Light and Heavy Vehicle Technology, M J J Nunney,Taylor & Francis, 2007

5.5 PROJECT WORK

Carrying out a project and submitting a Project Report is a requirement of the Graduateship Examination.

A. Choosing the project :

The Project Proposal submitted by the student has to be approved by the Institution before the student can start on his/her Project work.

The Project Work, should be carried out in an organization and under the guidance and supervision of the Project Guide.

1. The Project Work should be carried out Individually and personally by the student.
2. The Project Work should demonstrate the ability of the student to apply the techniques of Industrial Engineering to a specific situation or in any functional area.
3. The Project Work, through the Project Report, should demonstrate the ability of the student for Data Collection, Analysis of Data, Formulation of Recommendations and for suggesting a viable scheme for implementation of the recommendation.
4. The Data should be collected either by own observations and measurements or gathered from generally accepted first sources like Balance Sheets, Control figures used by the organization, Performance Reports from Departments etc. It general data on industry wise or a national basis are used. The source shall be quoted and should be generally accepted source shall be Industry Publications, Government Statistical Data etc.
5. The areas Chosen may be one or more of the areas in which the compulsory papers are prescribed for Section B Examination and or the areas from which the student has chosen his Elective papers for section B Examination.

   The student must have passed for all these papers before submitting the Project Proposal.
6. The student must make sure for self that the Project Work proposed to be under taken can be conducted in the organization and the Project Report, fully meeting the requirements of the Institution can be submitted to the Institution.
7. Following are some the typical areas chosen by students for Project work.
   1. Application of Statistical Techniques, Forecasting, Design of Experiments.
   2. Optimization and Appreciation of O.R.Techniques
   3. Marketing- Production Coordination, Inventory Levels, Introduction/Phasing out of Products.
   4. Aggregate Planning, Manufacturing Systems, Capacity, Investment Decisions, Inventory Levels.
   5. Production Methods, Process Analysis, Operations Planning, Operator Training.
   6. Operations Planning and Control, Scheduling, In process Inventory, JIT
   7. Cost Management, Activity Based Costing, Budgetary Controls
   8. Manufacturing Technology, CAD, CAM
   9. Facilities Planning, Material Handling, Layout, Welfare Services
   10. Project management, Application of Networks

11. Value Engineering, Innovation
12. TQM, Quality Circles, Kaizen etc.
13. Maintenance Management, TPM
14. Ergonomic Analysis and Design, Environment
15. Energy Management, Conservation, of Energy
16. Supplies Management, Vendor Development, Purchasing
17. Inventory Management, Physical Control, Marketing Coordination
18. MIS- Computerization, Extending Computer Applications, Networking, Communications
19. Technology Forecasting, Introduction of Technology, Change Over of Technology
20. Market Research, Forecasting, Product Life Cycles, Product Mix, Introduction/deletion of Products
21. Man Power Planning, Forecasting, Recruitment, Appraisal, Redeployment
22. Motivation, Incentive Systems, Employee Development, Training/Retraining
23. Education, Organization and Methodology,etc.

B. Preliminary requirement-approval of project work

1. The Student should submit the proposal of project work to the Institution and obtain its approval for the project work, for that application form to be submitted is titled Application for Approval of Project Proposal, can be downloaded from the website.
2. Student should select a Project Guide who will give his / her consent to guide the student in his/her Project Work. The Guide should be a competent Industrial Engineer or a Senior Officer with a Degree in Engineering, serving in the organization in which the project work will be carried out (A Professional Member of the Institution can also be a Guide)
3. A Certificate from the Project Guide is required to be submitted along with the Project Proposal as well as the final project report
4. The guide should be made familiar with the requirements of the Project work when seeking his consent to act as Project Guide.
5. Project Proposal should be accompanied by a Processing Fee of Rs. 600/- (Rupees Six Hundred only) by a Demand Draft in favour of "Indian Institution of Industrial Engineering", payable at Mumbai.
6. If any of the student's project proposal gets rejected twice, the candidate need to pay re-examination fee of Rs. 500/- (Rupees Five Hundred only) in the form of Demand Draft while submitting the project proposal 3rd time, thereafter for each rejection.
7. Student has to take practical project as theoretical project will not be accepted. The project proposal will be about 15-20 pages in length.
8. The text in the write up shall be Times New Roman font size 12, Chapter heading shall be in 14 font size and in capital letters. Paragraph heading shall be in 12 font size capitalize each word. Page numbers in numerical at the bottom of the each page except first page.
9. The work has to be carried out by the student himself after his proposal is accepted. The collection of data, analysis of data, formulating and justifying the recommendations and steps for implementation shall all be carried out by the student himself. Work done as study group shall not be accepted.
10. General recommendations based on literature search or comparative study is not acceptable. Similarly descriptions of work carried out in student's organization also

do not qualify.

11. Project work is an important phase of the development of the student for a successful career. The Project Work Requirement is designed to build the strength of the student in identifying of and getting the approval of the Management for measures to enhance the effectiveness of planning and operation functions in an organization.
12. Project proposal is valid upto two years from the date of project proposal approval.
13. If project report is not submitted within the period of two years, student will be required to take a fresh approval for project proposal alongwith stipulated fee.
14. The Institution may require clarifications or modification for the approval of the project
15. The write up for the approval of the project proposal should be made on the following format :

a) Title page (as per sample given on page No.71)
   (i) Name of the work proposed (font Arial black 18)
   (ii) Institution Name (font Arial Black 16)
   (iii) IIIE Logo (one inch dia.)
   (iv) Organization Name (font Arial Black 14)
   (v) Details of student (Name & Membership No.) (font Verdana 14)

Chapter 1. PREAMBLE
- 1.1 Introduction of Subject
- 1.2 Problem on hand (why student has selected this topic)
- 1.3 Importance of the problem
- 1.4 Aim, Objectives and Scope of the project

Chapter 2. DETAILS OF THE ORGANIZATION
- 2.1 Introduction
- 2.2 The organization
- 2.2.1 Products
- 2.2.2 Processes
- 2.2.3 Facilities
- 2.2.4 Organization structure
- 2.3 Organizational business profile
- 2.4 Other relevant information
- 2.5 Conclusion

Chapter 3. THE PROBLEM ON HAND
- 3.1 Introduction
- 3.2 Details of problem (Give detail of problem with Data & Graphs etc)
- 3.2.1. Historical perspective (History of problem)
- 3.2.2. Cause and effect relationships (How it is related)
- 3.2.3. Criticality of the problem
- 3.3 Conclusion

Chapter 4. RELEVANT LITERATURE REVIEW (From books, Journal, Internet. To study previous work carried out on the subject or similar work, techniques, methods and latest trends. This shall give direction for your work)

4.1 INTRODUCTION
- 4.2
- 4.3 (Presentation of material collected through review of relevant literature quoting the sources of each material)
- -- Say up to section 4.6
- 4.7 Conclusion

Chapter 5. DATA COLLECTION AND ANALYSIS
- 5.1 The type of data needed
- 5.2 The sources for the collection of data
- 5.3 Methods of the data collection
- 5.4 Processing of the data for analysis (type of analysis)
- 5.5 Conclusion

Chapter 6. ANALYSIS OF DATA
- 6.1 CHOICE OF TECHNIQUES
  Brief description of the choice of the techniques utilized and the justification for their use.

- 6.2 Devote one Section each to one analysis…say upto section 6.9.
  The analysis carried out and technique utilized (give suitable Headings)
  (All the steps in the analysis of the Data and the relevant theory have to be shown)

- 6.10 CONSOLIDATED RESULTS
  Give a consolidated representation of result of the analysis using necessary number of sections and headings. .....say upto section 6.14

- 6.15 GENERAL OBSERVATIONS

Chapter 7. RECOMMENDATIONS
- 7.1 Brief Idea of Recommendations likely to emerged

REFERENCES FORMAT

Text: All citations in the text should refer to:
1. Single author: the author's name (without initials, unless there is ambiguity) and the year of publication;

2. Two authors: both authors' names and the year of publication;

3. Three or more authors: first author's name followed by "et al." and the year of publication.

Citations may be made directly (or parenthetically). Groups of references should be listed first alphabetically, then chronologically.

Examples: "as demonstrated (Allan, 1996a, 1996b, 1999; Allan and Jones, 1995).
Kramer et al. (2000) have recently shown..."

List: References should be arranged first alphabetically and then further sorted chronologically if necessary. More than one reference from the same author(s) in the same year must be identified by the letters "a", "b", "c", etc., placed after the year of publication.

Examples:
Reference to a journal publication:
Coffey, C.S., 1994. Quantum-mechanical aspects of dislocation motion and plastic flow. Phys. Rev. 49, 208-214.

Sklad, P.S., Gibala, R. and Mitchell, T.E., 1973. Amplitude dependent internal frication of molybdenum single crystals. J. Phys. F: Metal Phys., 3, 1789- 1795.

Reference to a paper in the proceedings of a conference:
Holzwarth, U. and Seeger, A., 1991. in: Brandon, D.G., Chaim, R. and Rosen, A. (Eds.), Proceedings of the 9th International Conference on Strength of Materials, Freund Publications House, London, p. 577-576.
Reference to a book:

Hull, D. and Bacon, D.J., 2001. Introduction to Dislocations, 4th Edition, Butterworth – Heinemann, Oxford, pp. 182 – 187.

Reference to a chapter in an edited book:
Mettam, G.R., Adams, L.B., 1999. How to prepare an electronic version of your article, in: Jones, B.S., Smith , R.Z. (Eds.), Introduction to the Electronic Age. E-Publishing Inc., New York, pp. 281-304.

C. Submission of Project Report.

1. The Project Report should be submitted within 2 years of passing Section B. If the Report is not submitted within the period of two years, late fee will be charged. Additional course of study may also be prescribed. The Project Report should be submitted to the Institution within a period of two years from the date of completion of all papers in Section B.
2. The Project Report cannot be submitted until the student has passed all the papers (both Compulsory and Elective) of Section B.
3. The Project work should be done personally by the student under the approved project guide and in conformity with the approved Project Proposal.
4. A certificate from the Guide should also be enclosed in the Project Report as provided in the Format for Project Report. The Project Report should be ONLY in the Format prescribed for Project Report (See next section)
5. The Collection of Data, Analysis of Data and application of techniques for the formulation of recommendation should be clearly described in the Report.

   All steps in the analysis of the relevant theory shall be presented in the Report. While formulating the Recommendation, the expected costs and benefits, the advantages and limitations of the recommendations should be clearly discussed.

   The suggested scheme for implementation of the recommendations should be clear and logically laid out with details of steps involved, time schedule of implementation, monitoring, precautions to be observed.
6. A student is required to submit a Synopsis (ten pages approximetaly) consisting of following has also to be submitted along with the project Report: Title of project, Abstract, Background of study, Problem defination, Problem solving approach, Results and analysis, Discussion, conclusion and References.
7. The student should submit three hard bound copies of the Project Report (along with the synopsis).The copies of the Project Report will not be returned to the student.
8. Student must work on the project at least for a period of 4 months after the approval of proposal. Report submitted before this period will not be accepted.

9. All submission of Project Reports should be accompanied with an Examination Fee of Rs. 5000/- (Rupees Five Thousand only) in the form of crossed Demand Draft.

10. Publishing Rights.

a) The Project Report shall not be published before the decision of the Board of Examinations of its acceptance or otherwise.

b) The Institution will have the right to use the Project Report in any manner that may be deemed as expedient.

c) In case, the author wishes to publish the Report, due acknowledgment to the Institution that it was a Project Report prepared for the Graduateship Examination of the Institution has to be made by him/her.

D. Format for project report

PAPER

1.1 The Report shall be typed on white paper, A4 Size.

2.1 The Project Report

A. The Project work shall be done personally by the student under the guidance of an approved Project Guide. A certificate from the Guide should also be submitted in the form specified in the Format.

B. The project work is a test of the ability of the student for data Collection, Analysis of Data, Formulation of Recommendation and for suggesting a viable scheme for implementation of his/her recommendation. The Project Report should demonstrate these abilities.

The data should be collected either by own observations and measurements or gathered from generally accepted valid first sources like Balance Sheets, Control figures used by the Company, Performance Reports from Production, Sales Department, etc. If General Data is industry wise or national bases are used, the sources shall be quoted and should be generally accepted sources like Industry Publications, Government Statistics etc.

All the steps in the analysis of the relevant theory shall be indicated in the Report while formulating the Recommendations, The expected costs and benefits, the advantages and disadvantages of the recommendations etc. shall be clearly discussed. The suggested scheme for implementation of the recommendations should be clearly and logically laid out with all details of the steps involved, and time schedule for implementing the steps, precautions to be observed, monitoring etc.

C. Report is not submitted within two years student will be required to take a fresh approval for project proposal alongwith stipulated fee.

D. The Project Report should be submitted in the prescribed format.

3. Time Limit

A. The Project Report can't be submitted until the student has passed all the papers (both compulsory and elective) of section B.

B. The Project Report should be submitted to the Institution within a period of two years from the date of completing all the Section B papers.

C. If the report is not submitted within two years, late fee as applicable will be charged.

4. Project Report Examination Fee

The stipulated fees, (Rs.5000) for Examination of the Project including Viva should be paid in the same manner as for written papers along with the Project Report.

5. Examination of the Project Report

5.1 The Examiner may report the result as

a. Accepted
b. Revision, Additions, Modification necessary or
c. Rejected

5.2 When the Examiner requires revisions, additions, modifications, the same will be conveyed to the student who will have to comply with the examination requirements.

5.3 If satisfactorily done the examiner may recommend acceptance or otherwise he may recommend rejection.

5.4 In case of rejection the student may opt for reference to a Second Examiner with a fresh payment of the Stipulated Examination Fee. If the Second Examiners also agrees with the first examiner, the Report will be finally rejected.

If the two examiners differ, then the case will be refered to the Board of Examination whose decision will be final.

5.5 If the report is finally rejected, the student will have to undertake a fresh project and follow the same procedure as for his/her project, beginning with making a fresh proposal for Project Work.

5.6 FORMAT FOR THE PROJECT REPORT AND SPECIFICATIONS

The format to be followed for submission of the Report is as follows :

1. Paper

1.1 The report shall be printed on A4 size white paper, (Three copies to be submitted).

2. Printing

2.1 The printing shall be in Times New Roman (12 font) double spaced on one side of the paper only in black colour.

3. Margin

3.1 The pages shall have the following margins : Left 35mm, Top 35mm, Right 20mm, Bottom 20mm.

4. Binding

4.1 The report shall be rexin bound in black.

5. Lettering

5.1 The lettering shall be inscribed on the bound front cover.

5.2 The bound back shall contain the title and the name of the student in16 font size letters.

6. Front cover (as per sample given on page No. 72)

6.1 The front cover shall contain the following details:

6.2 Top-The title in block capitals of 18 font size letter, properly centered/aligned.

6.3 Full name of the student in block capitals of 14 font size letters.

6.4 IIIE Logo in one inch diameter shall be fixed below the name of the Institution.

6.5 Bottom- Name of the Institution, Year of submission all in the block capitals of 16 font letters in separate lines with spacing and properly centered. (This is the Standard Format)

6.6 Side bound cover shall contain name of the student, his/her membership number in block capitals and year of submission of 12 font size.

7. Blank sheet

7.1 At the beginning and the end of the report two white blank sheets of bond paper shall be provided one for the purpose of binding and another to be left blank.

8. Title sheet

8.1 The title sheet shall be the first typed sheet and shall follow immediately blank sheet :

9. Certificate from the guide

The proforma of certificate will be as follows:

This is to certify that the Project Work titled……(title) is a bonafide work carried out by ……..(name of the student), a student for the Graduateship Examination of Indian Institution of Industrial Engineering, under my guidance and direction.

Signature of Guide :

Name : Designation : Address : Membership No. (In case of Corporate Members of the Institution)

Date :

Place (This is the Standard format)

10. Abstract

10.1 Every report shall have an abstract following the title sheet. The abstract shall lead the reader by highlighting the important features of the material contained in the individual chapters. The abstract shall not exceed 500 words.

11. Contents

11.1 The contents shall follow the abstract indicating the title of Chapters, Section and Sub-Section etc. using the decimal notation with corresponding page numbers against them.

12. List of tables

12.1 The contents shall be followed by a “List of Tables” indicating the Table number Table title and the corresponding page number. The Table number shall be in decimal notation indicating the Chapter number and the Table number in that Chapter.

12.2 Any reference within the text shall be given by quoting the relevant number e.g. 'Table 2.2'

13. List of figures

13.1 The 'List of Figures' shall follow 'List of Tables' indicating the Figure numbers. Figure titles and the corresponding page numbers. The Figure shall be in decimal notation indicating the Chapter number and the figure number in that Chapter. For e.g.6.4 refers to Fig.4 in Chapter 6.

13.2 Any reference within the text shall be given by quoting the relevant number, e.g.,' Fig.6.4'

14. Nomenclature.

14.1 The 'Nomenclature' follows the 'List of Figures' and contains the list of symbols used. They shall be arranged alphabetically in order of Latin Letters, Greek letters, superscripts and subscripts. As far as possible generally accepted symbols shall be used. Symbols not available shall be written in permanent black ink.

15. Page numbering

15.1 For items (8) to (14) the page number shall be in small Roman at 15mm from the bottom of the page centrally located.

15.2 Page numbers in Arabic numeral shall start with 2 on the second page of the introduction chapter. There shall be no numbering of pages on which new chapters begin. The number shall be at 15 mm from the top, centrally located. All pages including those containing Figures and Tables must have page numbers, serially arranged.

16. Chapter numbering

16.1 The Chapter shall be numbered in Arabic numerals, Section and sub-section of any chapter shall be in decimal notation. All chapters shall begin on a new page. The titles for chapters, section, and sub-sections shall be in block capitals. The chapter number and title shall be properly centered at the top of the page and should have three spaces between them.

The chapter will be organized as follows.

17. Introduction to the project

17.1 The first chapter will be introductory Chapter. These chapters shall highlight the importance of the investigation and also define the topic and scope of the work envisaged. A typical format for the first three chapters are shown later in the Standard Format for Report Preparation.

18. Review of literature

18.1 This shall form Chapter 4. It shall present a critical appraisal of the previous work done on the topic. The extent of and emphasis on this chapter shall depend on nature of Investigation.

19. Work done

19.1 The work carried out by the student shall be presented in one or more chapters depending on the nature of Investigation. A typical format will be a chapter each on Data Collection analysis Data formation of Recommendations and typical format of these chapters are shown later in the specimen format for Report Preparation

19.2 Each chapter may have several sections and sub-sections with suitable titles.;

19.3 Important and short derivations, and representative data in tables and Figures, shall be presented in these chapters. Information such as lengthy derivations, voluminous tables and large number of figures shall be presented in the Appendix.

19.4 Figures and tables shall be on separate sheet and not inserted on the papers with running text. Depending on the size, figures and tables shall be accommodated on sheets of size 210 x 297 mm or 197 x 450 or 297 x 625 mm. If there are longer tables that cannot be accommodated on these sheets, there shall be a continuation table .Very large figures shall be placed in a pouch at end of the report. All figures and tables included in the Appendices shall be accordingly mentioned in the text, Lettering on figures shall be uniform either in engineering letters or typed. Each figure should be self-sufficient to provide all the information. There must be a title for very figure and table.

19.5 Mathematical portion of the text shall preferably be typed. Where it is not possible, ample space shall be left, and equations and symbols shall be inserted clearly in permanent black ink.

20. Concluding chapters

20.1 Discussion and conclusion

This chapter should include a thorough evaluation of the investigation carried out and shall clearly bring out the contribution. The discussion shall logically lead to certain conclusions and inferences. A suggested scheme of implementation should also be included. Precautions necessary while implementation should also be given.

20.2 Concluding remarks

This may also include limitations of the present study and scope for further work.

21. Appendices

21.1 Appendices shall follow item (21) and will be numbered in Roman capitals: The appendices shall normally contain detailed or lengthy derivations, sample calculation, voluminous tables, large figures and calculations.

22. References

22.1 'Bibliography' shall follow the last chapter. It shall give a list of works (papers, books etc.) referred to in the body of the text and they shall be arranged in the order they are first cited in the text. The numbering shall be in Arabic numerals indicated as superscript along with the author's name in the text. For any paper, the information shall contain the names of the authors, the title of the journal, the volume number underscored, the page number and the year of publication in parenthesis. In the case of reference from Journals and books in language other than English the titles of the journals or books should be transliterated into English and not translated. For any book of the publisher, the edition, and the year of publication in the parenthesis. For papers and books with joint authorship, the name of all the authors shall be reproduced in the same order. The author's name shall begin with the name followed by initials.

For example : Journal

JOURNAL

Vyas A.L. 'Fuzzy Logic' A New Vista for Industrial Engineering; S. & Industrial Engineering News, Vol.2(2), 1995, pp 1-15.

BOOKS

Hedge, B.K.Copen, M.R., - Production Management Text and Cases; Prentice Hall of India, New Delhi, 1972, p.p. 101-105.

23. Acknowledgments

23.1 Acknowledgments shall follow item (22) on a separate sheet. Acknowledgment shall indicate the extent to which assistance has been received by the student in his/her work from various sources. The student should sign on this page.

24. Synopsis (This should be separate from the Report)

Student to Submit a new Synopsis based on the work-done.

24.1 Synopsis has to be typed in loose sheets, stapled and submitted along with the project report. This should give information about the project in a nutshell and should not exceed ten pages.

24.2 Four copies of the project report as well as of the synopsis are to be prepared and 3 copies of each are to be submitted to the Institution. The student will hand over one of each to the Guide and retain one copy of each for himself/herself.

25 An Illustrative format follows

Illustrative Specimen format

1. TITLE PAGE (use Standard Format)

2. CERTIFICATE FROM GUIDE (use Standard Format)

3. ABSTRACT

4. CONTENTS

5. LIST OF TABLES

6. LIST OF FIGURES

Chapter 1 PREAMBLE

1.1 INTRODUCTION

1.2 PROBLEM ON HAND

1.3 IMPORTANCE OF THE PROBLEM

1.4 SCOPE OF THE PROJECT

Chapter 2 DETAILS OF THE ORGANIZATION

2.1 INTRODUCTION'

2.2 THE ORGANIZATION

2.2.1 PRODUCTS

2.2.2 PROCESSES

2.2.3 FACILITIES

2.2.4 ORGANIZATION STRUCTURE

2.3 ORGANIZATIONAL BUSINESS PROFILE

2.4 OTHER RELEVANT INFORMATION

2.5 CONCLUSION

Chapter	**3**	**THE PROBLEM ON HAND**
	3.1	INTRODUCTION
	3.2	DETAILS OF PROBLEM
	3.2.1	HISTORICAL PERSPECTIVE
	3.2.2	CAUSE AND EFFECT RELATIONSHIPS
	3.2.3	CRITICALITY OF THE PROBLEM
	3.3	**CONCLUSION**
Chapter	**4.**	**RELEVANT LITERATURE REVIEW**
	4.1	INTRODUCTION
	4.2	
	4.3	(Presentation of material collected through review of relevant literature quoting the sources of each material)
	-	Say up to section 4.6
	4.7	CONCLUSION
Chapter	**5.**	**DATA COLLECTION AND ANALYSIS**
	5.1	THE TYPE OF DATA NEEDED.
	5.2	THE SOURCES FOR THE COLLECTION OF DATA
	5.3	THE DETAILS OF THE DATA COLLECTED
	5.4	PROCESSING OF THE DATA FOR ANALYSIS
	5.5	CONCLUSION
Chapter	**6**	**ANALYSIS OF DATA**
	6.1	CHOICE OF TECHNIQUES Brief description of the choice of the techniques utilized and the justification for their use.
	6.2	Devote one Section each to one analysis…..**<u>say upto section 6.9</u>** The analysis carried out and technique utilized (give suitable Headings) (All the steps in the analysis of the Data and the relevant theory have to be shown)
	6.10	CONSOLIDATED RESULTS Give a consolidated representation of result of the analysis using necessary number of sections and headings…..**say upto section 6.14**
	6.15	GENERAL OBSERVATIONS
Chapter	**7.**	**RECOMMENDATIONS**
	7.1	Brief description of Recommendations
	7.2	Details of each recommendation, discussion of its technical suitability, economic justification and feasibility of implementation.

Do's and Don'ts of Project Proposal

1. Please refer to model project synopsis displayed on our website www.iiie-india.com for your guidance.

2. Check the details of Guide- address, email ID, Contact details, signature et

3. Provide relevant data to justify the problem / your statement.

4. Ensure that your explanation is simple and logical way. Do not write irrelevant information. Use full sentences

5. Explain important concepts, definitions and abbreviation. Related for your Project.

6. Carry out brief literature survey related to your project from Books, Journals and Internet during submission of Synopsis. Detail Literature Survey to be included in final Report.

7. Please Pay proper attentions to the guidelines. Do not take short cuts.

8. Do not use power point type presentation language / slides. Write full sentences.

9. Project Report is Technical Document not commercial Advertisement Pl Do not use fancy fonts / colors/ Font Sizes.

10. Please ensure title of project is simple and easy to understand. Do not unnecessary complicate the title.

11. Aim / Objective and scope of project to be given.

12. It is observed that students try to include too many things as objective which is not possible for them to carry out, focus on important things only.

13. Do not speculate at the beginning of the project.

Note your project report will be evaluated in reference to project proposal, if it is observed that Project Report is different from approved Project Proposal then the project proposal shall be rejected.

(Sample Project Proposal front cover)

IMPLEMENTATION OF LEAN MANAGEMENT (Title)

{font Arial black 18}

A PROJECT PROPOSAL *{font monotype Corsiva 22}*

SUBMITTED TO {font Arial 14}

INDIAN INSTITUTION OF INDUSTRIAL ENGINEERING

{font Arial BLACK 16}

To be carried out at:
(Name of Organization)
{Font Arial Black 14}

By {font Arial 14}

AZAD SINGH (S-23051) {font VERDANA14}

Sample Project Report front cover

IMPLEMENTATION OF LEAN MANAGEMENT { font Arial black 18 }

A PROJECT REPORT *(font monotype Corsiva 22)*

SUBMITTED TO { font Arial 14}

INDIAN INSTITUTION OF INDUSTRIAL ENGINEERING { font Arial BLACK 16 }

FOR THE PARTIAL FULFILLMENT OF THE GRADUATESHIP CERTIFICATE
{ font Arial BLACK 14 }
in{ font Arial 14 }
INDUSTRIAL ENGINEERING { font Arial 14 }

By{ font Arial 14 }

AZAD SINGH (S-23051)(font VERDANA14 }

INDIAN INSTITUTION OF INDUSTRIAL ENGINEERING
NAVI MUMBAI, INDIA
2014{ font Arial 16 }