M.Tech - Industrial Engineering & Management (2-Year)
at
West Bengal University of Technology(In-House Course
Course Structure

Semester-I (22 Credits)

Compulsory Papers	Credit points	L-T-P
IEM101-Quantitative Methods and Simulation Technology	4	3-1-1
IEM102-Manufacturing Systems Engineering	4	3-1-1
IEM103-Manufacturing Processes	3	3-0-1
IEM104-Production Planning and Materials Management	3	3-0-1

Electives (Any two)	Credit points	L-T-P
IEM105A-Enterprise Resource Planning and Supply Chain Management	3	3-0-1
IEM105B-Project Management and Technology	3	3-0-1
IEM105C-Computer Integrated Manufacturing	3	3-0-1

Sessional
IEM181-Seminar Presentation(Compulsory)	2	

Semester-II (22 Credits)

Compulsory Papers	Credit points	L-T-P
IEM201-Managerial Economics	3	3-0-0
IEM202-Quality Engineering and Management	3	3-0-1
IEM203-Product Design and Development	4	3-1-1

Electives (Any one)	Credit points	L-T-P
IEM204A-Ergonomics and Industrial Safety	3	3-0-1
IEM204B-Reliability Engineering and Terotechnology	3	3-0-1
IEM204C-Systems Analysis Techniques	3	3-0-1

Term Paper Assignment :
IEM281-(guided only, compulsory course)	6
IEM282-Comprehensive Viva-Voce(Compulsory)	3

Semester-III (18 Credits)

IEM381-Project/Thesis and Viva-Voce	18

Semester-IV (18 Credits)

IEM481-Project / Thesis and Viva Voce	18

Total of all four Semesters (Semester-I through Semester-IV) **: 80 Credits**

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Syllabus

Quantitative Methods and Simulation Technology (QMST)

Concepts in Discrete Event System Simulation; Random Number Generation; Application in Scheduling, Queuing systems, inventory systems; Simulation Packages; Simulation of Manufacturing Systems

Introduction to System Dynamics: Causal-Loop Diagram, Flow Diagram

Multi – objective decision making; Network Methods, Dynamic Programming, Non – linear programming, heuristics for optimization

References:

1) P K J Mahaptra,et al – System Dynamics, Orient Longman

   Sushil System Dynamics – A Practical Approach for Management Problems – Wiley Eastern Limited

   Narsing Deo, System Simulation with Digital Computer PHI (EEE)

   Geoferry Gordan, System Simulation, PHI (EEE)

   W.D.Kelton, R.P. Sadowski (1998), Simulation with Arena, Mc Graw Hill International – Industrial Engineering Series

   J.K.Sharma Quantitative Techniques for Managerial Decisions – MacMillian India Ltd.

Manufacturing Systems Engineering (MSE)

Production System Design; Facilities Planning – Facilities Location – Layout Design & Material Handling Systems; Line Balancing; Group Technology; Ergonomics and Work Study; Incentive Schemes; Job Evaluation; Value Engineering; Process Reengineering; Productivity Engineering; Systems of Manufacturing Flow & Flexible Cells; Production and Service Systems

References:

1) R.L.Francis and J.A. White and Mc Ginnies, Facilities Layout and Location – Prentice Hall India

2) J.M.Apple (1972) Plant Layout and Material Handling – McGraw Hill

3) K.Hitomi (1996) , Manufacturing Systems Engineering, Viva Books Pvt. Ltd., India

4) I.L.O Manual on Work Study, Geneva (1957)

5) H.B.Maynard, Hand Book of Industrial Engineering

6) B.S. Blanchard, Systems Engineering and Management

7) D.K.Carr and H.J. Johansson (1995) Best Practices in Re Engineering, McGraw Hill, Inc

8) Lon Roberts, Process Re Engineering – The Key to achieving Break through Success – TMH

9)   James A. Fitzzimmons and Mona J. Fitzzimmons (2000T), Service Management, Operations, Strategy and JIT, Third Edition, Mc Graw Hill,

10)   Konz, Stephan, Work Design : Industrial Ergonomics (3rd Ed) Willey, NY 1920

11)   Mc Cormick, E.I. and Marll Sanders – Human factors in Engineering and Design (7th Ed) McGraw Hill NY 1992

12)   Woodson Wesley E and Paggy Tillman, Human Factor Design Handbook 2nd ED),   McGraw Hill NY 1992

13)   Marvil E. Mundel, Motion and Time Study, PHI

14)   W.L. Gage, Value Analysis, McGraw Hill

15)   David Sumanth, Productivity Engineering & Management

16)   William W.Luggen Manufacturing Cells and Systems, Prentice Hall, N.Y.

17)   L.D.Miles, Techniques of Value Analysis and Engineering, 1972, Mc Graw Hill.

18)   S.S.Iyer, Value Engineering – A How to Manual, 2nd ED, New Age International Publishers.

Manufacturing Processes (MP)

Principles and Practices in Primary Production Process; Hot and Cold Working Process, formability of Engineering Materials, Powder Metallurgy Processes; Manufacturing of Composites; Machining of Advanced Materials; CNC Machining;
Extrusion; Electro-spark & Electrochemical Machining Process.
Joining Process; Forming Process.
Special Purpose Machines and Mechanized Transfers
Introduction to Advanced Machining Methods: Laser, Plasma; Ultrasonic systems, Micro Machining.

References:

1. Lindberg - Process and Materials of Manufacture, 4th Ed, PHI

2. De Gamo et al - Materials and Process in Manufacturing, 8th Ed, PHI

3. Chitale and Gupta – Product Design and Manufacturing, 2nd Ed, PHI

4. Parashar & Mittal, Elements of Manufacturing Processes, PHI

5. Pandey and Shah, Modern Machining Process

6. Production Technology by HMT

7. A. Bhattacharya, New Technology

8. MHA Kempster, Introduction to Jigs and Fixtures Design, ELBS, 1974

9. ASTME – Fundamentals of Tools Design, PHI (1979)

10. Rankey Paul, Designs and Operations of FMS – IFS Publication UK

Production Planning and Materials Management (PPMM)

Production Planning and Control; Industrial Scheduling; Job – shop Planning;
Demand Forecasting – Methods and Uses
JIT Manufacturing – Kanban System
Synchronous Manufacturing and Theory of Constraints
Operations Strategies; Hierarchical Planning System – Aggregate Planning & Manufacturing Resource Planning

Materials Management Concepts and Objectives for material function, administrative practices, purchasing system, purchasing cycle, Make or Buy decisions, Vendor Development and Evaluation, Inventory Planning, Control and Management: Selective Inventory Control; EOQ Models and its variants, safety stock, Stocking Policy, Stores Management. Procurements Negotiations and Pricing; Purchase Procedures; Policy and Procedure Manuals.

Demand Assessment; Materials Requirement Planning (MRP I)

Material Handling, Physical Distribution and logistics; Standardization

Computer Application in Materials Management and MIS.

References:

1) S.Nahmias, (1997), Production and Operations Analysis, R. Irwin.

2) D.D. Bedworth and J.E.Bailey (1983), Integrated Production Control System Management, Analysis and Design, John Wiley

3) M.Pinedo and X.Chao (1999), Operations Scheduling, Mc Graw Hill.

4) R.B.Chase, N.J. Aquilano and F.R.Jacobs, Production and Operatons Management – Manufacturing and Services 2nd Ed, TMH

5) John E.Biegel – Production Control – a Quantitative Approval, PHI

6) E.G. Coffman (1976), Computer and Jobshop Scheduling Theory, Wiley

7) Hanke, Wichem & Reitsch, Business Forecasting, 7th Ed, PHI

8) Bloomberg, Lemay and Hanna, Logistics, PHI

9)R.B.Ballot (1980), Materials Manamegement, Taraporewala, Bombay.]

10) P.Gopalkrishnan (1994), Handbook of Materials Management, PHI

11)P.Gopalkrishnan and M.S.Sandilya (1981), Inventory Management, PHI

12)M.S.Shah (1988), An Integrated Concept of Materials Management, TMH

13) J. Buchan, E.Koenigsberg, Scientific Inventory Management – PHI

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ERP and Supply Chain Management (ERPSCM)

The emergence and need for ERP concept; ERP Systems for manufacturing and service based organizations; Modules and Architectures of a typical ERP System; identification of suitable platforms; Selection and implementation of ERP Systems;

Strategic framework for Supply Chain, Materials Management Functions, Forecasting and Market Analysis, Purchasing and procurement, Physical Supply Inventory Management, Supply Chain Coordination; Bullwhip Effect; MRP and Capacity Planning; Logistical Management – Materials Handling, Warehouse / Storage and Retrieval, Transportation and Distribution. IT and Role of E – Business.

References:

1) Garg and Venkitakrishnan – Enterprise Resource Planning: Concepts and Practice, 2nd Ed, PHI

2) Garg and Venkitakrishnan – ERP Ware – ERP Implementation Framework, PHI

3) ASAP Consultancy and J.Blain, Understanding SAP R/3, PHI Ltd.

4) Supply Chain Management – 2001, Strategy, Planning & Operation. Sunil Chopra & Peter Meindl; Pearson Education Asia, ISBN: 81-7808-272-1.

5) Robert B Handfield, Ernest L Nichols, Jr. Supply Chain Redesign – Transforming Supply Chains into Integrated Value Syste ms, 2002, Pearson Education Inc, ISBN: 81-297-0113-8

6) Jeremy F Shapiro, Duxbury; Modelling the Supply Chain, 2002, Thomson Learning, ISBN 0-534-37363

7) David Simchi Levi, Philip Kaminsky & Edith Simchi Levi; Designing & Managing the Supply Chain; Mc Graw Hill

8) Dr. Dale S. Rogers,Dr. Ronald S. Tibben-Lembke Going Backwards: Reverse Logistics Trends and Practices,University of Nevada, Reno, Center for Logistics Management

9)Alexis Leon, Enterprise Resource Planning, 1999, Tata Mc Graw Hill Publishing Company Ltd.,

10) Thomas Volloman , etal , Manufacturing Planning & Controls.

Project Management and Technology (PMT)

Project Characteristics, Project Selection, Economics, Feasibility Assessment and Evaluation, Structuring, Organizational and Work Breakdown, Scheduling, Budgeting, Life Cycle Costing, Project Control; PERT/CPM, Crashing/Time-Cost Trade-off Contracts; Resource Leveling, Limited Resource Allocation; Line of Balance.

Computer Supports; MS Project / Prima Vera Software Application and Use

References:

1) Wiest & Levy, Management Guide to PERT/CPM : with GERT/PDM/DCPM and other networks, 2nd Ed, PHI

2) Narendra Singh, Project Management and Control, Himalaya Publishing House

3)   Yenyee Chong, Evelyn May Brown, Managing Project Risk – Business Risk Management for Project Leaders, PHI

4)MS Project, Microsoft Network

5)   Primavera Manual

6)   Prince Manual

7)   Bob Huges and Mike Cotterell, Software Project Management, 3rd ED, TMH

8)   Harold Kerzner, Project Management – A system approach to Planning Scheduling & Controlling, CBS Publishers & Distributors

9)   Beningston Lawrence - Project Management, McGraw Hill

Computer Integrated Manufacturing (CIM)

Fundamentals of Numerical Control (NC) and Computer Numerical Control (CNC); Direct Numerical Control (DNC) NC Part Programming.

Industrial Robot Application; Robot Programming Fundamentals;
Automated Guided Vehicle System; Automated Storage Systems;
Flexible Manufacturing Systems (FMS); FMS Components;
Transfer Lines and Automated Manufacturing Systems Automated Assembly.
Product Design and CAD; Computer Aided Manufacturing (CAM);
Computer Aided Process Planning (CAPP)

References:

1) Mikell P.Groover, Automation, Production Systems and Computer Integrated Manufacturing 2nd Ed, Pearson Education.

2) Chris Mc Mahon and Jimmie Browne, CAD CAM – Principles, Practice and Manufacturing Management, 2nd Ed (Addison – Wesley), Pearson Education, Asia

3) P. Radhakrishnan, S.Subramanyam, CAD CAM CIM, New Age International Publishers.

4) Vajpayee, Principles of Computer Integrated Manufacturing, PHI

Managerial Economics (ME)

Introduction:Nature, scope and application of Managerial Economics.
Time Value of Money: Nominal and effective interest rates and continuous   compounding
Role of engineering economy in the decision making process
Demand: Demand Analysis; Laws of Demand; Determinants of Demand; Elasticity of Demand; Demand forecasting.
Production and Costs: Production Theory & Analysis, Cost Analysis & Cost estimation; Break-even analysis. Replacement analysis. Using Optimisation techniques in Cost   Decisions
Market structure & Capacity Analysis: Competition and Monopoly; Game Theory and Strategic Behaviour
Pricing Decisions: Pricing of goods and services, Input factor pricing
Capital budgeting: Rate of return computation & Cost of Capital; Payback period; Present worth and capitalized cost evaluation; Benefit/Cost ratio evaluation
Depreciation: Concepts and computation models
Evaluating Business economics: Analysis and Interpretation of Financial statements

References:

1)   Petersen, C & Lewis, W.C.: Managerial Economics, PHI
2)   Hailstones, Thomas J. and Rathwell, John C., Managerial Economics, Prentice Hall International,
3)   Perk, Contemporary Engineering Economics, 3rd Ed, PHI
4)   Panneerselvam, Engineering Economics, PHI
5)   Thesen & Fabrycky, Engineering Economy, 9th Ed, PHI
6)   Kreps, D., A Course in Microeconomic Theory, Press, N.J.
7)   Chopra, O.P., Managerial Economics, Tata-McGraw Hill, .
8)   Baumol, W.J., Economic Theory and Operations Analysis, Prentice Hall International,
9)   Agarwal, Manju, Economics for decision Making, Indian Institute of Finance, 1997 .
10)   J.R. and Chang, Simon, Principles of Managerial Economics, Prentice Hall International.

Quality Engineering and Management (QEM)

Concepts and approaches in Quality Management and Assurance Technology;

Product Quality Control : Acceptance Sampling Methods; Metrology - Procedures and Methodology : Instruments : Coordinate Measuring Machines Process Evaluation and Control: Control Charts; Design of Experiment; Process Capability Studies and Indices.

Robust Design; Taguchi Principle and methods;

Total Quality Management: Approach, Methodologies and Procedures; Quality Tools – Advanced Tools: Cause Effect Diagram, FMEA / FMECA, Fault Tree Analysis, QFD, Kaizen Systems;

Six Sigma Methods. ISO 9000 QMS. Applications in service sector.

References:

1) A. Zaidi (1995), SPC: Concept, Methodologies and Tools, PHI

2) S.Halpern (1979), The Assurance Sciences, PHI

3) A.V. Feizenbaum (1987) Total Quality Control, Mc Graw Hill.

4) D.C. Montogomery (1984), Design and Analysis of Experiments, John Wiley & Sons.

5) Besterfield et al – Total Quality Management

6) Taguchi G, Introduction to Quality Engineering, Bedford : Asian Productivity Organisation (1986)

7) S.Pande, Roebrt P. Neuman, Ronald R Cavanagh – The Six Sigma Way – How GE, Motorola ands other top companies are honing their performances.

8) Doeblin, E.O ., Measurement Systems : Applications and Design, Fourth Edition, Mc Graw Hill, Inc, NY, 1990

9) ASTME – Handbook of Industrial Metrology, PHI

10) Juran, Handbook & Quality Control, Mc Graw Hill.

11) Juran, Gryna, Quality Planning and Analysis, TMH

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Product Design and Development (PDD)

Introduction: Challenges of product development; Successful product development; Quality aspect of product design; Market Research; Survey.
Identify customer needs and Product Planning Processes. Product specifications: Process of setting specifications. Concept generation – selection – testing.
Product Architecture: Implication of architecture, establishing the architecture, related   system level design issue.   Industrial design : Overview
Design for manufacturing and assembly - tolerancing, design of gauges; Design for environment; Robust design. Prototyping; Engineering Materials. Concurrent engineering.   Product costing, value engineering, Aesthetic concepts; visual effects of form and colour.   Product data management.
            Innovation and Creativity in Product Design. Case Studies.

References:

1. Product Design and Development: Karl T. Ulrich, Steven G. Eppinger; Irwin McGrawHill
2. Product design and Manufacture: A.C.Chitale and R.C. Gupta; PHI
3. New Product Development: Tim Jones, Butterworth, Heinmann, Oxford, 1997.
4. Product Design for Manufacture and Assembly: Geoffrey Boothroyd, Peter Dewhurst and Winston Knight.
5. Product Design : Otto and Wood; Pearson education.
6. Industrial Design for Engineers: Mayall W.H, London, Hiffee books Ltd, 1988
7. Applied Ergonomics, Hand Book: Brien Shakel (Edited) Butterworth Scientific, London 1988.
8. Introduction to ergonomics – R.C.Bridger, McGrawHill Pub.
9. Human Factor Engineering – Sanders & McCormick, McGrawhill Publications.

Ergonomics and Industrial Safety (EIS)

Introduction - general approach to the man-machine relationship-workstation design-working position and posture. An approach to industrial design - elements of design structure for industrial design in engineering applications in manufacturing systems.

Control and Displays: configurations and sizes of various controls and displays;- design of controls in automobiles, machine tools etc., - design of furniture, design of instruments.

Ergonomics and Manufacturing: Ergonomics and product design; ergonomics in automated Systems;Anthropomorphic data and its applications in ergonomic design; limitations of anthropomorphic data - use of computerized database.

Safety & Occupational Health and Environment: Application of Ergonomics in industry for Safety, Health and Environment Control;
Prevention and specific safety measures for manufacturing and processing industry – safety in the use of machines, precaution for certain chemical industry.

Environmental Safety and ISO 14000 System.

Occupational Health – Health and Safety consideration; Personal protective Equipment.

References:

1) Industrial Design for Engineers: Mayall W.H, London, Hiffee books Ltd, 1988
2) Applied Ergonomics, Hand Book: Brien Shakel (Edited) Butterworth Scientific, London 1988.
3) Introduction to ergonomics – R.C.Bridger, McGrawHill Pub.
4) Human Factor Engineering – Sanders & McCormick, McGrawhill Publications.

5) Colling D.A., Industrial Safety Management and Technology, PHI

6) Della D.E., and Giustina, Safety and Environmental Management, Van Nostrand Reinheld International Thomson Publishing Inc.

7)Goetsch D. L., Occupational Safety and Health for technologists, Engineers and Managers, PHI

8) Industrial Safety and Polution Control Handbook, National Safety Council and Associate(Data) Publishers Pvt.Ltd.

9) Reese, C.D.,(2001), Accident/Incident Prevention Techniques, N.Y, Taylor & Francis, Inc.

10) Michand, P.A., Accident Prevention and OSHA Compliance, Boca Raton, FL : CRC Press/ Lewis Publisher.

<u>**RET**</u>   **(Reliability Engineering & Terotechnology)**

Introduction: General Objectives, Functions; Organization and Administration of Maintenance Systems; Requirements, Failure Analysis; Source Identification, Classification and selectivity of failure; statistical and Reliability Concepts and models for Failure Analysis.

Reliability Models – Series, Parallel, Hybrid

Classification and Maintenance Systems – Basis and Models

Decision Models for Maintenance Planning: Operation and Control, Optimum Level of Maintenance; Replacement aspects; Scheduling of Activities; Cost Management and budgeting; Work Measurement and Controls.

Availability, Maintainability – MTBF, MTTR; Breakdown Maintenance, Preventive Maintenance, Predictive Maintenance. Total Productive Maintenance. Spare Parts Management.

<u>References:</u>

1)   A.K.Gupta, Reliability Engineering and Terotechnology, Macmillan India Ltd.

2)   Dhilon, Engineering Maintainability – How to Design for Reliability and Easy maintenance, PHI

3)   Mishra and Pathak – Maintenance Engineering and Management, PHI.

4)   Gopalkrishnan & Banerji - Maintenance and Spare Parts Management, PHI.

5)   Masters, Introduction to Environmental Engineering and Science

6)   Higgins, L.C. and L.C. Morrow (eds), Maintenance Engineering Handbook, McGraw Hill

7)   Heintzelman, J.E., The Complete Handbook of Maintenance Management.

8)   H.P. Garg, Industrial Maintenance

Systems Analysis Techniques (SAT)

Introduction to Analysis and Design of intelligent systems using soft computing techniques.
Application of soft computing; Soft Computing Methods.
Artificial Neural Network(ANN): Fundamental Model, Learning Rules
Hebb Net Architecture, Algorithm, linear separability; Perceptron Networks – single and m multilayer; Adeline and Madeline Networks;
Feedback Networks – Discrete Hopfield Net – architecture, training and application algorithm, analysis(ATTAA)
Feed Forward Networks(ATTAA) : Back Propagation, Radial Basis Function
Self Organising Feature Map : Kohonen SOM, LVQ
Fuzzy Systems / Logic – Fuzzy Set Theory; Fuzzy Sets Applications
Hybrid : Neuro-Fuzzy Modeling
Introduction to Genetic Algorithm
Software in ANN, Fuzzy and Hybrid Systems.

References:

1. J.S.R Jang, C.T.Sun, E.Mizutani; Neuro-Fuzzy and Soft Computing, PHI
2. K. Gurney, An Introduction to Neural Networks, UCL Press.
3. Vose M. D., The Simple genetic Algorithm, MIT Press(1999)
4. Andries P Engelbrecht, Computational Intelligence, John Wiley & Sons Ltd., 2003
5. Timothy J Ross, Fuzzy Logic with Engineering Applications, McGraw Hill 1997
6. S. Rajasekaran and G.A.V.Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI
7. Davis E Goldberg, Genetic Algorithms: Search, Optimisation and Machine Learning, Addison Wesley, N.Y., 1989