SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR

An Autonomous College of Rashtrasant Tukadoji Maharaj
Nagpur University, Nagpur, Maharashtra, India

TEACHING SCHEME & SYLLABUS
2015-16

M.TECH. INDUSTRIAL ENGINEERING

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ISO 9001 : 2008 CERTIFIED ORGANISATION

Shri Ramdeobaba College of Engineering & Management has the distinction of offering first inter disciplinarily post graduate programme in Industrial Engineering in the year 2004.

This Post Graduate programme has the available expertise of its core faculty supported by faculty of other departments and expert faculty from other engineering colleges. Faculty specialises in Operations Research, Quality Management, Human factors Engineering, Simulation and Modelling. Most of the faculty members are doctorates and deeply involved in the research work. The programme is functioning with the state of the art laboratories and close association with industries around.

All the Post Graduate Projects are based on live problems offered by the industry.

Program Educational Objectives are as follows:

1. Programme will prepare students to work in any engineering organization and undertake research work.
2. Programme will ensure development of problem solving ability through the use of industrial engineering tools and software.
3. Programme will encourage development of independent thinking and also the ability to work in teams through live projects undertaken in industry.

Scheme of Examination of Master of Technology (Industrial Engineering)
Semester Pattern

I Semester M. Tech. (Industrial Engineering)

Sr. No.	Code	Course	L	T	P	Credits	Maximum Marks			Exam Duration
							Internal Assessment	End Sem Exam	Total	
1	INT501	Operations Research	4	0	0	8	40	60	100	3 Hrs
2	INP501	Operations Research Lab	0	0	2	2	25	25	50	--
3	INT502	Computers and Database Management	4	0	0	8	40	60	100	3 Hrs
4	INP502	Computers and Database Management Lab	0	0	2	2	25	25	50	--
5	INT503	Statistics & Quality Control	4	0	0	8	40	60	100	3 Hrs
6	INP503	Statistics and Quality Control Lab	0	0	2	2	25	25	50	--
7	INT504	Personnel Management and Industrial Relations	4	0	0	8	40	60	100	3 Hrs
8	INT505	Planning and Controlling of Manufacturing Systems	4	0	0	8	40	60	100	3 Hrs
		TOTAL	**20**	**0**	**6**	**46**				

Scheme of Examination of Master of Technology (Industrial Engineering)
Semester Pattern

II Semester M. Tech. (Industrial Engineering)

Sr. No.	Code	Course	L	T	P	Credits	Maximum Marks			Exam Duration
							Internal Assessment	End Sem Exam	Total	
1	INT506	Automation in Production	4	0	0	8	40	60	100	3 Hrs
2	INP506	Automation in Production Lab	0	0	2	2	25	25	50	--
3	INT507	Methods Engineering and Ergonomics	4	0	0	8	40	60	100	3 Hrs
4	INP507	Methods Engineering and Ergonomics Lab	0	0	2	2	25	25	50	--
5	INT508	Manufacturing Economics and Analysis	4	0	0	8	40	60	100	3 Hrs
6	INT509	Project Evaluation and Management	4	0	0	8	40	60	100	3 Hrs
7	INT510	Maintenance Engineering	4	0	0	8	40	60	100	3 Hrs
		TOTAL	**20**	**0**	**4**	**44**				

Scheme of Examination of Master of Technology (Industrial Engineering)
Semester Pattern

III Semester M. Tech. (Industrial Engineering)

Sr. No.	Code	Course	L	T	P	Credits	Maximum Marks			Exam Duration
							Internal Assessment	End Sem Exam	Total	
1	INT601	Research Methodology	3	0	0	6	40	60	100	3 Hrs
2	INT602	Elective - I	3	0	0	6	40	60	100	3 Hrs
3	INT603	Elective -II	3	0	0	6	40	60	100	3 Hrs
4	INP604	Project Phase - I	0	0	6	24	50	100	150	--
		TOTAL	**9**	**0**	**6**	**42**				

Course Code	Elective I	Course Code	Elective II
INT602-1	Marketing Management	INT603-1	Materials Management
INT602-2	Flexible Manufacturing System & Robotics	INT603-2	Mechatronics
INT602-3	Total Quality Management	INT603-3	Value Engineering
INT602-4	Energy Management	INT603-4	Industrial Design
INT602-5	System Design & Engineering	INT603-5	Information Systems in Engineering
INT602-6	Communication	INT603-6	Reliability Engineering

Scheme of Examination of Master of Technology (Industrial Engineering)
Semester Pattern

IV Semester M. Tech (Industrial Engineering)

Sr. No.	Code	Course	L	T	P	Credits	Maximum Marks			Exam Duration
							Internal Assessment	End Sem Exam	Total	
1	INP605	Project Phase - II	0	0	12	48	50	100	150	
		TOTAL	**0**	**0**	**12**	**48**				

Syllabus of Semester I, M. Tech (Industrial Engineering)

Course Code: INT501 **Course: Operations Research**

L: 4Hrs. T: 0Hrs. P: 0 Hrs. Per week **Total Credits: 8**

Course Outcomes :

1. Formulate given situation to get better visualization of objectives and constraints.
2. Represent any project through a network and understand its critical activities.
3. Apply the concepts covered in Markov Chain Analysis.
4. Apply the concept of dynamic programming to solve problems of discreet and continuous variables.
5. Able to apply the concept of non-linear programming and goal programming.
6. Carryout sensitivity analysis (post optimality analysis)
7. Model any real-world problem into a simulation model

Syllabus:

Introduction

Introduction to O.R, Optimization Techniques, Model Formulation, Assignment, Transportation models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models, Deterministic and Probabilistic Models. Competitive Models, Waiting Line Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Shortest Route Problems. Investment Models, Game Theory Simulation, Project Networks.

Reference Books:

1. Operations Research: Hitler Libermann, McGraw Hill Pub.
2. Operations Research: Pannerselvam, Prentice Hall of India
3. Principles of Operations Research: Harvey M Wagner, Prentice Hall of India

Syllabus of Semester I, M. Tech (Industrial Engineering)

Course Code : INP501 **Course: Operation Research Laboratory**

L:0 Hr.,T:0 Mrs., P:2 Mrs., Per week **Total Credits : 2**

Practicals based on theory syllabus.

Syllabus of Semester I, M. Tech (Industrial Engineering)

Course Code: INT502 **Course: Computers & Database Management**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 8**

Course Outcomes :

1. To get Familiarized with the various hardware and its architecture.
2. To realize the importance of information for decision making in the organizing.
3. Use of the database in strategic planning process.
4. To do the cost benefit analysis of information System.

Syllabus:

Various types of Hardware and Software in common use as applicable to Information Technology. The different Hardware Application Architectures available e.g. Centralized, Distributed, Client-Server. Concept of General System Theory and their applications to Information Systems. Designing Data and Information Architecture to assist and improve planning, decision making and control. Use of information / data for decision making at the various levels of the organization and components of the information system which can support those decisions i.e. transaction processing systems, management information system etc. Cost benefit analysis of I.T, Different methods of data collection. Electronic Commerce and its impact on Business Strategy. Use of databases and planning modules in strategic planning process e.g. external database economic models, forecasting and modeling packages strategy of information development and management on organization structure. Safety of data, evaluation of database system to avoid fraud, ERP and Relational Database Management System.

Reference Books:

1. A Profile of Information Technology: Computer Digest: H.R Banerjee, Jaico Publications.
2. Management Information System: Gordon B. Davis andM.H. Olson, Tata McGrawHill.
3. Computer Fundamental: Concept, Systems and Applications: RK. Sinha.
4. Database system concept: Henry Korth and S. Sudarshan, Tata McGraw Hill.
5. Complete reference Oracle 8: Oracle Press.

Syllabus of Semester I, M. Tech (Industrial Engineering)

Course Code : INP502 **Course : COMPUTERS & DATABASE MANAGEMENT LAB**

L:0 Hr.,T:0 Mrs., P:2 Mrs., Per week **Total Credits : 2**

Practica1s based on theory syllabus.

Practica1s :

1. Development of software for file handling system.
2. Development of programs using simple SQL commands.
3. Use of DDL commands on Computer (MS-SQL)
4. Use of DML Commands
5. Development of database management system for any Industrial application
6. Specific application system progress for detail study.
7. Development of any practical oriented system as applicable in industry

Syllabus of Semester I, M. Tech (Industrial Engineering)

Course Code: INT503 **Course: Statistics and Quality Control**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 8**

Course Outcomes:

1. Understand the applications of Probability distribution in predicting behavior of the process.
2. Develop conceptual understanding of Quality of Product and Process and its Management.
3. Develop Control charts for process control.
4. Develop understanding of sampling plans for acceptance of materials.
5. Understanding of concepts such as six sigma, Lean Production and JIT

Syllabus:

I. Statistical Methods Useful in Quality Improvement Introduction to Quality, Meaning of Quality, Brief History of Quality Control and Improvement, Statistical Methods of Quality Control and Improvement, Other Aspects of Quality Control and Improvement. Modeling Process Quality, Describing Variation, Important Discrete Distributions, Important Continuous Distributions, Inferences about Process Quality Statistics and Sampling Distributions, Point Estimation of Process Parameters, Statistical Inference for Two Samples, Statistical Inference for more than Two Populations, Basic Methods of Statistical Process Control and Capability Analysis

II. Methods and Philosophy of Statistical Process Control Introduction, Chance and Assignable Causes of Quality, Statistical Basis of the Control Chart, QC tools, New seven QC tools, Pareto analysis, Implementing SPC, An Application of SPC, Control Charts for Variables, Control Charts for x bar and R, Applications of Variables Control Charts. Control Charts for Attributes, Control Charts for Fraction Nonconforming, Control Charts for Nonconformities (Defects), Choice between Attributes and Variables Control Charts, Guidelines for Implementing Control Charts. Process and Measurement System Capability Analysis, Process Capability Analysis Using a Histogram or a Probability Plot, Process Capability Ratios, Process Capability Analysis Using a Control Chart, Process Capability Analysis Using Designed Experiments, Gage and Measurement System Capability Studies, Setting Specification Limits on Discrete Components.

III. Acceptance Sampling Lot-by-Lot Acceptance Sampling for Attributes, Acceptance Sampling Problem, Single-Sampling Plans for Attributes, Double, Multiple, and Sequential Sampling, Military Standard 105E (ANSI/ASQC Z1.4, ISO 2859), Conceptual understanding of AQL, LTPD. Applications of OC curve.

IV. Six Sigma/Lean Six Sigma, DMAIC, Application of Six Sigma tools to minimize production variability, Taguchi Loss Function, Lean Production and Quality, The Birth of Lean Production, The Lean Production System, Stability, Just-In-Time

Reference Books:

1. Statistical Quality Control: E. L. Grant, Richard S. Leavenworth, Tata McGraw Hill.
2. Quality Planning and Analysis: Juran, Tata McGraw-Hill.
3. The Assurance Sciences: S. Halpern, Prentice Hall India Ltd. New Delhi,
4. Managerial Statistics: Winston and Zappen Duxbury, Thompson Learning Inc.

Syllabus of Semester I, M. Tech (Industrial Engineering)

Course Code : INP503 **Course : STATISTICS AND QUALITY CONTROL LAB**

L:0 Hr.,T:0 Mrs., P:2 Mrs., Per week **Total Credits : 2**

Practicals based on theory syllabus

Syllabus of Semester I, M. Tech (Industrial Engineering)

Course Code: INT504 **Course: Personnel Management And Industrial Relations**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 8**

Course Outcomes :

1. To understand the scope & Objective of personnel Management.
2. To get knowledge about personnel functions like personnel planning, recruitment training appraisal etc.
3. To become aware about employee health security welfare related issues.
4. To understand nature, Causes and settlement of Industrial disputes.
5. To know about role, functions of Trade unions. And related labour legislations.

Syllabus :

Human behavior of an individual as a member of a small group and as a member of an organization Influence of culture; organizational, social, national and international on individual. Analysis of dynamic behavior of organization by simulation, structure of organization and flow of men, money, material, information capital, equipment and order, system models to evolve effective policies for management.

Scope and objective of personnel management, personnel planning, labor market, recruitment, training and placement, Job evaluation, Merit rating, wage incentives, employee health, security and welfare, morale, and motivation, industrial disputes, voluntary and compulsory settlement, trade unionism, labour legislations, performance appraisal and evaluation.

Reference Books :

1. Human Resources Management: K. Aswathappa, Tata McGraw Hill.
2. Dynamics of Industrial Relations: C. B. Mamoria, Himalaya Publication.
3. Personnel Management: Edwin Flippo, Tata McGrawHill.
4. Fundamentals of Human Resource Management: David A. Decenzo & Stephen PRobbins, Wiley-India.

Syllabus of Semester I, M. Tech (Industrial Engineering)

Course Code: INT505 **Course: Planning and Control of Manufacturing Systems**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 8**

Course Outcomes :

1. To make students understand the different manufacturing systems and material handling equipments along with the problems and uses associated with them.
2. To make students understand the significance of use of various demand forecasting tools, production planning, aggregate planning and process planning techniques.
3. To make students understand the sequencing, scheduling and line balancing of production jobs.
4. To make students understand the problems of planning and control of group technology and cellular manufacturing.

Syllabus :

Types of manufacturing systems and their associated planning and control problems, Material handling and Material flow characteristics in manufacturing systems.Tools and techniques of facility planning and layout.

Demand forecasting:

Tools and techniques. Production planning and control, Capacity planning: tools and techniques, Aggregate production planning, MRP, ERR Process planning and LOB techniques.

Scheduling of Production :

Sequencing Decisions in Single Machine and Flow Shops, Job-shop Scheduling, Scheduling in parallel Machines and Networks, simulation and priority rules.

Problems of planning and control of group technology, cellular manufacturing, CIMS and FMS.

Reference Books:

1. Theory and problems in Production and Operation Management: S. Chary, McGrawHill (1995).
2. Production and Operation Management: E. Buffa, RichardD. Irwin.
3. Industrial Engineering and Production Management: MartandTTelsang, S. ChandA Co.,
4. Production and Operation Management: Pannerselvam, Prentice Hall of India

Syllabus of Semester II, M. Tech (Industrial Engineering)

Course Code: INT506 **Course: Automation in Production**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 8**

Course Outcomes:

1. Students will be able to evaluate & Compare investment Projects.
2. Students will be able to analyze & the evaluate the performance of automated production times based on production times, production rate and efficiency of live.
3. Students will be able to design part delivery System and evaluate the performance of automated assembly times.
4. Students should be able to evaluate and select a suitable CNC/ machining centers for manufacturing a particular component.
5. Students should be able to use different performing codes for preparing a CNC part programme and its execution.

Syllabus:

Automation:

Principles, basic concepts, economy, efficiency, productivity and performance of machine tools, main trends in automation, automatic devices and design, automatic and semi-automatic machines, programme controlled machines, special purpose machines, unit type and transfer machines, automation in assembly, gauging and size control.

Numerical Control (N.C.):

Management implication, advantages and applications, N.C Systems and controls, information processing and storage. Part programming languages, manual programming, machine axis system, machining centres, computer aided N.C. and adaptive control. Selection of components for NC manufacturing, tools for NC.

Reference Books:

1. Automation in Production: Groover M.R, Tata McGraw Hill.
2. Numerical Control of Machine Tool: Yoram Koren andBehuriJ., Khanna Publication.
3. NC and CAM: Kundra and Rao, Tata McGraw Hill-.
4. CAD/CAM: M. R Groover, Zimmers Jr., Tata McGraw Hill.
5. Computer Automated Manufacturing: Power J. Jr., Tata McGraw Hill.

Syllabus of Semester II, M. Tech (Industrial Engineering)

Course Code : INP506 **Course : AUTOMATION IN PRODUCTION LABORATORY**

L:4 Hr, T:0 Mrs., P:0 Mrs., Per Week **Total Credits : 8**

Practicals based on theory syllabus.

Syllabus of Semester II, M. Tech (Industrial Engineering)

Course Code: INT507 **Course: Methods Engineering & Ergonomics**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 8**

Course Outcomes :

1. Students will be able to understand the concept of total time of manufacturing.
2. Students will understand the better methods and concept of productivity measurement.
3. Students can evaluate performance of service industry and give proper measures for improvement.
4. They can determine standard time for a job or a process and delays in work.
5. Students will be able to put ergonomic assessments and solutions to practical use in the workplace.
6. Students will be able to find and assure that the workplace fits the worker

Syllabus :

Methods Engineering :

Analysis of operations, job work, systems involving man and machines, Schematic models, charts and other aids for analysis. Work Measurement, stop watch time study; PMTS; work sampling, Setting of Time standards. Principles of motion economy and work place design. Total time to manufacture the job Work content and ineffective time. Productivity Introduction and models for Productivity Improvement e.g. OMAX etc .Productivity Improvement techniques e.g. SMED, KAIZEN etc.

Ergonomics :

Basic anatomy of human body and its functional systems; principles of ergonomics, design of displays and controls in relation to information processing by human being; Anthropometry, effects of personal factors and environment on human performance, Determination of physiological work load.

Reference Books :

1. Work study: International Labor Organization (ILO).
2. Motion and Time Study: R. M. Barnes,
3. Human factors in Engineering: S. Sanders, Me Cormick, McGrawHill.
4. Motion and Time Study: M. E. Mundel.

Syllabus of Semester II, M. Tech (Industrial Engineering)

Course Code : INP507 **Course : Methods Engineering & Ergonomics Lab**

L:4 Hr, T:0 Mrs., P:0 Mrs., Per Week **Total Credits : 8**

Practicals based on theory syllabus.

Syllabus of Semester II, M. Tech (Industrial Engineering)

Course Code: INT508 **Course: Manufacturing Economics & Analysis**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 8**

Course Outcomes :

1. To make students understand the concept of Time Value of Money.
2. To make students understand the various costs and their application in manufacturing scenarios.
3. To make students understand Capital budgeting, and evaluation of various financial ratios.
4. To make students understand Financial Accounting, its principle, interpretations various types of financial statements and their use.

Syllabus:

The principal and use of economic analysis in the engineering practices,

Time Value of Money :

Nominal and effective interest rates and continuous compounding Role of engineering economy in the decision making process, Discounted cash flow analysis, evaluation of investment alternatives, evaluation of alternatives with equal and unequal lives, the effects of income tax on economic studies, Replacement analysis.

Capital budgeting :

Rate of return computation & Cost of Capital; Payback period; Present worth, Annual Worth and capitalized cost evaluation; Benefit/Cost ratio evaluation.

Financial accounting :

Accounting Principles, Financial Statements, Interpretation and use of accounting information. Cost Accounting, Cost control, Analysis of cost, fixed, variable and semi variable cost, Break-even analysis, CVP Analysis, Marginal and absorption costing, Depreciation: Concepts and Computational Models.Theory of Firm as an owner and as a Producer-Economics of scale-Market Models-Production Function

Reference Books:

1. Engineering Economy: Theusen H. G. and others Prentice Hall of India
2. Engineering Economy: William G. Sullivan, Prentice Hall
3. Engineering Economy: Leland Blank and Anthony Tarquin, McGraw Hill
4. Engineering Economy: De; Garmo PE., MacMillan Publication
5. Cost Accounting: Jawaharlal, Tata McGraw Hill
6. Advanced Accounts Volume II: M.C. Shukla, TS. Grewal, S. C. Gupta, S. Chand and company
7. Cost Accounting, Principles& Practice: Jain Narang, PHI

Syllabus of Semester II, M. Tech (Industrial Engineering)

Course Code: INT509 **Course: Project Evaluation & Management**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 8**

Course Outcomes :

1. Students will be able to proper project charter.
2. Students will be able to plan & Schedule the Project activity.
3. Students will be Demonstak the ability to understand to use of human resources, contract project team.
4. Students will be able evaluate Project performance.
5. Students will be able to prepare project audit report.

Syllabus :

Introduction, Concepts of Project Management, Project Management Life Cycle, Establishing the Project: Scope, Time, Cost and Performance Goals, Organizing Human Resources and Contracting, Organizing systems and Procedures for Project implementation, Project Direction, Coordination and Control, Project Evaluation, Benefits of Project evaluation, Limitations of Project evaluation, Methods of Project evaluation. Project Management Performance. Management Information System, Project Management Tools.

Reference Books :

1. Project Management: David Cleland, Lewis Ireland, Tata McGraw Hill
2. Project Management: S. Chaudhary, Tata McGraw Hill
3. Guide to Project Management: Harold Kerzner, Tata McGraw Hill.
4. Project Management: Jack Gido, James Clements, Cengage Learning

Syllabus of Semester II, M. Tech (Industrial Engineering)

Course Code: INT510 **Course: Maintenance Engineering**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 8**

Course Outcomes:

1. To understand the statistical & Reliability concepts applied in maintenance and related models. Criticality of failure analysis, review of reliability. Logical diagrams of real life situations to find the reliability of the system.
2. To understand basic models of maintenance systems, including various aspects of breakdown & prevention of breakdown in respect of the maintenance and their controls.
3. To understand spares management, costing and budgeting of equipment maintenance resources planning for flaming for maintenance facilities and their implications in real scenario.
4. Cost and resources management for maintenance.
5. Condition monitoring programs to ensure performance of equipments. Various practical techniques involved with different levels of use of these techniques

Syllabus:

Introduction:

General Objectives, Functions. Organization and administration of Maintenance Systems; Requirements, Concepts and Structure of Suitable Organization for Maintenance system, Failure analysis: Classification and Selectivity of Failure, Statistical and Reliability Concepts and Models for Failure Analysis, Maintenance system models, Decision Models for Maintenance Planning; Operation and Control, Optimum Level of Maintenance/Replacement, Aspects of Break Down and Preventive Types, Group and Individual Type, Obsolete Facility, Deteriorating and Completely Failing Facilities, Replacement Vs. Reconditioning, Economics of Maintenance, Space Planning and Control; Static Spares, Insurance Spares With and without Salvage Value, Low Moving Spares, Man power Planning -Crew Size. Allocation etc.

Standby Machines:

Economical and Operational Aspects: Scheduling and Planning of Activities, Monitoring and updating, Recourses Allocation. Assigning Priorities. Cost Management for Maintenance: Cost Estimates-Recording, Summarizing and Distributing Cost Data, Maintenance Budget. Work Measurement for Maintenance, Maintenance Control Indices, .Maintenance Service Contracts, Preventive Maintenance, Management Guidelines, Procedure, General Management of Lubrication Systems, Organizing Preventive Maintenance Programme Using Vibration Signature of Analysis, Management of Records for Maintenance, Computerization of Maintenance Activities, Major Plant Shut-Down Procedures.

Reference Books:

1. Maintenance Engineering Hand Book: LIHiggins, L C. Morrow, McGrawHill.
2. Management of Industrial Maintenance: A. Kelly and M. J. Harris, Newness-Butterworths, London.
3. Reliability, Availability and Maintainability: J. W. Foster, D. T. Phillips and IR. Rogers., M/A Press.
4. The Complete handbook of Maintenance Management: J. E. Heiltzelman, Prentice Hall of India.
5. Maintainability and Maintenance, Management Instrument Society of America: J. D. Patton (Jr.).

Syllabus of Semester III, M. Tech (Industrial Engineering)

Course Code: INT601 **Course: Research Methodology**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes:

1. Students will be able to gain insights into different aspects of research
2. Student will be able to understand different data collection methods in research.
3. Student will be able to learn and understand the basics of data analysis tools and techniques.
4. Students will be able to understand the role of computers in research.
5. Students will be able to understand the documentation of research and report writing.

Syllabus:

Meaning of Research, Research Methods versus Methodology Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Identification of a research problem, Criteria for selection of the problem, Defining the Research Problem ,Selecting the Problem ,Technique Involved in Defining a Problem, Research Design: Need, Features of a Good Design, research design concepts, Different research designs,

Literature survey and review: need of review of literature, reporting

Data Collection: Meaning and Importance of Data, Sources of Data, Methods of Data Collection, Collection of Primary Data; Observation Method, Interview Method, Data through Surveys and Questionnaires, Some Other Methods of Data Collection, Experimentation, Simulation.

Data Analysis: Statistical Analysis, Measures of Central Tendency, Measures of Dispersion, Probability distributions: Binomial, Poisson, Uniform, Normal and Exponential, Hypothesis Testing, Procedure for Hypothesis Testing Confidence Interval, Test of Significance, Comparison of Two Proportions, Comparison of Means, Analysis of Variance (ANOVA), basic principle of ANOVA, One way and Two way ANOVA, Design of Experiments, Importance of experimental designs.

Optimization of Model parameters, Application of optimization theory to modeling, heuristic and metaheuristic approaches like Fuzzy logic, Genetic Algorithm (GA), Simulated Annealing (SA), etc.

Role of computers in Research : Introduction to spreadsheet application, features and functions, Using formulas and functions, Data storing, Features for Statistical data analysis, Generating charts/ graph and other features, Use of MS Excel, Power Point, Use of statistical Analysis software SPSS, MINITAB, MATLAB, etc.

Report Writing and publication: Planning of Report Writing, Thesis writing, Formats of report writing, Types of Reports, Different steps in writing report, Formats of publications in Research journals.

Reference Books:

1. Research Methodology- Methods and Techniques: Kothari C.R. (2004), 2/e, New Age International, New Delhi
2. Design and Analysis of Experiments: Angela Dean and Daniel Voss, Published by Springer-Verlag NewYork, In
3. Theories of Engineering Experimentation, 1st ed.: H. SchenckJr.,, Mc-GrawHill.
4. Simulation Modeling and Analysis, 2nd ed.: Law, A. M., and W. D. Kelton, 1991,, McGrawHill
5. Discrete event system simulation, 2nd ed.: Banks, J. J., S. Carson, andB. L Nelson. 1996, Upper saddle river, New Jersey: Prentice-Hall.
6. Design and Analysis of Experiments, 5th ed.: Montgomery, Douglas C. (2007), (Wiley India)
7. Applied Statistics & Probability for Engineers: Montgomery, Douglas C. & Hunger, George C. (2007), 3/e, (Wiley India)

Syllabus of Semester of III, M. Tech (Industrial Engineering)

Course Code: INT602-1 (Elective I) **Course: Marketing Management**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes :

1. Students will be able to understand concept of Marketing and model the marketing system.
2. Will be able to formulate form "P" of marketing and understand buyer behavior.
3. Methods of market forecast and demand potential estimate.
4. Will be able to understand market activities such as MIS, Market Research.

Syllabus :

Modern Marketing Concept :

Changing business orientation, integrated marketing, customer satisfaction, definition of marketing management, basic marketing system model, e-commerce and Internet marketing. Marketing Environment: Marketing opportunity concept, economic, social, political and cultural environment, Duryer behavior and the four P's of marketing mix, brand preference. Measurement and Forecasting of Demand: Concept of Market Forecast and Market potential methods of estimating current demand, Chain ratio, Index of buying pinrer method, estimation of future demand, Survey of buyer intentions, Statistical analysis. Organizing for Marketing: Break up of marketing activities, organization for integrated marketing, Market information systems (MIS), internal accounting and intelligence systems, marketing research and decision making. Marketing Strategies : Product market matching, Product management, Product life cycles, innovations, Promotion strategies in advertising, personal selling, sales promotion and publicity. Price decisions: Reasons, Objectives and Methods; Price setting, Buyers reaction, demand elasticity of price, distribution trade off analysis, physical distribution methods, concept of level of service and Cost of services, overall marketing mix. Market Segmentation and marketing Control: Concept of segmentation, methods of segmentation, control of management over marketing subsystems, efficiency control, short and long controls.

Text Books :

1. Modern Marketing: A Manual of Marketing, Salesmanship and advertising : Bombay, Himalaya Publishing House, 1990
2. Marketing Management Strategies and Progress: Guiltima J.P.& Paul, G. W. Singapore; McGraw Hill, 1985
3. Marketing Management: Philips Kotler

Syllabus of Semester of III, M. Tech (Industrial Engineering)

Course Code: INT602-2 (Elective I) **Course: Flexible Manufacturing System & Robotics**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes:

1. Will be able to understand concept of FMS, group technology & Cellular Manufacturing.
2. Know the component of FMS, AGV
3. Kinematics & Dynamics involved in Robotics.
4. Application of Robotics in helical hanging Welding, Painting

Syllabus:

Introduction to Automation Flexible Manufacturing, Manufacturing Integration Model, Inventory's Relation to Integration Effect, Flexible Manufacturing Strategy, Manufacturing Cells, Group Technology & Cellular Manufacturing, Components of Flexible Manufacturing, Pallets and Fixtures, Machining Centers, Inspection Equipment, Material Handling Stations, Storage System, In-process Storage system, Manually Operated Stations, Allied Operation Centers, AGV, Robotics Configuration, Introduction to Kinematics & Dynamics, Drives, Control, Sensors and Gripers, Robotic Work cells, Applications of Robotics in handling, Welding, Painting, Assembly, Machining and other areas, Selection of Robots.

Text Books:

1. Robotics Technology & Flexible Automation: S. R. Deb (Tata McGrawHill)
2. Automation, Production System, and CIM: M. P. Groover (Pearson Education)
3. Computer Control of Manufacturing System: Yoram Koren (McGrawHill)

Syllabus of Semester of III, M. Tech (Industrial Engineering)

Course Code: INT602-3 (Elective I) **Course: Total Quality Management**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes :

1. Make control charts for predicting loss of process control.
2. Make use of statistical tools for minimizing inspection in acceptance control.
3. Design quality management and assurance systems.
4. Predict and evaluate reliability of the products.
5. Develop skills to increase quality and reliability of manufactured product

Syllabus :

Introduction to TQM, Quality Assurance, Quality Design and Development, Total Quality Control, Cost of Quality, Total Quality Culture, TQM and Team Work, ISO 9000 Series of standards, Special requirements for Implementation of ISO in Organization, Quality Management, Reliability as Quality Characteristic, Failure analysis, Redundancy, System Reliability, Auditing Quality System, Concepts in Quality repay, Total Safety system for TQM, Quality Circles, Use of control charts, Inspection and Measurement, TAGUCHI loss function, System approach to TQ culture, Acceptance Sampling methods- single, multiple and sequential plans, Quality Control Tools for Quality improvement, Quality system-KAIZEN, Quality circles, Statistical Quality Control and its tools, Problem Solving methodology for quality improvement, Terotechnology and product Quality, TQM implementation.

Text Books:

1. TQM. And IS014000: Dr. K. Arora
2. Essentials of TQM / More house: Debra L
3. Engineered Quality in Construction, partnering & TQM - Singapore: McGraw Hill, 1994

Syllabus of Semester of III, M. Tech (Industrial Engineering)

Course Code: INT602-4 (Elective I) **Course: Energy Management**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes :

1. Ability to understand and identify areas of energy conservation in industries.
2. Know the duties and responsibilities of an energy manager and energy auditor.
3. Ability to analyze and modify existing working of the energy utilizing and generating machines.
4. Know how to use instruments in energy audit process.
5. Ability to understand and implement proper energy saving techniques in boiler, furnaces, compressor, and heavy machineries.

Syllabus:

Importance of energy management, Energy auditing: methodology, analysis of past trends (plant data), closing the energy balance, laws of thermodynamics, measurements, portable and online instruments, Energy economics - discount rate, payback period, internal rate of return, life cycle costing. Steam Systems: Boiler-efficiency testing, excess air control, steam distribution and use of Steam straps, condensate recovery, flash steam utilization, Thermal insulation. Electrical systems: Demand control, Power factor correction; load Scheduling/ shifting motor drives-motor efficiency testing, energy efficient motors and motor speed control. Lighting: lighting levels, efficient options, fixtures day lighting, timers, energy efficient windows, Energy conservation in Pumps, Fan (flow control), Compressed Air Systems, Refrigeration and air conditioning systems, Waste heat recovery; recuperates, heat wheels, heat pipes, heat pumps. Cogeneration: Concept, options (steam / gas turbines- diesel engine based) selection criteria, control strategy, Heat exchanger networking-concept of pinch, target setting problem table approach, composite curves. Demand side management, Financing energy conservation.

Text Books:

1. Industrial Energy Management and Utilization : LC Witte, P.S. Schmidt, D.R. Brown Hemisphere Publ. Washington, 1988 Industrial Energy Conservation Manuals-MIT Press, Mass, 1982
2. The Efficient Use of Energy : Ed. I.G. C. Dryden, Butterworth London, 1982, Ed. W. C. Turner -Energy Management Handbook- Wiley, NewYork 1982
3. Technology Menu for Efficient Energy Use : Motor Drive Systems, Prepared by National Productivity Council and Centre for and Environmental Studies- Princeton Univ. 1993

Syllabus of Semester of III, M. Tech (Industrial Engineering)

Course Code: INT602-5 (Elective I) **Course: System Design & Engineering**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes:

1. Students will develop understanding of system Concepts, Component, properties.
2. Will be familiarized with process of design of system.
3. Will be able to understand the concept of system reliability, maintainability,

Syllabus:

Types of information:

operational, tactical, strategic and statutory, need of information systems, management structure, requirements of information at different levels of management, functional allocation of management, requirements of information for various functions, qualities of information.

Requirements determination:

requirements specifications, feasibility analysis, final specifications, hardware and software study, system design, system implementation, system evaluation, system modification.

Role of systems analyst:

attributes of a systems analyst, tools used in system analysis. Strategies: methods, documenting study, system requirements.

Specification:

from narratives of requirements to classification of requirements as strategic, tactical, operational and statutory. Deciding project goals: examining alternative solutions, cost benefit analysis, quantifications of costs and benefits, payback period, system proposal preparation for management, parts and documentation of a proposal, tools for prototype creation.

Data flow diagrams:

case study for use of DFD, good conventions, leveling of DFDs, leveling rules, logical and physical DFDs, software tools to create DFDs.

Procedure specifications in structured English:

examples and cases, decision tables for complex logical specifications, specification oriented design vs procedure oriented design.

Entity relationship model:

E-R diagrams, relationships cardinality and participation, normalizing relations, various normal forms and their need, some examples of relational data base design.

Text Books :

1. Systems Engineering and Analysis (5th Edition): (Prentice Hall International Series in Industrial & Systems Engineering) by Benjamin S. Blanchardand WolterJ. Fabrycky (2010)
2. Systems Engineering Principles and Practice : (Wiley Series in Systems Engineering and Management) by Alexander Kossiakoff, William N. Sweet, Sam Seymour and Steven M. Biemer(2011)
3. System Engineering Management: (Wiley Series in Systems Engineering and Management) by Benjamins. Blanchard(Jul28,2008)

Syllabus of Semester of III, M. Tech (Industrial Engineering)

Course Code: INT602-6 (Elective I) **Course: Communication**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes:

1. To make students realize the importance of communication.
2. To prepare for making effective communication.
3. To prepare for group discussion & Personnel Interview.
4. To be able to write Business letters, Report etc.

Syllabus:

The aim of this course is to equip the students of science & technology with basic communication skills, Group behavior and group dynamics, Process of communication, Barriers to communication, Overcoming the barriers in communication, Effective verbal communication, Public speaking, Oral presentation, Group discussion, Facing the personal interview, Practice sessions, Non-verbal communication, Effective written communication, Reports Business letters Exercises, Effective use of the English Language, Elements of Style, Pronunciation-practice in the language laboratory, Implication for performance and satisfaction.

Text Books:

1. Communication for Professional Engineers: Bill Scott, Thomas TelfordLtd., 1984
2. Technical Writing: John M. Lannon, Little Brown and Co. 1985
3. The element of Style: 3d edition., Willianl StrunkJr., Macmillan Publishing Co. 1979

Syllabus of Semester of III, M. Tech (Industrial Engineering)

Course Code: INT603-1 (Elective II) **Course: Materials Management**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes:

1. Students will understand the objective and scope of material management.
2. Students will be able to understand the concept various cost involved in inventory control.
3. Students will be able to understand various purchase and production based inventory control models.
4. Students will be able to understand the vendor rating system, MRP, JIT, KANAN etc
5. Students will be able to understand various algorithms in inventory control

Syllabus:

Role of materials management techniques in material productivity improvement, Cost reduction and value improvement, Purchase management, Incoming material control, Acceptance sampling and Inspection, Vendor rating system, Inventory management, Various inventory control models, Material requirement planning systems, Discrete lot size techniques, Wangar and Whitin algorithm, Silver and metal algorithm, Algorithms for multi product lot sizing with constraint inventory management of perishable commodities, Design of inventory distribution systems, Inventory management in KANBAN and JIT.

Text Books:

1. Selection & Use of Engineering Materials: Crane, FA.A & Charles, IA. London Butterworths, 1984
2. Material management & Inventory Control: Tersine
3. Applied Materials Management: S. Chatterjee

Syllabus of Semester of III, M. Tech (Industrial Engineering)

Course Code: INT603-2 (Elective II) **Course: Mechatronics**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes:

1. Describe the basic building blocks of mechatronic systems (e.g hardware, software, communication, interfacing, sensing, control and actuation)
2. Sketch such a technical solution and select component types.
3. Identify critical problems/design issues and suggest feasible methods and tools to solve those.
4. Be able to summarize and on smaller problems apply a development model for mechatronic product development.
5. Model, simulate and synthesize (but not realize) smaller mechatronic systems and products.

Syllabus:

Introduction of Mechatronics Technology and approach towards Mechatronics designing, Study of sensors and transducers, measurement of various parameters like displacement, position, proximity, velocity, force temperature, light, etc., Selection criteria for sensors, signal conditioning elements and their needs, data indicators and recorders for a Mechatronics systems, Actuation system including pneumatic/hydraulic, electrical and mechanical actuation. System modeling for mechanical, electrical, fluid, thermal and the combination to find transfer function. Checking system stability by using tools like MATLAB and SIMULINK, close loop controllers, Digital logic including combination of logic and sequential logic, Study of microprocessor and programmable logic controllers (PLC), Fault detection technique in Mechatronics systems.

Text Books:

1. Mechatronics: HMTLtd. New Delhi- Tata McGraw Hill 12001.
2. Mechatronics: W.Bolton, Longman Second Edition. 1999
3 Introduction to Mechatronics and Measurement Systems:Michel Huston,David Alciatore McGraw Hill 1998

Syllabus of Semester of III, M. Tech (Industrial Engineering)

Course Code: INT603-3 (Elective II) **Course: Value Engineering**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes :

1. Students will be able to apply cost reduction techniques.
2. Will be able to evaluate various alternatives.
3. Will be able to prioritize functions of products.
4. Will be able to identify under value products.
5. Will be able to improve value of product.

Syllabus:

Value engineering and its application in product design, Identification of major function and removal of poor value functions in a product, Types of value Effects of functions and cost on value, Life cycle of product and value engineering, Steps in value engineering, Methodology in value engineering, Fast diagram, Matrix method and other approaches in value engineering, Evaluation of value alternatives, Case studies in value engineering.

Text Books:

1. Value engineering in Manufacturing: American Society of Tool & Manufacturing Engineers, New Jersey, Prentice Hall incorporated, 1967.
2. Cost Engineering Analysis: Park, W.R. NewYork, John Wiley & Sons, 1973
3. An Introduction to Value Engineering: L. D. Miles

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Course Code: INT603-4 (Elective II) **Course: Industrial Design**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes :

1. Students will able to apply the knowledge of methods engg. in Industrial design situations.
2. Apply the knowledge of facilities planning.
3. Apply the optimization techniques in design Situations.
4. Apply the concept of Scheduling in design.

Syllabus:

Industrial system and organization: engineering economy; work measurement technique; motivation and time study; factory planning and material handling. Industrial standardization, critical path method, quality assurance and statistical quality control, Reliability, maintenance and management planning, scheduling, job analysis, evaluation, value engineering.

Text Books:

1. The Ergonomics of work spaces and Machines - a Design Manual: Clark T.S. & Corleft, E. N. London, Taylor & Francis, 1984
2. Introduction to work-study: International Labour organization, Universal Publishing Company. ISBN81-850270
3. Motion & Time study: Design and Measurement of Work: Barnes Ralph M., Wiley Text Books, 2001

Syllabus of Semester of III, M. Tech (Industrial Engineering)

Course Code: INT603-5 (Elective II) **Course: Information Systems In Engineering**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 6**

Course Outcomes :

1. To leverage the IT infrastructure as a growth career for a given business model.
2. To make necessary changes in the organization to make the best use of IT growth. To empower the employee in the lower stata of the organization as they capture and process the valuable data.
3. To evolve an effective decision support system (DSS) to guide the decision making and forecast the effect of those decision.
4. To devise and use the artificial intelligence to accomplish the complex task of their business process.
5. To integrate and streamline the process of a business enterprise and add value to it.

Syllabus:

MIS introduction:

Concepts of Information System and Management, Contemporary Approaches to Information Systems, Role of Information Systems in Organization. Information Systems in the Enterprise: Different Types of Systems, Relationship of System to one another, System from a functional Perspective, Enterprise Systems, Supply Chain Management and Collaborative Commerce, Customer Relationship Management, Decision Making in Information Systems, Business-Level Strategy and the Value Chain Model, Competitive Forces and Network Economics. Electronic Commerce: Customer Centered Retailing, Business-to-Business Electronic Commerce, Intranet Support Electronic Business, Management Challenges and Opportunities, Ethical and Social Issues. Infrastructure: Managing Hardware and Software Assets, Database Approach to Data Management, Database Trends, Telecommunications and Networks, Internet. Knowledge Management: Organizational Learning and Knowledge Management, Knowledge Work Systems, Artificial Intelligence, Decision-Support System (DSS), Group Decision-Support System (GDSS), Executive Support in the Enterprise (ES). Building Information System: Linking Information Systems to the Business Plan, Systems Development, Establishing Organizational Information Requirement, Business Process Reengineering and Process Improvement, Change Management. ERP: Introduction, ERP Legacy, ERP's element and sub elements, Need of having ERP, ERP Implementation, ERP Vendors.

Text Books:

1. Management Information System: LuceyT., Hants, 1987
2. Information Systems for Modern Management: New Delhi, Prentice-Hall India, 1983
3. Reliability Evaluation of Engineering Systems, Concepts and Techniques: New York, Plenum Press, 1983

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Course Code : INT603-6 (Elective II) **Course : Reliability Engineering**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 6**

Course Outcomes:

1. Students will be able to understand the importance of Reliability in product Design.
2. Develop understanding of reliabilities of Systems, System Reliability Models.
3. Develop understanding of concepts to Arability and avaibilility.

Syllabus:

Introduction:

Basic Reliability Models, Reliability Function, Mean time to Failure, Hazard rate Function, Bath Tub Curve, Conditional reliability. Constant Failure Rate Model: Exponential Reliability Function, Failure Modes, applications, the two parameter Exponential Distribution, Poisson process, Redundancy and the CFR Model. Time Dependant Failure Models, The Weibull Distribution, The Normal Distribution, The Lognormal Distribution. Reliability of Systems: Serial Configuration, Parallel Configuration, Combined Series-Parallel Systems, System Structure Function, Minimal Cuts, Minimal Paths, Common Mode Failures, Three State Devices.

State Dependent System:

Markov Analysis, Load-Sharing System, Standby Systems, and Degraded Systems, Three State Devices. Physical Reliability Models: Covariate Models, Static Models, Dynamic Models, Physics of Failure Models.

Design for Reliability:

Reliability specification and system Measurements, Reliability allocation, Design Methods, Failure analysis, System safety and Fault free analysis, Maintainability, Design for Maintainability, Availability. Data Collection and Empirical Methods: Data collection, Empirical Methods, Static Life Estimation. Product Reliability testing, Reliability Life testing, test time calculations, Burn-In Testing, Acceptance testing, Acceptance life Testing, Experimental Design.

Reliability Growth Testing:

Reliability, Growth Process, Curve, Duane Growth model, AMSAA Model, Identifying Failure and Repair, Repair Distribution, Goodness-of-FitTests, Reliability Estimation, Application and Implementation.

Text Books:

1. An Introduction to Reliability and Maintainability Engineering : Charles E. Ebeling Tata McGraw-Hill publishing Company Limited
2. Reliability Based Design : S. S. Rao, McGraw Hill
3. Reliability Engineering: E. Balagurusamy, Tata McGraw Hill Publishing Co. Ltd.

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Course Code: INP604 **Course: Project Phase I**

L: 0 Hr.,T:0 Mrs., P:6 Mrs., Per week **Total Credits : 24**

Project Phase

Seminar/research work based on some topic related to Industrial Engineering