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| **KERALA TECHNOLOGICAL UNIVERSITY**  http://ktu.edu.in/images/logo_final.png  **SCHEME AND SYLLABUS**  **FOR**  **M. Tech. DEGREE PROGRAMME**  **IN**  **MECHANICAL ENGINEERING**  **WITH SPECIALIZATION**  **INDUSTRIAL ENGINEERING AND MANAGEMENT**  **CLUSTER 05 (ERNAKULAM II)**  **KERALA TECHNOLOGICAL UNIVERSITY CET Campus, Thiruvananthapuram Kerala, India -695016**  **(2015 ADMISSION ONWARDS)** |

**KERALA TECHNOLOGICAL UNIVERSITY**

**SCHEME AND SYLLABUS FOR M. Tech. DEGREE PROGRAMME**

**Branch: MECHANICAL ENGINEERING**

**Specialization: INDUSTRIAL ENGINEERING AND MANAGEMENT**

**Semester 1** (Credits: 21)

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| Exam Slot | Course No: | Name | L- T - P | Internal  Marks | End Semester Exam | | Credits |
| Marks | Duration (hrs) |
| A | 05ME 6401 | Integrated Materials  Management | 3-1-0 | 40 | 60 | 3 | 4 |
| B | 05ME 6403 | Manufacturing System Management | 3-1-0 | 40 | 60 | 3 | 4 |
| C | 05ME 6405 | Organizational Behaviour | 3-1-0 | 40 | 60 | 3 | 4 |
| D | 05ME 6407 | Quality Engineering and Management | 3-0-0 | 40 | 60 | 3 | 3 |
| E | 05ME 641x | Elective-I | 3-0-0 | 40 | 60 | 3 | 3 |
|  | 05ME 6477 | Research Methodology | 0-2-0 | 100 | 0 | 0 | 2 |
|  | 05ME6491 | Software Lab | 0-0-2 | 100 | 0 | 0 | 1 |

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| **Elective** 05ME 6411 | Business Mathematics |
| 05ME 6413 | Marketing and Consumer Behaviour |
| 05ME 6415 | Industrial Relations |

**Semester 2** (Credits: 21)

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| Exam Slot | Course No: | Name | L- T - P | Internal  Marks | End Semester Exam | | Credits |
| Marks | Duration (hrs) |
| A | 05ME 6402 | Advanced Operations Research | 3-1-0 | 40 | 60 | 3 | 4 |
| B | 05ME 6404 | Work System  Design | 3-0-0 | 40 | 60 | 3 | 3 |
| C | 05ME 6406 | Supply Chain  Management | 3-0-0 | 40 | 60 | 3 | 3 |
| D | 05ME 642x | Elective-II | 3-0-0 | 40 | 60 | 3 | 3 |
| E | 05ME 643x | Elective-III | 3-0-0 | 40 | 60 | 3 | 3 |
|  | 05ME 6466 | Seminar I |  | 100 | 0 | 0 | 2 |
|  | 05ME 6488 | Mini Project | 0-0-4 | 100 | 0 | 0 | 2 |
|  | 05ME 6492 | Lab | 0-0-2 | 100 | 0 | 0 | 1 |

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**Elective II**

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| 05ME 6422 | Human Resource Management |
| 05ME 6424 | Marketing Logistics |
| 05ME 6426 | Safety and Environment Management System |

**Elective III**

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| 05ME 6432 | Business Practise and Industrial Economics |
| 05ME 6434 | Reliability Engineering And Management |
| 05ME 6436 | Management Information System |

**Semester 3** (Credits: 14)

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| Exam Slot | Course No: | Name | L- T - P | Internal  Marks | End Semester Exam | | Credits |
| Marks | Duration (hrs) |
| A | 05ME 744x | Elective-IV | 3-0-0 | 40 | 60 | 3 | 3 |
| B | 05ME 745x | Elective-V | 3-0-0 | 40 | 60 | 3 | 3 |
|  | 05ME 7467 | Seminar II | 0-0-2 | 100 | 0 | - | 2 |
|  | 05ME 7487 | Project (Phase 1) | 0-0-12 | 50 | 0 | - | 6 |

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**Elective IV**

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| 05ME 7441 | Practical Project Management |
| 05ME 7443 | System Modeling and Simulation |
| 05ME 7445 | Plant Engineering and Maintenance |

**Elective V**

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| 05ME 7451 | Modern Manufacturing System Design |
| 05ME 7453 | Knowledge Management |
| 05ME 7455 | Industrial Scheduling |

**Semester 4** (Credits: 12)

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| Exam Slot | Course No: | Name | L- T - P | Internal  Marks | End Semester Exam | | Exam Slot |
| Marks | Duration (hrs) |
|  | 05ME 7488 | Project (Phase 2) | 0-0-21 | 70 | 30 | - | 12 |

12

Total: 68

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| 05ME 6401 | | **INTEGRATED MATERIALS MANAGEMENT** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  This programme aims to produce engineers who are highly skilled in the techniques of inventory management and its related technologies. This will provide the basis for effective careers as managers with a well coordinated approach towards various issues involving decision making with respect to inventory. Balancing of conflicting objectives so as to achieve optimum results for the organisation as a whole.    **COURSE OUTCOMES:**  1. define materials management and state its relevance to firm’s profit maximization  objective  2. explain and demonstrate the basic understanding of purchasing process, policies and procedures and discuss the use of information technology in supply management  3. explain the concept of quality as it relates to supply chain management  4. discusshowcompetentpersonnelcanbehiredtobetterthefunctionsofmaterials management | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Introduction, scope of materials management, primary and secondary objectives, integrated materials management, elation with other functional areas of organization. Organizing for materials management, basis for forming organizations, conventional and modern approaches to organizing materials management . | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Materials identification, classifyingof materials,codification ofmaterials, standardization, simplification and variety reduction of materials | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Inventory control techniques, FSN, VED,ABC, working capital management with reference  To inventory. Management of stores location different types of stores methods of storing safety and security of materials stores equipment materials handling equipment factors affecting materials handling. | | | | 10 |
| **IV** | Stores issues and receipts procedures-forms and policies- accounting in stores, organization materials safety and security. Management of surplus obsolete and scrap materials, accumulation of surplus obsolete and scrap materials methods of disposal regulations and procedures Purchasing planning purchasing materials norms of vendor rating CEI  methodology, Japanese industry, selection and development purchasing procedures and methods legal aspects, sources of supply, out sourcing. Sub contracting, criteria for selecting sub contractors rating | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. Gopalakrishnan, P. (2001). Purchasingand Materials Management. Tata McGraw-Hill.  2. Ross, D.F. (2003). Distribution Planningand Control: Managingin theEra of Supply  Chain Management. Springer.  3. Sharma, A.K. (2007). Purchasingand MaterialsManagement. AnmolPublisher.  4. Datta,A.K.(2009).MaterialsManagement:Procedures,TextandCases.Prentice  HallIndia.  5. Gopalakrishnan,P., andSundaresan, M.(2009).Materials Management:AnIntegrated Approach. PrenticeHallIndia. | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6403** | | **MANUFACTURING SYSTEMS**  **MANAGEMENT** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  The interdisciplinary programme prepares manufacturing professionals to lead their companies in the integration of the entire product commercialization process–fromconcept to design, manufacturing process development, production and for distribution and reuse.  The programme provides a broad set of business skills to manage this integrated process including strategies, globalization, project management, and quality.  This will provide the basis for effective careers as managers who can meet the challenges of the rapidly changing global manufacturing industry.  **COURSE OUTCOMES:**  1.Students will recognize manufacturing organizations, including job shops, flow lines,  Assembly lines, work cells.  2.Students will have a basic understanding of time and motion study,worksampling,and process flowcharting.  3.Students will have a basic understanding of current manufacturing control theories,such as lean thinking, Opt,and JIT.  4.Students will be able to solve basic scheduling problems for assembly lines,job shops  5.Students will be able to use the library to do technical research.  6.Students will learn to critically observe manufacturing operations. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Introduction: Operations strategy, system concept of production, types of production system,  process planning– make or bye decisions– specific equipment selection– process plans, process reengineering. Facilities location: Facility location factors, location analysis techniques – location factor rating–center of gravity technique– load distance technique. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Plant layout:Need for layout, objectives, types of layout, layout design process, layout design  cycle, data collection, equipment requirement, activity analysis, RELdiagram, employee requirement, development of layout-block plan, selection, specification, evaluation. Layout design procedures: ALDEP, CORELAP and CRAFT. | | | | 9 |

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| **INTERNAL TEST 2 (Module 2)** | | |
| **III** | Aggregate planning: Aggregate planning strategies– heuristic method for aggregate planning.  Materials requirement planning: Objectives, master production schedule, bill of materials, MRP calculations, lot sizing in MRP- economic order quantity method-minimum cost per period method -periodic order quantity method-least unit cost method-part period balancing, Evolution from MRP to manufacturing resource planning(MRPII).  Enterprise resource planning(ERP): Overview of ERP, benefits of ERP, ERP and functional units. | 10 |
| **IV** | Inventory analysis and control:Definitions–inventory control systems- ABC inventory  System –EOQ models for purchased parts and manufactured parts– quantity discounts–reorder point –inventory models under uncertainty.  Justin time manufacturing:Introduction, elements of JIT, pull versus push method, kanban systems | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | |
| **REFERENCES:**  1. R. Paneerselvam, “Production and operations management”, PHI, 2010  2. RobertaS. Russelland Bernard W. TaylorIII,“Operations management”,PHI, 2007  3. P. B. Mahapatra, “Operations management: a quantitative approach”, PHI,2010  4. Francis, R. L. andWhite, J. A., “Facility layout and location: an analytical approach”, Prentice-HallInc., New Jersey, 1974.  5. Moore, J. M., “Plant layout and design”, Macmillan Company, New York,1970.  6. Apple, J. M., “Plant layout and material handling”, JohnWileyand Sons, New York.  7. Tompkins and White, “Facilities planning”, John Wileyand Sons, New York.  8. Brady,“Enterprise resourceplanning”,Thomson Learning, 2001  . 9. S. Sadagopan,“ERP: amanagerial perspective”, Tata McGraw-Hill, New Delhi1999. | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6405** | | **ORGANISATIONAL BEHAVIOUR** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  This course will equip students with an ability to Identify, explore and examine factors impinge on individual and group behaviour in organizations in the new millennium.  Explain the terminology associated with organizational behaviour.  Incorporate and apply the predominant organizational behaviour theories to gain knowledge of contemporary issues in organizational behaviour and frameworks to work with real life organizational issues concerned with Human Behaviour at work place.**COURSE OUTCOMES:**  1. Understand the theoretical underpinnings of organizational behavioras a discipline.  2. Recognizethevariousformsofpoliticalactivityandtodeterminewhensuchactivity is positive ornegative.  3. Use a structure group diagnostic model to analyze and resolve group/team performance problems.  4. Recognizewhenconflictisgoodandtoproperlyselectaconflictresolutionstrategy when conflict is dysfunctional.  5. Draw upon various motivational theories to design a motivational program.  6. Develop and use a systematic/structured approach to solve organizational problems. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | . The Organizational basics for behavior, Systems approach to organization, Organizational  structure, Making Organizing effective, Organizational culture. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Perception and learning, Theories of learning, Motivation theories, Role analysis and Inter  personal Dynamics, Assumptions, perceptions and feelings – Interpersonal interactions, activities and sentiments – Interpersonal communication – Problems in role effectiveness | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | Personality – Theories – effects on behaviour. Group Dynamics and Inter-group  relationships, Characteristics of work group – Basic forces that shape group behavior Dynamics of effective operating groups – Work group behaviour and productivity. Team Management | | | | 10 |
| **IV** | Organizational Development - Styles and skills in leadership and communication – Power  and politics in organization - Managing differences and conflicts – Managing change –  Organisation and society. Grid Management – Transactional Analysis – Sensitivity Training  – Process consultancy. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. Dick, P., and Ellis, S. (2005).Introduction to Organisational Behaviour. McGrawHill.  2. Mullins, L.(2007). Management &OrganisationalBehaviour, 7th edition. Pearson EducationIndia. 3.Brooks,I.(2009). Organisational Behaviour:Individuals, Groups and Organisation. PrenticeHall.  4. Sodhi, J., and Saiyadain,M. (2009). Cases in Organisational Behaviour& Human  ResourceManagement.Tata McGraw-Hill.  5. Luthans,F. (2013).Organizational Behavior. TataMcGraw-Hill. | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6407** | | **QUALITY ENGINEERING AND**  **MANAGEMENT** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  The Quality Engineering Management provides individuals with the knowledge and techniques to improve the delivery and quality of goods and services.  The focus of the program is the achievement of performance excellence in manufacturing and business processes through the use of modern quality improvement methods.  An ability to develop, operate, and manage quality control systems.  An ability to acquire and analyze data using appropriate statistical methods to facilitate process analysis and improvement.  An ability to apply modern problem solving tools and techniques necessary for quality tracking and improvement.  An understanding of quality auditing and principles for meeting domestic and international standards.  An ability to manage relations with customers and suppliers.  **COURSE OUTCOMES:**   1. This course balances the quantitative elements of quality engineering with a   managerial approach to using quality in an organization to effect change.   1. We cover the statistical basics needed for each of the well-known process- improvement cycle steps: Define, Measure, Analyze, Improve, and Control, covering the most important quality methods and techniques including sampling, statistical process control, process capability, regression analysis, and design of experiments. 2. Quality assurance is examined, from the viewpoint of quality incorporated into product design, measuring and controlling quality in production and improving quality using quantitative problem-solving and interactive, guided exercises. 3. The graduate will be able to contribute to the role of creating value in an organization   and will be able to apply modern quality techniques and procedures to solve problems and enhance the quality of goods and services, to eliminate waste and improve value to the end customer. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Quality: Defining quality – philosophies of quality ‘gurus’- dimensions of quality -  measures of quality – cost of quality – direct costs & indirect costs – ‘defectives’ and its significance - traditional model and emerging model of ‘cost-of-quality.’ Continuous process improvement: PDSA cycle – problem solving methodology | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Statistical process control: Statistical tools - control charts and use of probability distributions, process capability.  Acceptance sampling: Lot-by-lot acceptance sampling by attributes – fundamental concepts, statistical aspects: operating characteristic curve, producer’s risk and consumer’s risk, AQL, LQ, AOQ, ASN, ATI – sampling plan design. | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | Taguchi methods: Loss functions – signal-to-noise ratio - process optimization and robust  product design using orthogonal arrays, parametric and tolerance design. Quality function deployment: Concept - house of quality – QFD process. | | | | 10 |
| **IV** | Total quality management (TQM): Definition - basic concepts – strategies.  Six sigma methodology: Basic concepts – DMAIC problem solving technique.  Quality system and standards: An overview of ISO 9000 and ISO 14000 series of standard | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. Dale H.Besterfield, Carol Besterfield, Glen H.Besterfield&MaryBesterfield, “Total  qualitymanagement”, Person Education, New Delhi, 2008.  2. R. Subburaj, “ISO 9000:Path to TQM”, Allied PublishersLimited, New Delhi, 1997  3. Bank J., “The essenceoftotal qualitymanagement”, PrenticeHall  4. Dale B.G., “Managingquality”, PrenticeHall  5. A.V. Feigenbaum, “Totalqualitycontrol”, McGraw Hill  6. G.L. Taguchi and Syedet. al., “Qualityengineeringproduction systems”,McGrawHill  7. Essenceof TQM John bank PrenticeHall  8. Zaidi, “SPC- concepts,methodologyand tools”,PrenticeHall  9. PerryLJohnson, “ISO 9000”, McGraw mount | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME6477** | | **RESEARCH METHODOLOGY** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  Understand some basic concepts of research and its methodologies, Identify appropriate research topics , Select and define appropriate research problem and parameters , Prepare a project proposal (to undertake a project) , Organize and conduct research (advanced project) in a more appropriate manner , Write a research report and thesis , Write a research proposal (grants)  **COURSE OUTCOMES:**  1. . To develop understanding of the basic framework of research process.  2. To develop an understanding of various research designs and techniques.  3. To identify various sources of information for literature review and data collection.  4. To develop an understanding of the ethical dimensions of conducting applied research.  5. Appreciate the components of scholarly writing and evaluate its quality. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Research: Meaning & objectives – types of research - identification, selection and  formulation of research problem - research design - review of literature. Data collection  & presentation: Primary & secondary data - collection methods. Basic statistical measures: Measures of central tendency, variation and skewness. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Probability: Definition – discrete and continuous probability distributions: binomial, poison,  uniform, exponential and normal distributions. Sampling technique: Sampling methods, sampling distribution of mean, variance and proportion, confidence interval estimation, determination of sample size. | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | Testing of hypothesis: Fundamentals of hypothesis testing – procedure of hypothesis testing -  testing of mean, proportion and variance: one-tailed and two -tailed tests – chi-square test for checking independence of categorized data - goodness of fit test. Test for correlation and regression. | | | | 10 |
| **IV** | Non - parametric tests: One sample tests - sign test, chi-square test, Kolmogorov-Smirno test, run test for randomness – two sample tests: sign test, median test, Mann-Whitney U test– K-samples tests: median tests, Kruskal -Wallis test. Interpretation and report writing: Meaning of interpretation, techniques of interpretations - types of report, layout of research report. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. Panneerselvam, R., “Researchmethodology”, PrenticeHallofIndia, NewDelhi,2011  2. Kothary, C. R.,“Research methodology: methodsand techniques”, New Age  International, New Delhi,2008  3. Goddard, W. andMelville, S., “Researchmethodology–an introduction”,Juta& Co.  Ltd.,Lansdowne, 2007  **4.** Miller andFreund,“Probabilityandstatistics for engineers”,PrenticeHallofIndia  PrivateLimited, New Delhi | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | | |
| **05ME6491** | | **SOFTWARE LAB** | 3-1-0-4 | 2015 | | |
| COURSE OBJECTIVES:  The lab shall provide facilities to build capabilities in diverse software applications for appropriate data collection and analysis relating to Industrial Engineering domain. The lab could include experiments with computer applications in some of the basic domain areas highlighted below, but must be limited to demonstrating/solving Industrial Engineering problems or are in the purview of the Industrial Engineering domain. A typical laboratory course shall contain a minimum of 10 experiments preferably from multiple domains highlighted below.  **Note:** It is not mandatory to provide the software listed below for the course, and is presented only as a guide  • . Simulation and system analysis  - Simulation of queuing systems, material handling system, production systems, inventory systems, maintenance and replacement systems  - Simulation for investment analysis and network.  • Representative software includes GPSS, WITNESS, ARENA, SIMSRIPT, MATLAB.  • Data collection tools and statistical analysis for decision making  - Solving univariate / multivariate linear regression problem.  - Factor analysis, clustering or classification analysis for data reduction. - Quality analysis based on control charts.  Representative software or language includes SPSS, MINITAB, SAS.   • Optimization of resources or solving decision making problems with  constraints: - Solving linear programming problems.  - Solving dynamic programming problem, goal programming problem, problems in markov process, queuing problem.  Representative software includes LINDO / LINGO, TORA, PALISADE, WINQSB  • MATLAB.   • Scheduling, Project management and Supply chain modeling and analysis  - Modeling simple job-shop scheduling problems.  - Undertake CPM and PERT exercise.  Representative language & software includes C++, MS PROJECT, PRIMAVERA.   • Design and testing of products, process or work-systems:  - Process planning and verification of design.  - Ergonomic design of product, work-station / work-space. - Ergonomic analysis of product or work-system.  - Layout analysis and design.  - Setting standard times for tasks or process. - Analysis of quality of process or output.  Representative software includes JACK, CATIA, CRAFT, CORELAP, ALDEP, FLOWPLANNER, WORKSTUDY+, WORKPRO, SPSS, MINITAB.   Representative software includes JACK, CATIA, CRAFT, CORELAP, ALDEP, FLOWPLANNER, WORKSTUDY+,WORKPRO, SPSS, MINITAB. | | | | | | |
| COURSE CODE | | COURSE NAME | L-T-P-C | | YEAR | |
| **05ME 6411** | | **BUSINESS MATHEMATICS** | 3-1-0-4 | | 2015 | |
| COURSE OBJECTIVES:  To understand the concepts, theories and methods of solving linear equations To introduce the concept of probability theory and mathematical statistics To understand the concept of hypothesis testing, To understand the concept of curve fitting  **COURSE OUTCOMES:**   1. The student will demonstrate the ability to solve the problems involving Linear   equations, Mathematical Statistics, hypothesis testing and curve fitting | | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | | HRS |
| **I** | Rank of a matrix, elementary transformations, Normal form of a matrix, Echelon form of  a matrix, consistent system of linear equations, Cramers rule for solving linear equations, solution of system of homogenous and non-homogenous linear equations. | | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | | |
| **II** | Standard Distribution – Uniform: Geometric Binomial; Poisson; Fitting of Distributions (Binomial and Poisson). Properties – Mean, Variance; Exponential; Normal; Standard Normal – definitions, Simple Properties and applications, Use of Standard Normal Tables for Computation of Various Probabilities. | | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | | |
| **III** | Testing of hypothesis- Statistical hypothesis, Simple and composite hypothesis Null and Alternate hypothesis, Type I and Type II errors, Critical Region, Size of the test, P value, Power Large Sample test – Z test, Chi-Square test; Small sample tests – t test, Chi-square test, F test, Tests of Correlation and Regression; Analysis of Variance (one way classification); Non parametric tests (All tests as techniques only). Basic ideas, sign test for one sample and two sample cases, signed rank tests for one sample and two sample cases, run test for randomness.. | | | | | 10 |
| **IV** | Curve Fitting: Principle of Least Squares, Fitting of Straight Lines, Parabolas,  Exponential Curves. Bivariate Linear Correlation – Scatter Diagram Pearsons Correlation Coefficient, Spearman’s Rank Correlation Coefficient. Bivariate Linear Regression – Regression Lines, Coefficients of Regression.. | | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | | |
| **REFERENCES:**  1. Gupta, S.C., and Kapoor,V.K. (2011).*Fundamentals ofMathematical Statistics.*  Sultan Chand and Sons.  2. RichardJohnson,R.A.(2011):*MillerandFreundsProbabilityandStatistics forEngineers, 8th edition.*PrenticeHallIndia.  3. Md. EhsanesSaleh, A.K., and Rohatgi, V.K. (2008).*An Introduction to Probability*  *Theory and Mathematical Statistics,2nd edition.*Wiley India.  4. Mann, P.S. (2012).*Introductory Statistics, 7th edition.*WileyIndia.  5. Grewal, B.S. (2012).*Higher Engineering Mathematics, 42nd edition.*Khanna  Publishers. | | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6413** | | **MARKETING AND CONSUMER BEHAVIOUR** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  Marketing managers need knowledge of consumer behaviour in order to develop, evaluate, and implement effective marketing strategies., The focus of this course will be on the theoretical concepts of consumer behaviour and the application of these concepts in marketing strategy and decision making., Be able to identify the dynamics of human behaviour and the basic factors that influence the consumers decision process, Be able to demonstrate how concepts may be applied to marketing strategy  **COURSE OUTCOMES:**  1. Be able to develop appropriate marketing strategies for different segments of consumers The course deals with the behavioral aspects of marketing management.  2. It explains how the markets, consumers behave under circumstances and how the cultural, social, personal and psychological factors influence their behavior.  3. The course should enable students to develop marketing strategies that are consumer based and create and enhance customer value.  4. The purpose of this course is to introduce students to consumers, consumer behaviour in the market place and their impact on marketing strategy. Discussing the principal factors that influence consumers as individuals and decision makers with an application to the buying decision process.  5. The course content will also address the importance of subculture and global consumer culture as marketing opportunities  6. Learn key concepts and theories of consumer behaviour ,, Learn psychological theories relevant for understanding consumer behaviour , Learn how different aspects of the environment influences consumer behaviour , Learn what marketing strategy is and how it influences consumer behaviour , Understand applications of important concepts and theories in developing viable marketing strategies | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Marketing - Definition, Marketing concepts - present and emerging. Market mix and  Product mix. Concepts and classifications of products, services, needs, wants and demands. Societal, integrated, mega and micro marketing. Role of the internet. Marketing of services, Governmental and private marketing. Latest trends in Indian marketing environment. | | | | 9 |

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| **INTERNAL TEST 1 (Module 1)** | | |
| **II** | Marketing management process: Marketing goals, objectives and strategies. Classification of  marketing strategies. Marketing strategies for growth and emerging markets. Strategies for mature and stable markets. Requirements for global, international and transnational competencies. Functioning of different types of marketing organizations. | 9 |
| **INTERNAL TEST 2 (Module 2)** | | |
| **III** | Market mix: Product lifecycle strategies, Branding-Brand equity-Packaging-marketing activities connected with product development and launching-Test marketing. Price, satisfaction, delight and value. Pricing strategies. Methods for promoting the products and services. Service channels and marketing logistics. | 10 |
| **IV** | Consumer behavior - Definition. Determinants of consumer behaviour. Psychological, social, demographic and cultural factors. Types and stages of buyer decision behaviour. Models of consumer behaviour. Role of gate keepers and influencers. Application of market research in consumer behaviour.Domestic versus industrial purchases .Indian consumer profile. Market segmentation-definition-difference between market segmentation and product differentiation.Bases of segmentation. Characteristic features of market segments. Service segmentation. Functional and non-functional aspects of segmentation. Product proliferation. Application of market research in segmentation. Limiting features of market segmentation. | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | |
| **REFERENCES:**  . Kotler, P., andKeller,K.L.(2009).*A Frameworkfor MarketingManagement,*  *4th edition.* Pearson EducationIndia.  2. Kotler, P., Armstrong, G., Agnihotri, P.Y., and ulHaque, E. (2010). *Principles of*  *Marketing: ASouth Asian Perspective, 13thedition.*Pearson EducationIndia.  3. Kotler, P. (2013). *Rethinking Marketing, 2nd edition.*Pearson Education.  4. Kumar, S.R. (2012).*Case Studies in Marketing Management,1st edition.*Pearson  EducationIndia.  5. Anand, V.P. *MarketingManagement:An IndianPerspective.*Wiley India.  6. Kumar, S.R. (2009).*Consumer Behaviour and Branding: Concepts, Readings and*  *Cases -The Indian Context, 1stedition.*Pearson EducationIndia. | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6415** | | **INDUSTRIAL RELATIONS** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  Identify and discuss some of the distinctive features of labour relations in the public sector provide reasons for this distinctiveness, and discuss some of the major issues arising from it, discuss the nature and role of employment in the public sector , and describe some of the major aspects of the institutional framework, present a critical analysis of the dominant forms of and approaches to management in the public sector, as well as to its unions and other forms of worker organization, identify, describe, and take a position on some of the current trends and developments in labour relations in the public sector  **COURSE OUTCOMES:**  1 acquire a solid theoretical, practical and ethical perspective on many aspects of  industrial relations.  2. critically analyse theories, models, and paradigms in the field  3. understand the key participants, institutions, relationships and processes in employment relations, so that you acquire an enhanced ability to influence industrial relations outcomes in an informed manner  4. develop research, writing and speaking skills necessary for work, life and further postgraduate study  5. strengthen key competencies in group participation, oral and written communication and persuasion, critical thinking, problem-solving, information processing and planning | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Industrial Relations: The changing concepts of Industrial relations, Factors affecting employee stability. Application of psychology to industrial relations. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Industrial Harmony and Conflict: Harmonious relations in industry, importance and means;  cause of industrial disputes, Machinery for settling of disputes, Negotiation, Conciliation, Mediation, Arbitration and Adjudication, Strikes, Lock-outs, Layout and Retrenchment codes of discipline, Grievance procedure, Labour management co-operation; Worker’s participation in management. | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | Labour Relations: Changing concept of management labour relations; Statute laws, Tripartite conventions, development of the idea of social justice,limitation of management prerogatives increasing labour responsibility in productivity.Joint Consultation: Principal types,Attitude of trade unions and management;Joint consultation in India. | | | | 10 |
| **IV** | Trade Unions: Development of trade unionism, Theories of trade unionism, Aim and objectives, Structure and governing of trade unions. Problems of Indian Trade Unions:  Political activities, Welfare, Legislation, Responsibilities, positive role in economic and social development. Role of Collective Bargaining - Methods and tactics, Administration of  collective bargaining agreements; Fair and unfair labour practice. Tripartite Machinery: At the center and in the states; I.L.O. – Its functions and role in labour movement – Industrial health and safety; Industrial legislations. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1.Mamoria,C.B,andSathishMamoria.(1998).*DynamicsofIndustrialRelations.*  Himalaya PublishingHouse, New Delhi.  2.Dwivedi,R.S.(1997).*HumanRelations&OrganisationalBehaviour.*MacmillanIndia  Ltd., New Delhi.  3.Pylee,M.V,andSimonGeorge.(1995).*IndustrialRelationsandPersonnelManagement*.  VikasPublishingHouse(P)Ltd, New Delhi.  4.Nair, N.G.,andLataNair. (2001).*PersonnelManagement andIndustrial Relations*.  S.Chand.  5.Srivastava. (2000).*Industrial Relations and Labour Laws*. Vikas, 4TH edition.  **6.**VenkataRatnam,C.S.(2001).*Globalisationand LabourMangementRelations.*Response  Books. | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME6402** | | **ADVANCED OPERATIONS**  **RESEARCH** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively; knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry; skills in the use of Operations Research approaches and computer tools in solving real problems in industry; mathematical models for analysis of real problems in Operations Research.  **COURSE OUTCOMES:**  1. recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry;  2. formulate a managerial decision problem into a mathematical model; understand  Operations Research models and apply them to real-life problems; use computer tools to solve a mathematical model for a practical problem. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Linear programming: Problem formulation, graphical solution, simplex method,  artificial starting solution, dual simplex method, duality theory, sensitivity analysis Parametric linear programming: Introduction, changes in objective function coefficients, changes in right-hand side constants of constraints. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Integer programming: The branch and bound technique, Gomory’s cutting plane method  Network analysis: Shortest route problem: systematic method - Dijkstra’s algorithm - Floyd’s  algorithm, minimal spanning tree problem: PRIM algorithm – Kruskal’s algorithm,  maximum flow problem. | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | Deterministic dynamic programming: Cargo loading model, reliability improvement  model, single machine scheduling model, capital budgeting problem.  Queuing theory: Introduction to queuing system, terminologies, classification of queuing models – (M/M/1) : (GD/α/α), (M/M/C) : (GD/α/α), (M/M/1) : (GD/N/α), (M/M/C) : (GD/N/α), (M/M/C) : (GD/N/N), (M/M/1) : (GD/N/N) models. | | | | 10 |
| **IV** | Goal programming: Goal programming formulation, simplex method for solving  goal programming.  Nonlinear programming: Lagrangean method, Kuhn-Tucker conditions, quadratic programming. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  HamdyA. Taha, “Operations research”, Pearson, 2004  2. R. Paneerselvam, “Operations research”, PHI, New Delhi, 2008  3. Ravindran, Phillips, Solberg, “Operations researchprinciples andpractice”,Willeyand  Sons 1987 | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6404** | | **WORK SYSTEM DESIGN** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  In order to work effectively on this team, each member needs to be aware of the fundamental systems and design aspects of the problem ,Effective solutions to problems involving both society and technology must be based on a broad systems point-of-view, Not only must the overall technical factors of these problems be carefully considered, but the economic, social, human and political parameters must be given equally careful attention. solutions must be arrived at by interdisciplinary teams where each member contributes his or her own special expertise  **COURSE OUTCOMES:**   1. graduates who can solve problems lying at the interface of technology and 2. the human environment 3. faculty members of the Department are involved in a wide spectrum of research activities such as conflict analysis, pattern recognition, ergonomics, computer engineering, and mechatronics 4. acquire the tools for resolving the problems of complex systems 5. increases in awareness of the theories of human communication and electro- mechanical systems, makes progress in the areas of Systems Theory, Human Systems Engineering, and Socio-Economic Systems, and absorbs the implications of the tremendous growth of electronic computing systems | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Work Study Fundamentals - Productivity, Definition and scope of Motion and Time Study, Reducing Work Content and in effective time.  Method Study - Basic procedure, Process analysis, Activity charts, Man-Machine charts, Operation analysis, Micro motion study, Principles of motion economy, Use of films in Method and Motion Analysis. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Work Measurement - Purposes and uses, Basic procedure, Work sampling, Stop-watch  time study, Concepts of rating and allowances, Setting standard times for jobs, Standard data, Predetermined Time Standards.  Job Evaluation - Basic concepts, Different methods and their use, Compensation  Schemes and wage incentive plans. | | | | 9 |

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| **INTERNAL TEST 2 (Module 2)** | | |
| **III** | Ergonomics Fundamentals - Simple and complex worksystems, Ergonomic aspects in workstation design and analysis.  Anthropometric Principles and Postural Analysis in Workspace Design – Anthropometry and its uses, applications of anthropometry in design, postures and body mechanics, musculoskeletal problems in sitting and standing.  Physiology, Workload, and Work Capacity - Physical work capacity, factors affecting work capacity, measurement of physiological cost of work, fitness for work. | 10 |
| **IV** | Design of Physical Environment-Human thermoregulation, measuring thermal environment, measurement of light, lighting design considerations, measurement of sound/ industrial noise and its control, vibration, principles for the design of visual displays andc ontrol, work organization and work system design. Human sensory system, Cognitive load and design principles for cognitive load. | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | |
| **REFERENCES:**  1. Barnes, R. M. (1980). Motion and TimeStudy:Designand MeasurementofWork. Wiley  &Sons.  2. Niebel, W. B.,andFreivalds, A. (2004). Methods, Standards, andWork Design.McGraw  Hill.  3. Groover, M.P. (2007). Work Systems:TheMethods, Measurementand Management of  Work, 1st edition. PrenticeHall.  4. Tayyari,F.,andSmith,J.L.(2003).OccupationalErgonomics-Principles and Applications. Kluwer AcademicPublishers.  5. Bridger, R.S. (2008).Introduction to Ergonomics,3rd edition. CRC Press. | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6406** | | **SUPPLY CHAIN MANAGEMENT** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  provide participants with a detailed knowledge of the theory and practice of SCM develop graduates to contribute effectively to multi-discipline teamwork aimed at radical improvements in supply chain capability, prepare graduates of all disciplines for a variety of roles in SCM; and Provide personal development opportunities for students in parallel with their meeting career development objectives.  **COURSE OUTCOMES:**   1. Define business concepts and theories underlying supply chain management. 2. State how supply chains are structured differently in different kinds of organisations and industries and for different products. 3. Summarise the nature of different kinds of flows (e.g. information, money and product) within the supply chain. 4. Describe how supply chains can be managed more effectively. 5. Illustrate a broad over view of supply chain strategy, development and trends. Explain how problems in supply chain management can be overcome. 6. Demonstrate understanding about the dynamic behaviour of supply chains and be able to analyze performance metrics. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Introduction to supply chain management: Supply chain basics, decision phases in supply chain, supply chain flows, supply chain efficiency and responsiveness, supply chain integration, process view of a supply chain, uncertainties in supply chain, key issues in supply chain management, drivers of supply chain performance. Supply chain coordination, bullwhip effect, developing relationships in the supply chain, resolving conflicts in supply chain relationships, role of information technology in supply chain | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Demand forecasting in supply chain: Role of forecasting in supply chain, components of  a forecast, forecasting methods, estimating level, trend and seasonal factors, Holt’s model, Winter’s model, measures of forecast error.  Role of aggregate planning in supply chain: Aggregate planning strategies, managing supply and demand in supply chain. | | | | 9 |

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| **INTERNAL TEST 2 (Module 2)** | | |
| **III** | Supply chain inventory: Role of cycle inventory in supply chain, economies of scale, lot sizing for a single product, lot sizing for multiple products, quantity discounts, trade  promotions, price discrimination. Role of safety stock in supply chain, determining appropriate level of safety inventory, inventory replenishment policies, measures of  product availability. | 10 |
| **IV** | Sourcing decisions in supply chain: Supplier selection and contracts, design  collaboration, making sourcing decisions in practice.  Transportation decisions: Role of transportation in supply chain, factors affecting transportation decisions. Routing and scheduling in transportation.  Logistics: Definition, logistics and SCM, international considerations, inbound logistics, internal logistics and outbound logistics. Reverse logistics, green supply chain. | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | |
| **REFERENCES:**  1. SunilChopraandPeterMeindl,“Supplychainmanagement-strategyplanning  and operation”, PHI  2. HandfieldR. B., NicholsJr. E. L., “Introduction to supply chain management”,  Pearson Education  3. RaghuramR. andRangaraj N.,“Logistics and supplychain management”,Macmillan,  2001  4. Simchi-Levi, D., Kaminsky, P., and Simchi-Levi, E., “Designing &managing the supplychain:concepts, strategies&casestudies.”2 nd Edition, Tata McGraw-Hill, 2003  5. Agarwal D. K., “A text book oflogistics and supplychain management”,Macmillan, 2003  6. Srinivasan, G., “Quantitativemodels in operations and supplychain management”, PHI | | |

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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05ME 6466** | **SEMINAR I** | 3-1-0-4 | 2015 |
| **COURSE OBJECTIVE**  Each student shall present a seminar on any topic of interest related to the core / elective  courses offered in the first semester of the M. Tech. Programme. He / she shall select the topic based on the references from international journals of repute. They should get the paper approved by the Programme Co-ordinator / Faculty member in charge of the seminar and shall present it in the class. Every student shall participate in the seminar. The students should undertake a detailed study on the topic and submit a report at the end of the semester. Marks will be awarded based on the topic, presentation, participation in the seminar and the report submitted. | | | |

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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05ME 6488** | **MINI PROJECT** | 3-1-0-4 | 2015 |
| **COURSE.OBJECTIVE**  At the end of the project, he / she has to submit a report on the work being carried out. The mini project is designed to develop practical ability and knowledge about practical tools/techniques in order to solve the actual problems related to the industry, academic institutions or similar area. Students can take up any application level/system level project pertaining to a relevant domain. Projects can be chosen either from the list provided by the faculty or in the field of interest of the student. For external projects, students should obtain prior permission after submitting the details to the guide and synopsis of the work. The project guide should have a minimum qualification of ME/M.Tech in relevant field of work. At the end of each phase, presentation and demonstration of the project should be conducted, which will be evaluated by a panel of examiners. A detailed project report duly approved by the guide in the prescribed format should be submitted by the student for final evaluation. Publishing the work in Conference Proceedings/ Journals with National/ International status with the consent of the guide will carry an additional weightage in the review process | | | |
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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05ME6492** | **INDUSTRIAL ENGINEERING LAB** | 3-1-0-4 | 2015 |
| COURSE OBJECTIVES:  The lab shall provide an environment to undertake method, motion and time study, ergonomic evaluation, quality control and reliability analysis exercises within the infrastructure of workshop of Department of Mechanical Engineering and Industries around at the basic level. A typical laboratory course shall contain a minimum of 10 experiments preferably from multiple domains highlighted below.  Experiments on Method Study: Practical application of Operation process charts, Flow process charts, Multiple Activity chart, Two-handed Process chart, Travel Chart, Flow and  string diagrams, Models and templates.  Experiment on Motion Study: Motion study using paper-pen, Micro motion study using video analysis- preparation SIMO chart  Experiments on Work Measurement Analysis: Standard time estimation using conventional stop watch, Use of Work Sampling analysis, Use of PMTS like Work Factor system / MTM / MOST  Experiments on Learning Curves  Experiments on Ergonomic Evaluation: Analysis of manual material handling task, Postural analysis of a manual task, Estimation of physical exertion level in a manual task, Estimation of cognitive demand in a manual task  Experiment to evaluate Work-system: Anthropometrics and workstation evaluation, Evaluating illumination level, Hand tool and equipment design, Use of virtual reality or human modeling to evaluate workspace  Experiments on Quality Control: Construction of X chart, R chart, P chart and C chart,  Construction of OC curve  Experiments using Design of Experiment principles: DOE using two-level factorial design, DOE using fractional factorial design  Experiments on Automation and Product testing: CNC programming and machining of a part, Quality assessment and reliability testing of product or system. | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6422** | | **HUMAN RESOURCE MANAGEMENT** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  People (human resources) are viewed by most experts as the most important asset of any organization. Managing an organization’s people is often the most challenging and complex task required of a manager. It is also the responsibility, if executed well, that permits a person to rise to the senior level of management, or prevents a manager from rising to the senior  level if done poorly.  The objective of the course is to teach the basic principles of strategic human resource management—how an organization acquires, rewards, motivates, uses, and generally manages its people effectively. In addition to providing a basic legal and conceptual framework for managers, the course will introduce the manager to practices and techniques for evaluating performance, structuring teams, coaching and mentoring people, and performing the wide range of other people related duties of a manager in today’s increasingly complex workplace  **COURSE OUTCOMES:**   1. students develop the knowledge, understanding and key skills that are required by today's HR professionals and to enable students to effectively contribute to dynamic   organisations An ability to evaluate and apply theories of social science disciplines to workplace issues HRM functional capabilities used to select, develop, and motivate workers.   1. Strong analytical, communication, and decision making skills. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | HumanResourceManagement–IntroductionandImportance-ConceptualbetweenPersonnel  Management and HRM– Strategic HRM-role of a HR Manager | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Human Resources Planning – Objectives - HRP Process –Manpower Estimation - Jobanalysis-jobDescription-JobSpecification-Recruitment-SourcesofRecruitment–SelectionProcess-Placement and Induction-Retention of Employees. | | | | 9 |

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| **INTERNAL TEST 2 (Module 2)** | | |
| **III** | Training and Development-Objectives and Needs - Training Process- Methods of Training- Tools and Aids - Evaluation of training Programs. Career Planning-Succession Planning. Different methods of Performance Appraisal - Rating Errors – Competency Management. Compensation Management-Concepts and Components-Job Evaluation- Incentives and Benefits. Retirement/Separation - Superannuation - Voluntary Retirement Schemes- Resignation - Discharge-Dismissal -Suspension-Layoff. | 10 |
| **IV** | Performance Management System – Definition, Concept and Ethics. Productivity  Management-Concepts-TQM-Kaizen-Quality Circles Industrial relations - Grievance  Procedure - collective Bargaining- Settlement of Disputes. | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | |
| **REFERENCES:**  1. Dessler, G. (2012) Human ResourceManagement13thedition. Pearson Education.  2. Mamoria, C. B., andGankar, S. V. (2002). Personnel Management23rdedition.  Himalaya PublishingHouse.  3. Dwiwedi,R.S.(2000).ManagingHumanResources.GalgotiaPublishingCompany,  New Delhi.  4. Pardeshi, P. C. (2012). Human ResourceManagement. | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6424** | | **MARKETING LOGISTICS** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the fundamental concepts, theories and methods in marketing Logistics. * To understand how the logistics management is done in industry   **COURSE OUTCOMES:**  1. The student will understand how logistics management is being done in industry and  Will be in a position to develop logistic plans for synergistic growth and sustenance of a business | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | logistics - Introduction, Objectives and Scope. Physical distribution management. Functions  of the logistics system - Transportation, Warehousing,  Order processing, Information handling and procurement. Customer relationship management. Marking mix - Product, Product life cycle, Product line, Product mix strategies | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Importance of marketing logistics system - Goals, Integrated logistics management, Major  logistics functions, Role of RFID. Marketing channels and Supply chain management - Vertical marketing system, Horizontal marketing system, Multi channel distribution system, Channel design decisions, Channel management decisions. | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | Retailing and Wholesaling - Marketing decisions for Retailing and Wholesaling, Types of  wholesalers, Trends in wholesaling. Direct and online marketing - Types, promises and challenges. | | | | 10 |
| **IV** | Transportation alternatives and technologies - Transportation performance analysis,  Transportation cost analysis, Fleet development and management, Fleet performance indicators, Routing and scheduling, Shipment planning, Vehicle loading, Transportation management and information systems requirements.  Logistics in different industries - Third party and Fourth party logistics, Reverse logistics, Airline Schedule Planning, Railway Networks, Postal services, Logistics in maritime industry / health care and other service industries. | | | | 8 |

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| **END SEMESTER EXAM (ALL Modules)** |
| **REFERENCES:**  1. Bloomberg, D. J.,LeMay,S.B.,and Hanna, J.B. (2002).Logistics. PrenticeHall.  2. Teufel, T.,Rohricht, J., and Willems, P. (2002). SAP Processes:Logistics.Addison- Wesley.  3. Blanchard,B.S. (2004).Logistics Engineering & Management, 6thedition. Prentice  Hall.  4. Ballou, R.H., and, S., and Srivastava, S.K. (2007). BusinessLogistics/SupplyChain  Management. Pearson EducationIndia.  5. Langford, J. (2007).Logistics: Principles andApplications, 2nd edition. Tata McGraw- Hill.  6. Sople, V.V. (2012).Logistics Management,3rdedition. Pearson EducationIndia |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6426** | | **SAFETY AND ENVIRONMENT**  **MANAGEMENT SYSTEM** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  The course will give an overview of the safety and environmental issues in the industry. It will provide detailed understanding of the methods and techniques to resolve these key issues in todays industrial environment production and processing, cleaner and safer.  This course would educate the participants to identify and assess hazards in any stage of operation, to quantify and manage them as well.  **COURSE OUTCOMES:**  The student will understand the safety management as practiced in industry and knows the  concepts of Environment Impact Assessment | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Safety Systems - Definition, Safety information system - Basic concepts, Definition of accidents, Analysis of causes of accident.  Hazard analysis - General hazard analysis, Analysis of electrical, physical and chemical hazards. Cost effectiveness in hazard eliminations, Fault Tree Analysis and HAZOP studies. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Managing for Safety - Safety inspection, procedure, periodicity, checklist, report forms.  Planning for safety and productivity, Safety sampling, Safety audit, Safety survey, JSA, Accident prevention, Work permit and lock out system, Accident analysis, Safety education and communication, Safety performance analysis. Personal protective equipment testing  and usage.  Safety in Material Handling: Selection of material handling equipment. Equipment used - ropes, chains, slings, hooks, clamps. Procedure for testing and checking as per standard. Design conservation, conveyor systems, belt, roller chain and elevator and lifts, industrial hoists, mobile crane, forklift, operation maintenance and checking procedure. | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | Fire Protection System - Automated fire fighting system, chemistry of fire, water sprinkler,fire hydrant, alarm and detection system. Suppression system, CO2 system, Foam system, DCP system, Halon system, Portable extinguisher.  Safety in Process: Design for safety, safety in use of power press. Safety in foundry, forging, welding, hot working and cold working, electroplating and boiler operation. | | | | 10 |
| **IV** | Safety Legislation: Provisions in factory act for safety, explosive act, workmen compensation act, compensation calculation. Boiler act and pollution control act, electrical safety,  electricity act and rules.  Environment Impact Assessment (EIA): Introduction, EIA capability and limitations, Legal provisions on EIA, Methods of EIA – checklists, matrices, Networks. Cost benefit analysis, Analysis of alternatives. Case studies. Adverse impact on environment. ISO14001:2004 EMS standards. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. Nicholas, P.C. (2000).*Practical Guide toIndustrial Safety:Methods for Process*  *SafetyProfessionals.* Marcel Dekker.  2. National SafetyCouncil.(2000).*Accident Prevention Manual: Engineering&Technology, 12th edition.*National SafetyCouncil.  3. Deshmukh,L.M.(2005).*Industrial Safety Management.*Tata McGraw-Hill.  4. Macdonald, D.(2004).*Practical IndustrialSafety, Risk Assessmentand Shutdown*  *Systems, 1stedition.*Newnes (Elsevier).  5. Ridley, J., and Channing, J. (2008).*SafetyatWork.*Butterworth-Heinemann UK. | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6432** | | **BUSINESS PRACTICE AND INDUSTRIAL**  **ECONOMICS** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To introduce the concepts of economics relevant to business and industry to the students. * To make the students understand the importance of leadership, motivation and teamwork in the management perspective. * To introduce the concept of cost accounting and its methods   **COURSE OUTCOMES:**  1. The student will understand the concepts of economics necessary in an Industrial  Organisation and will be able to take decisions based on break even analysis,capital budgeting etc. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Introduction to management, Organization Structure, Industrial Politics, Authority-Responsibility and Accountability, Span of Control & Delegation of Power, Functions of Management, SWOT analysis | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Organizing - Organizational Design & Structure, Human Resource Management, Managing Organizational Change & Innovation, Leading – Motivation and Leadership, Teams & Team work, Communication & Negotiation, Controlling | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | Definition of Managerial Economics, Decision making and the fundamental concepts affecting business decisions, Utility Analysis & Demand Curve, Demand Forecasting. | | | | 10 |
| **IV** | Cost Considerations, Break-Even Analysis and its application, Cost output relationship, Principles of Capital Budgeting, Cost of Capital, Market Structure, Pricing and Output, Pricing Methods. | | | | 8 |

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| **END SEMESTER EXAM (ALL Modules)** |
| **REFERENCES:**  1. Koontz, H., and Weihrich, H. (2004). *Principlesof Management.*TataMcGraw-Hill.  2. Stoner, J.A.F., Robbins,S.P., Hitt, M.A., Manjunath, V.S., and SatyaRaju, R. (2010).  *Principles of Management, 2nd edition.*Pearson Education.  3. Bhattacharyya, D.K. (2012).*Principles of Management: Text and Cases, 1st edition.*  Pearson Education.  4. Luthans,F. (2013).*OrganizationalBehavior.*Tata McGraw-Hill.  5. Gupta, G. (2011).*ManagerialEconomics.*Tata McGraw-Hill.  6. Andreosso,B.,and David Jacobson, D. (2005).*IndustrialEconomics and*  *Organisation.* Tata McGraw-Hill.  7. Horngren, C.T. (2012). *Cost Accounting: AManagerialEmphasis, 14th edition.* |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6434** | | **RELIABILITY ENGINEERING AND**  **MANAGEMENT** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  This course is designed to teach you about the concepts underlying the analysis of  reliability data and tools you can use to improve the outcomes of your Reliability initiatives. In addition to the ability to apply knowledge of mathematics, science and engineering the course also prepares the students to design a system, component, or process to meet desired needs and develop in them an ability to identify, formulate, and solve engineering problems This also helps the students in understanding of professional and ethical responsibility .  **COURSE OUTCOMES:**   * Students will be able to define and develop measures for reliability and safety Students will be able to model reliability by various life distributions Students will be able to compute system reliability. * Students will be able to relate reliability and safety factor Students will be able to estimate reliability by product testing. * Students will be able to understand design and management of reliability. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Basic Concepts of Reliability: Definitions-Reliability, Hazard rate, Active Redundancy, Maintainability, Downtime; Reliability and Quality, Failure and failure modes, Causes of failures, Maintainability and Availability.  Reliability Mathematics: Introduction to probability distributions, Concept of Bathtub Hazard Rate curve, Reliability Evaluation of two-state device networks-series, parallel, k-out-of-m systems; Standby redundant systems, Reliability evaluation of three-state device networks-series and parallel | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Reliability Determination Methods: Network reduction technique, Path tracing technique, Decomposition technique, Delta-Star method.  Advanced Reliability Evaluation Concepts: Supplementary variables technique, Interference theory, Human reliability, Common cause failures, Fault trees, Failure mode and effect analysis.  Reliability Optimization: Redundancy optimization-parallel, series-parallel, and series networks. | | | | 9 |

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| **INTERNAL TEST 2 (Module 2)** | | |
| **III** | Failure Data Analysis: Failure data banks, Non repairable items failure data analysis-complete data, incomplete data; incomplete failure data hazard plotting technique, Maximum likelihood estimation technique.  Total Productivity Maintenance (TPM): Distinctive features of TPM, Basic philosophy of zero defects (ZD), Maximizing equipment effectiveness, Six major losses, TPM development activities, Steps of TPM development, Autonomous maintenance, Planned maintenance, Measuring TPM effectiveness. | 10 |
| **IV** | Maintainability and Availability Concepts: Maintainability function, Availability function, Frequency of failures, Two-unit parallel system with repair, k-out-of-m systems, Preventive maintenance.  Reliability Management: Reliability Programme, Management policies and decisions, Reliability management by objectives, Reliability groups, Reliability data acquisition and analysis, Managing people for reliability. | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | |
| **REFERENCES:**  1. Balagrusamy, E. (1984).*ReliabilityEngineering*. Tata-McGrawHill Publishing  Company Limited, NewDelhi.  2. Dhillon,B.S.(1983).*ReliabilityEngineeringinSystemDesignandOperation*.  Von Nostrand ReinholdCompany, New York, 1983.  3. Nakajima Seiichi, N. (1997).*Introduction to TPM*. ProductivityPressIndia(P) Madras.  4. Lewis, E. E. (1987).*Introduction to ReliabilityEngineering*. John Wiley&Sons, New  York.  **5.** O'ConnorPatric,D.T.(1995).*PracticalReliabilityEngineering,3rdrevisededition*.  JohnWiley&Sons | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 6436** | | **MANAGEMENT INFORMATION SYSTEM** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  1. To understand the evolution and role ofMIS in anorganisation  2. To understand the designof MIS and basic steps in design  3.To understand the process of decision making using MIS  **COURSE OUTCOMES:**  The student will be able to  1. describe the evolution and role of MIS in an organisation  2. describe the designing and functioning of MIS  3. describe computer based applications in MIS | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Introduction: Meaning and definition – system approach – role of MIS to face increased complexity of business and management – system view of business – MIS organization within the company.  Conceptual information system design: Defining the problems – setting system objectives– establishing system constraints – determining information needs – determining information sources – developing alternate conceptual design and selecting one – documenting the conceptual design – preparing the conceptual design report.. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Detailed information system design: Informing and involving the organization – project management of MIS detailed design – identifying dominant and trade-off criteria – defining the subsystems – sketching the detailed operating subsystems and information flows – determine the degree of automation – informing and involving the organization again – inputs, outputs and processing – early system testing – propose an organization to operate the system – documentation – revisiting the manager-user. | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | Evolution of information systems: Basic information systems – financial information  systems – production / operations systems – marketing information systems – personnel information systems. Information system softwares – selection – complexity and errors. Information systems and decision making: Decision making and MIS – programmed and non programmed decision – MIS for making programmed decisions – decision-assisting information systems – components of decision support systems | | | | 10 |
| **IV** | Information technology and MIS: Comparison of manual and computer based information systems – conversation of manual to computer based systems – types of computer based applications in MIS – application of multimedia, internet, intranet and extranet technologies in MIS. E-business: Introduction – models – security. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. HenryC.Lucas Jr., The analysis, designand implementation of information systems,  4th Edition, McGraw Hill Company, New York, 1992.  2. Burch J. E., StraterF. R &GrudnikskiG.,Information systems:theoryandpractice, JohnWileyand Sons, New York, 1987.  3. Murdick R. G., Ross J. E. &ClaggettJ. R.,Information systems formodern management, 3rd Edition, PrenticeHallofIndiaPrivateLtd.,India, 1992.  4. James A. O’Brien, Management information systems:amanagerialend user perspective,GalgotiaPublications, 1997. | | | | | |

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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05ME 7467** | **SEMINAR II** | 3-1-0-4 | 2015 |
| COURSE OBJECTIVES:  Each student shall present a seminar on any topic of interest related to the core/elective  Courses offered in the first semester of the M. Tech. Programme. He/she shall select the topic based on the references from international journals of repute. They should get the paper approved by the Programme Co-ordinator/Faculty member in charge of the seminar and shall present it in the class. Every student shall participate in the seminar. The students should undertake a detailed study on the topic and submit a report at the end of the semester. Marks will be awarded based on the topic, presentation, participation in the seminar and the report submitted. | | | |

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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05ME 7487** | **PROJECT PHASE I** | 3-1-0-4 | 2015 |
| COURSE OBJECTIVES:  In Project Phase-I, the students are expected to select an emerging research area in the field  of specialization which is relevant to Industry. After conducting a detailed literature survey, they should compare and analyze research work done and review recent developments in the area and prepare an initial design of the work to be carried out Emphasis should be given for introduction to the topic, literature survey, and scope of the proposed work along with some preliminary work carried out on the thesis topic.    Students should submit a copy of Phase-I thesis report covering the content discussed above and highlighting the features of work to be carried out in Phase-II of the project. The candidate should present the current status of the thesis work and the assessment will be made on the basis of the work and the presentation, by a panel of internal examiners in which one will be the internal guide. The examiners should give their suggestions in writing to the students so that it should be incorporated in the Phase–II of the thesis. | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 7441** | | **PRACTICAL PROJECT MANAGEMENT** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  Assume the role of project manager in their company or organization.  Develop and manage a complex project plan based on one of three case studies.  This approach has the advantage of thoroughly covering each knowledge area while applying it in the context of real-world project work.  Pursue learning through real world experiences and case studies. In addition to technical competencies, the course emphasizes the psychology and politics of the craft by using examples from participants and the instructor’s own projects.  **COURSE OUTCOMES:**  1. understand the practical application of basic project management  principles understand key project success factors and typical project pitfalls understand project stakeholders and their expectations  2. understand dynamic relationships and trade-off decisions between a project's scope, time, cost and quality  3. understand roles and responsibilities of a project manager ,a project sponsor and project team members  4. define project out comes and create a plan for achieving them | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | **Introduction and Systems approach-**Basic characteristics of modern projects, The need of project management, Types of project managers, The forms of project management.  The systems approach, Basic systems concept, A general systems approach, The life cycle concepts of projects, A systems design algorithm.  **Planning of Projects-**Project organization structure, Formal and informal organization structure, Forms of organization structures, Requirements of project organization, Matrix organization structure, Pure project organization structure, selection of project organization structure.  **Work definition-**Planning of project work, Work Breakdown Structure(WBS), Responsibility chart and responsibility matrix, Integration of WBS and organization structure, a detailed project plan. Conflict and negotiation. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | **Scheduling of Projects-**Project scheduling, Definitions, Gantt charts, Network scheduling, Programme Evaluation and Review Technique (PERT), Critical Path Method(CPM). Risk analysis using simulation.  **Project scheduling with resource constraints**-crashing of projects, Resource leveling, resource loading and simple problems. | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | **Budgeting and Appraisal of projects-**Project costing, Cost of project, Mean of finance, cost of production, cost estimation and budgeting, and Project Cost Accounting System (PCAS). Construction and use of audit report, Project audit lifecycle, Essentials of audit and evaluation, Varieties of project termination, the termination process, The Final Report.  **Project appraisal-**Financial evaluation of projects, Net Present Value Method, Benefit Cost Ratio method, Internal Rate of Return method, Accounting Rate of return method, Assessment of various methods, simple problems. | | | | 10 |
| **IV** | **Controlling of Projects-**Introduction, Phases and types of project control, Variance Analysis of project performance, Problems of project control. Simple problems.  The role of project manager, team work and leadership functions, Information needs and the reporting process, computers in project management, software’s in project management. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. Ghattas, R.G., Mckee,S.L.,and Ghattas, R. (2000). Practical Project Management, 1st  edition. Prenticehall.  2. Maylor,H. (2004). Project Management, 3rdedition. Pearson EducationIndia.  3. Chandra, P. (2009). Projects planningAnalysis SelectionImplementation and Review, 7th edition. Tata McGraw-Hill.  4. Meredith, J.R., and Mantel, S.J. (2010). Project Management–A Managerial Approach,  7th edition. WileyIndia.  5. Kerzner, H.(2012). Project Management– A Systems Approachto Planning, Scheduling and Controlling, 12th edition. WileyIndia. | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 7443** | | **SYSTEM MODELINGAND**  **SIMULATION** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To understand the basic system concept and definitions of System and to learn techniques to model and to simulate various systems. * To be able to analyze a system and to make use of the information to improve the performance.   **COURSE OUTCOMES:**   1. The student will demonstrate the ability to model and simulate various engineering systems | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | System Concept: Systems and system environment, Components of a system, Discreteand continuous systems, Systems approach to problem solving, Types of system study, System analysis, system design and system postulation, System modelling, Types of models.  System Simulation: Technique of simulation, Comparison of simulation and analytical methods, Types of system simulation, Steps in simulation study, Monte Carlo simulation. Concepts in Discrete Event Simulation: Event scheduling/Time advance algorithm, Modelling world views, Simulation programming tasks, Comparison and selection of simulation languages. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Random Number Generation: Techniques for generating random numbers, Linear congruential method, Test for random numbers, Frequency tests, run tests, tests for autocorrelation, gap test, and Poker test.  Random Variate Generation: Inverse transformation technique, Exponential, Uniform, Weibull, Triangular, Empirical-Discrete and continuous distributions. Convolution method, Acceptance-Rejection technique.  Input Modelling for Simulation: Data collection, Identifying the distribution with data, Parameter estimation, Goodness of fit test, Chi square, Klomogrov and Smirnov tests, Selecting input model when data are not available | | | | 9 |

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| **INTERNAL TEST 2 (Module 2)** | | |
| **III** | Verification and Validation of Simulation Models: Verification of simulation models,  Calibration and validation of models, Face validity, Validation of model assumption, validating input-output transformation, Input-output validation using historical input data. Output Analysis for a Single Model: Measures of performance and their estimation, Point estimation, Interval estimation, Output analysis for terminating simulations and Steady state simulations. | 10 |
| **IV** | Simulation Modelling and Analysis of Manufacturing Systems: Objectives, Performance  measures, Issues in simulation of manufacturing systems, Simulation software for manufacturing applications, Simulation of job shop manufacturing systems, Simulation Modelling and Analysis of Single Server and Single Queue Systems, Inventory systems and PERT networks. | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | |
| **REFERENCES:**  1. Deo, N. (1997). SystemSimulation with Digital Computer. PrenticeHallofIndia.  2. Askin, R.G. and Standridge, C.R. (1993). Modelling and Analysis of  ManufacturingSystems.JohnWiley&Sons.  3. Sengupta, S. (2013). System Simulation and Modeling. Pearson EducationIndia.  4 Panneerselvam, R., and Senthilkumar, P. (2013). System Simulation, Modelling and Languages. PrenticeHallIndia. | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 7445** | | **PLANT ENGINEERING AND**  **MAINTENANCE** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * Understand the tools and methods for analysis, design, and operation of manufacturing systems. * To understand current trends in manufacturing * To understand the process of aggregate planning,scheduling production flow analysis etc. To familiarize with softwares used in production systems * To understand systems modelling and simulation in manufacturing   **COURSE OUTCOMES:**  The student will be able to   1. Describe current trends in manufacturing   2. formulateandsolveproblemsinscheduling,productionflowandsimulation of manufacturing problems  3. work using softwares involved in production systems  4. to model and simulate manufacturing systems | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | **Introduction to Manufacturing System:** Current trends in Manufacturing in India, Operations Management functions. Operations management in service systems. Methods of sales forecasting: time series analysis, moving average, exponential smoothing, least square fit methods, regression analysis and other methods such as market survey and Delphi analysis.  **Aggregate planning methods-**graphical and reaction rate methods. Aggregate planning with linear programming transportation model. Linear Decision Rule. Master Production schedule. Production planning in made-to-stock and made-to-order type of companies.  **Scheduling–**Loading and Sequencing. Gantt charts, Index method, Johnson’s method, critical ratio and other methods of loading and sequencing.  **Dispatching-**progress reporting and **expediting** functions. Designing, installing and evaluating production control system. | | | | 9 |

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| **INTERNAL TEST 1 (Module 1)** | | |
| **II** | **Facilities Planning: Plant location**-Selection of locations, Factor rating, Transportation methods, Centriod methods. Locating service facilities. **Facility Layout** – Basic production layout, product layout, Process layout, Group layout (Cellular), Problems in GT/CMS- Design of CMS– Production Flow Analysis, Rank Order Clustering(ROC)Optimization Models, traditional approaches and non-traditional approaches-Simulated Annealing, Genetic Algorithms, Fixed position layout, Retail Service Layout, Office Layout, Automated production Systems, Automation, Software for Automation:-Systematic layout planning, CORELAP, ALDEP and CRAFT. **Flexible Manufacturing Systems-**Components of  FMS, Structure of FMS, Conceptual model of FMS. **Characteristics of Lean systems for services and Manufacturing-**Pull method of work flow, Small lot sizes, Kanbansystem, Value stream mapping, JIT **Business Process Reengineering -**Principles of Reengineering, Implementation of Reengineering, Issues in Reengineering. | 9 |
| **INTERNAL TEST 2 (Module 2)** | | |
| **III** | **Resources Planning**: Planning frame work, Multiple levels in products, Product structure, Bill of Materials, Time phasing the requirement, Determining the Lot size, Lead time information. Material Requirement Planning, Updating MRP Schedules, Safety stock and Safety Lead Time. Capacity Requirement Planning, Distribution Requirement Planning,  Manufacturing Resources Planning(MRP-II).**Enterprise Resources Planning-**Definition | 10 |
| **IV** | **Simulation Applications in Manufacturing Systems: Systems modeling**– General systems theory, concept of simulation, simulation as a decision making tool, types of simulation. Pseudo random numbers, methods of generating random variates, testing of random numbers and variates. **Problem formulation-**data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation. Comparison and selection of simulation languages**,** Development of simulation models for queuing systems, production systems, inventory systems, maintenance and replacement systems, investment analysis and network. | 8 |

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| **END SEMESTER EXAM (ALL Modules)** |
| **REFERENCES:**  1. Chase, R.B., Aquilano, N.J., andJacobs, F.R. (2000).*Operations Management for*  *CompetitiveAdvantage.*Irwin Professional Pub.  2. Ebert, J. R., and Adams, E.E. (2009).*Productionand Operations Management: Concepts, Models and Behavior.*PrenticeHallIndia.  3. Mahadevan,B.(2010). *Operations Management:Theory and Practice.*Pearson Education  India.  4. James, A.T., John, A.W.,Yavuz, A.B.,and Tanchoc, J.M.A. (2011).*Facilities Planning,*  *3rd edition.*WileyIndia.  5. Leon,A. (2007). *EnterpriseResourcePlanning, 2nd edition.*Tata McGraw-Hill.  6. Wagner,B., andMonk,E. (2009).*EnterpriseResourcePlanning, 3rdedition.*Cengage  Learning.  7. Law, A.M. (2008). *Simulation Modeling and Analysis, 4th edition.*Tata McGraw-Hill.  8. Banks, J., Carson, J.S., Nelson, B.L., andNicol, D.M. (2009).*Discrete-Event System*  *Simulation, 5th edition.*Pearson Education. |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 7451** | | **MODERN MANUFACTURING**  **SYSTEM DESIGN** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  Understand the tools and methods for analysis, design, and operation of manufacturing systems. , To understand current trends in manufacturing , To understand the process of aggregate planning, scheduling production flow analysis etc. , To familiarize with softwares used in production systems , To understand systems modelling and simulation in manufacturing  **COURSE OUTCOMES:**  The student will be able to  1. describe current trends in manufacturing  2. formulateandsolveproblemsinscheduling,productionflowandsimulation of manufacturing problems  3. work using softwares involved in production systems  4. to model and simulate manufacturing systems | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | **Introduction to Manufacturing System:** Current trends in Manufacturing in India, Operations Management functions. Operations management in service systems. Methods of sales forecasting: time series analysis, moving average, exponential smoothing, least square fit methods, regression analysis and other methods such as market survey and Delphi analysis.  **Aggregate planning methods -** graphical and reaction rate methods. Aggregate planning with linear programming transportation model. Linear Decision Rule. Master Production schedule. Production planning in made-to-stock and made-to-order type of companies. **Scheduling –** Loading and Sequencing. Gantt charts, Index method, Johnson’s method, critical ratio and other methods of loading and sequencing.  **Dispatching -** progress reporting and **expediting** functions. Designing, installing and evaluating production control system. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | **Facilities Planning:Plant location**-Selection of locations, Factor rating, Transportation methods, Centriod methods. Locating service facilities. **Facility Layout** – Basic production layout, product layout, Process layout, Group layout (Cellular), Problems in GT/CMS- Design of CMS– Production Flow Analysis, Rank Order Clustering(ROC)Optimization Models, traditional approaches and non-traditional approaches-Simulated Annealing, Genetic Algorithms, Fixed position layout, Retail Service Layout, Office Layout, Automated production Systems, Automation, Software for Automation:-Systematic layout planning, CORELAP, ALDEP and CRAFT. **Flexible Manufacturing Systems-**Components of  FMS, Structure of FMS, Conceptual model of FMS. **Characteristics of Lean systems for services and Manufacturing-**Pull method of work flow, Small lot sizes, Kanban system, Value stream mapping, JIT **Business Process Reengineering -**Principles of Reengineering, Implementation of Reengineering, Issues in Reengineering. | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | **Resources Planning**: Planning frame work, Multiple levels in products, Product structure, Bill of Materials, Time phasing the requirement, Determining the Lot size, Lead time information. Material Requirement Planning, Updating MRP Schedules, Safety stock and Safety Lead Time. Capacity Requirement Planning, Distribution Requirement Planning Manufacturing Resources Planning(MRP-II).**Enterprise ResourcesPlanning-**Definition, Evolution, Demand of ERP, ERP Modules, Benefits of ERP, Competitive Environment Analysis, Strategic Need Analysis, Feasibility Analysis, ERP softwares, ERP enabled Business Process Re-Engineering,and Resources Planningin Services. | | | | 10 |
| **IV** | **Simulation Applications in Manufacturing Systems: Systems modeling**– General systems theory,concept of simulation, simulation as a decision making tool, types of simulation. Pseudo random numbers, methods of generating random variates, testing of random numbers and variates. **Problem formulation-**data collection an dreduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation. Comparison and selection of simulation languages**,** Development of simulation models for queuing systems,production systems, inventory systems, maintenance and replacement systems, investment analysis and network. | | | | 8 |

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| **END SEMESTER EXAM (ALL Modules)** |
| **REFERENCES:**  1. Chase, R.B., Aquilano, N.J., andJacobs, F.R. (2000).*Operations Management for*  *CompetitiveAdvantage.*Irwin Professional Pub.  2. Ebert, J. R., and Adams, E.E. (2009).*Productionand Operations Management: Concepts, Models and Behavior.*PrenticeHallIndia.  3. Mahadevan,B.(2010). *Operations Management:Theory and Practice.*Pearson Education  India.  4. James, A.T., John, A.W.,Yavuz, A.B.,and Tanchoc, J.M.A. (2011).*Facilities Planning,*  *3rd edition.*WileyIndia.  5. Leon,A. (2007). *EnterpriseResourcePlanning, 2nd edition.*Tata McGraw-Hill.  6. Wagner,B., andMonk,E. (2009).*EnterpriseResourcePlanning, 3rdedition.*Cengage  Learning.  7. Law, A.M. (2008). *Simulation Modeling and Analysis, 4th edition.*Tata McGraw-Hill.  8. Banks, J., Carson, J.S., Nelson, B.L., andNicol, D.M. (2009).*Discrete-Event System*  *Simulation, 5th edition.*Pearson Education. |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 7453** | | **KNOWLEDGE MANAGEMENT** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  Identify the different types of knowledge and the ways in which knowledge is created and used , Understand the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management. , Appreciate the role and use of knowledge in organizations and institutions, and the typical obstacles that KM aims to overcome. , Know the core concepts, methods, techniques, and tools for computer support of knowledge management.  **COURSE OUTCOMES:**   1. The student will be able to describe different types of knowledge and the role of   knowledge management in today’s organisation.   1. The student can explain about creation and management of organisational knowledge. | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Introduction to Knowledge Management, Understanding Knowledge ,Data, Information and Knowledge, Experience , Cognition, Types of Knowledge, Expert Knowledge , Human Thinking and Learning, Knowledge creation at the level of the individual, group and organization, Driving forces in KM, Challenges in Building KM Systems, KM System Life Cycle (KMSLS), Knowledge Creation and Knowledge Architecture – Nonaka’s Model of Knowledge, Creation and Transformation. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Managing organizational knowledge, Role of KM in today’s organization Multi-dimensional organizational learning, Elements of Knowledge Management, Capturing knowledge, KM Systems, Evaluating the Expert, Developing a Relationship with Experts, Fuzzy Reasoning and  The Quality of Knowledge , Knowledge Capturing Techniques, Brain Storming, Protocol Analysis, Consensus Decision Making, Repertory Grid, Concept Mapping, Black | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | Knowledge codification, Need of codification, Modes of Knowledge Conversion, Codification Tools and Procedures, Knowledge maps, Decision Tables, Decision Trees, case based reasoning, Knowledge based agents, Knowledge Developer’s Skill Sets, System Testing and Deployment, Knowledge Testing , managing test phase, Approaches to Logical Testing, User Acceptance Testing , KM System Deployment, User training, Post implementation. | | | | 10 |
| **IV** | Knowledge transfer and sharing , Transfer Methods , Role of the Internet, Knowledge Transfer in e-world, Web-centric knowledge management, Data Mining and Business Intelligence , Decision Making Architecture , Data Management , Managing Knowledge Workers, Knowledge based value chain, Applications of knowledge management, information technology and organizational Productivity, Knowledge management in manufacturing and the service sector, Impact on Organizational Performance. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  1. Elias.M.Awadand Hassan M. Ghaziri– “KnowledgeManagement”, PHILearning, 2011  2. SheldaDebowski, “KnowledgeManagement”Wiley India Pvt.Ltd, 2012  3. Shadbolt,WalterVandeVeldeandBobWielinga,“KnowledgeEngineeringand | | | | | |

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05ME 7455** | | **INDUSTRIAL SCHEDULING** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To learn the importance of industrial scheduling. To develop idea about different scheduling. * To learn the applications of scheduling.   **COURSE OUTCOMES:**  1. The student will be able to describe the systems and processes involved in  scheduling and will be able to solve scheduling problems | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Introduction: Importance of scheduling in implementation of production planning – overview of models – machine configurations – processing characteristics and constraints – objectives and performance measures – computational complexity; NP complete and NP hard – optimality of schedules. Aggregate production planning – Master production scheduling – Project scheduling.  Single machine sequencing with independent jobs; without due dates, with due dates – adjacent pair wise interchange methods – branch and bound approach – neighborhood search techniques – random sampling – parallel machine models. | | | | 9 |
| **INTERNAL TEST 1 (Module 1)** | | | | | |
| **II** | Flow shop scheduling: Introduction – permutation schedules – Johnson’s problem-Ignall and  Schrage algorithm – dominance properties for makespan problems –CDS, Palmer, Gupta heuristics - Scheduling in process industries with no waiting or work in process. | | | | 9 |
| **INTERNAL TEST 2 (Module 2)** | | | | | |
| **III** | Job shop scheduling Introduction, types of schedules, schedule generator – Disjunctive  programming and Branch and bound – shifting bottleneck heuristic and the makespan – simulation studies -elements of dynamic job shop , Scheduling in dynamic flow systems. Use of priority disciplines. | | | | 10 |
| **IV** | Applications and directions: Scheduling of Flexible assembly systems – lot sizing and scheduling –Scheduling balancing and other aspects of design in mixed model assembly lines and flow lines- A survey of other scheduling problems. Applications in manufacturing systems. | | | | 8 |
| **END SEMESTER EXAM (ALL Modules)** | | | | | |
| **REFERENCES:**  2. Pinedo,M.andChao,X.(1993).*OperationsScheduling:Withapplication*  *inManufacturing and Services*. McGraw Hill.  3. Kenneth, R.B.(1974), *Introduction to sequencing and scheduling*. John Wileyand Sons.  4. Conway, R.W., Maxwell, W.L., and Miller, L.M. (1967). *Theoryof Scheduling*.  Addison, Wesley.  5. Pinedo, M. (1995). *Scheduling: theory, algorithmsand systems*.PrenticeHall, New Delhi.  **6.** French, S. (1982).*Sequencing and Scheduling*. ElisHorwoodLtd., Chichester, U.K. | | | | | |

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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05ME 7488** | **PROJECT PHASE II** | 3-1-0-4 | 2015 |
| COURSE OBJECTIVES:  In the fourth semester, the student has to continue the thesis work and after  Successfully finishing the work, he/she has to submit a detailed bounded thesis report.The evaluation of MTech Thesis will be carried out by a panel of examiners.The work carried out should lead to a publication in a National/International Conference or Journal. The papers received acceptance before the M.Tech evaluation will carry specific weightage. | | | |