NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF PRODUCTION ENGINEERING

Curriculum and Syllabus

With effect from July 2021

M.Tech. Industrial Engineering & Management
Department Vision

- To establish a world class academy for Manufacturing and Industrial Engineering

Department Mission

- Curriculum development with state-of-the-art technologies.
- Pursue research interests of manufacturing and industrial engineering.
- Consultancy in design, manufacturing and industrial engineering
- Industry-Institute interaction
- Equipping Laboratories with state-of-the-art equipment.

Programme Educational Objectives (PEOs):

PEO 1: Graduates of the programme will be capable of integrating Engineering fundamentals and advanced Industrial Engineering concepts.

PEO 2: Graduates of the programme will be professionally competent for gainful employment in Industrial Engineering and Management functions and sustain future challenges.

Programme Outcomes (POs):

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<td>On successful completion of the programme, the graduates will be able to</td>
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# Curriculum Structure

**M.Tech. (Industrial Engineering & Management)**  
*Min. Total Credits required: 69*

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PR651 Data Analytics

COURSE OBJECTIVES:

- To realize the importance of data analytics.
- To gain competence on data analytics packages.
- To explore industrial applications of data analytics methodologies.


Multiple Regression- Linear and Nonlinear techniques- Backward-Forward-Stepwise-Hierarchical regression-Testing interactions (2way interaction) - Analysis of Variance and Covariance (ANOVA & ANCOVA) - Multivariate Analysis of Variance and Covariance (MANOVA & MANCOVA).

Logistic regression: Regression with binary dependent variable -Simple Discriminant Analysis- Multiple Discriminant analysis-Assessing classification accuracy- Conjoint analysis (Full profile method).

Principal Component Analysis -Factor Analysis- Orthogonal and Oblique Rotation-Factor Score Estimation-Multidimensional Scaling-Perceptual Map-Cluster Analysis (Hierarchical Vs Nonhierarchical Clustering).

Latent Variable Models an Introduction to Factor, Path, and Structural Equation Analysis- Time series data analysis (ARIMA model) – Decision tree analysis (CHAID, CART) - Introduction to Big Data Management.

REFERENCES:

COURSE OUTCOMES:

1. Recognize the importance of data analytics.
2. Exhibit competence on data analytics packages.
3. Apply solution methodologies for industrial problems.

MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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COURSE OBJECTIVES:

1. Students will gain sound knowledge on the need to increase productivity with techniques that eliminate waste, efficient operations, and effective resource utilization.

2. Students will learn methods and tools for improving operations and controlling the production costs and enhancing quality.

Productivity: Concept, Productivity improvement factors, Productivity appraisal, productivity analysis in the enterprise- The Kurosawa structural approach, Lawlor’s approach, Gold’s approach, Quick Productivity Appraisal approach (QPA), Inter-Firm Comparison (IFC).

Work Design: Work study, Method study, Work measurement, Standard output, Time study, Work sampling, Process analysis.

Facility Layout: Principles of layout and facilities planning, Material flow patterns, Material handling systems, Types of material handling equipment.

Value Engineering: Fundamental concepts and applications of value engineering, Function Analysis System Technique (FAST).


REFERENCES:


COURSE OUTCOMES:

1. Define and understand basic Productivity Concepts, Productivity Measurement Approaches of the Organizations.
2. Perform Work design and facility planning.
3. Outline the basics of Value Engineering (VE) and System Engineering.

MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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PR653  Analysis and Control of Manufacturing Systems  

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COURSE OBJECTIVES:

- To enable the students to understand the production and operations function and its subsystem.
- To study the manufacturing planning and control activities in the organization.
- To study the production control concepts, strategies, policies in organization.

Basics of product management—Forecast models, errors, tracking signals.

Inventory costs – Types of systems – Policies – Analysis & static models

Concept of aggregate production planning – Strategies – Charting techniques – Problems Value stream management

MRP concepts – Problems – Lot sizing – Techniques

Scheduling concepts – Various types of scheduling – Methods and tools to solve scheduling problems – Assembly line balancing problems

REFERENCES:


COURSE OUTCOMES:

1. The students will be able to understand importance of production management and its concepts.
2. The various models of sub systems will be known to them.
3. Will be able to solve industrial problems involved in inventory, MRP and scheduling.
### MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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COURSE OBJECTIVES:

- To understand Linear programming, Dynamic programming & Non-linear programming techniques.
- To make use of duality and sensitivity analysis for real time applications.
- To analyse network models and crashing of various project networks.

Linear programming- Simplex method – Big M method – Two phase method – Dual simplex method – Problems in all the above methods.

Duality analysis, sensitivity analysis-Changes in right- hand side constants of constraints- changes in objective function co-efficient-adding a new constraint-adding a new variable. Integer programming algorithm - Cutting plane algorithm- Branch and Bound technique – Problems.

Deterministic dynamic programming –Recursive nature of computations in dynamic programming - Applications of dynamic programming - Cargo loading model – Work force size model – Equipment replacement model-Inventory model.

Crashing of project network – Problems. Network models - Shortest path model – Systematic Method; Dijkstra’s Algorithm; Floyd’s Algorithm – Minimum Spanning Tree Problem – PRIM Algorithm; Kruskal’s Algorithm; Maximal flow problem.

Unconstrained nonlinear algorithms-Constrained algorithms- Separable programming -Quadratic programming-Geometric programming-Stochastic programming.

REFERENCES:

COURSE OUTCOMES:

1. To understand the various Linear programming methods.
2. To know about duality analysis, sensitivity analysis and integer programming problems with examples.
3. To understand different dynamic programming concepts and its applications.
4. To solve various network models including crashing of project networks.
5. The basics of non-linear programming techniques.

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COURSE OBJECTIVES:

- Building of Models with logic
- Develop routines to capture uncertainty in systems
- Modelling and Simulation of Discrete Event Systems

Introduction to systems and modelling Discrete and continuous system - Monte Carlo Simulation. Simulation of Single Server Queuing System Simulation of a manufacturing shop Simulation of Inventory System

Random number generation, properties - Generation of Pseudo Random Numbers Tests for Random Numbers


Testing -Analysis of simulation data-Input modelling Verification and validation of simulation models – output analysis for a single model.

Simulation languages and packages Case studies in WITNESS; FLEXSIM, ARENA, SIMQUICK Simulation based optimization-Modelling and Simulation with Petrinets Case studies in manufacturing systems

Evaluation Scheme: Term Tests 30   Tutorials and Practical Assignments 20   Final Examination 50 Marks

REFERENCES:


COURSE OUTCOMES:

1. Develop manufacturing models of discrete event systems
2. A generation of uncertainty using random numbers and random variates
3. Perform input, output analysis: Verification and validation of models and optimization
MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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COURSE OBJECTIVES:

- To demonstrate operational purchasing methods and techniques on supplier management and supply in specific business contexts.
- To explain the strategic importance of logistic elements and describe how they affect supply chain management.
- To analyze the creation of new value in the supply chain for customers, society and the environment.

Introduction to supply chain management - Supply Chain Performance: Achieving Strategic Fit and Scope - Supply Chain Drivers and Metrics.

Planning in Supply chain - Demand Forecasting in a Supply Chain - Aggregate Planning in a Supply Chain – Planning and Managing Inventories in a supply chain.


Managing cross-functional drivers in supply chain - Sourcing Decisions in a Supply Chain - Pricing and Revenue Management in Supply Chain - Information Technology in Supply Chain - Coordination in Supply Chain.

Modern Supply chain management - Reverse supply chain strategies – Green and sustainable practices of Supply chain – Supply chain cases.

REFERENCES:

2. V.V.Sople, “Supply Chain Management, text and cases”, Pearson Education South Asia, 2012

COURSE OUTCOMES:
1. Explain the major building blocks, major functions, major business processes, performance metrics, and major decisions in supply chain networks.

2. Summarize the foundation for design and analysis of supply chains and synthesize advanced and specialized concepts, principles and models for operational and strategic improvement.

3. Analytically examine the supply chain of organizations and measure performance improvement.

**MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:**

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COURSE OBJECTIVES:

1. To understand data analytics methods
2. To gain competence on data analytics packages

LIST OF EXERCISES

1. Basic statistics
2. Correlation analysis
3. Regression analysis
4. Testing of Hypothesis (One sample t-test)
5. Testing of Hypothesis (Two sample t-test)
6. Testing of Hypothesis (Paired t-test)
7. Case study on Testing of Hypothesis and ANOVA
8. Analysis of Variance (One-way)
9. Analysis of Variance (Two-way)
10. Cluster Analysis and Life Cycle Assessment using GaBi LCA software

REFERENCES:


COURSE OUTCOMES:

1. Exhibit competence on data analytics packages.
2. Apply solution methodologies for case/industrial problems.
MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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COURSE OBJECTIVES:
To have practical exposure on operations management packages like OM Expert, CPLEX, LINDO, GAMS, TORA extra and also to study on the ergonomic aspects of human evaluation.

1. Forecasting Models
2. Linear Programming Problem
3. Transportation Model
4. Inventory Models
5. Scheduling Case studies
6. Material Requirements Planning
7. Project management
8. Facilities layout
9. Ergonomics Study
   a. Performance rating using stop watch
   b. Peg board experiment
   c. Time study trainer
   d. Fitness study using treadmill
   e. Fitness study using ergo cycle

COURSE OUTCOMES:

1. Experience operations management packages like OM Expert, CPLEX, LINDO, GAMS, TORA extra and also to study on the ergonomic aspects of human evaluation.

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LIST OF EXERCISES
1. Random Number Generation approaches
2. Random Variate Generation
3. Simulation of Manufacturing Shop
4. Simulation of Multiple Servers Queuing System
5. Simulation of Supply Chain Inventory System
6. Simulation of Batch Production System
7. Simulation of Multi Machine Assignment System
8. Simulation of Manufacturing and Material Handling Systems
9. Simulation of a Shop Floor
10. Simulation of Material Handling Systems

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COURSE OBJECTIVES:

- To gain sound knowledge on creating the Bill of Materials, and model uncertainties to manage the Internal Supply Chain.
- To generate Sales Order, Work Order and generate Gantt Chart & Supply Chain Diagram.
- To forecast demand and plan for replenishment and reorder.

LIST OF EXPERIMENTS:

1. Creating a Base Model.
2. Generate Sales Order and Work Order from the given base model.
3. Modeling for Uncertainties in Resources, Routing and BOM.
5. Modeling for Additional resources.
6. Modeling for Alternate BOM and Alternate Item.
7. Exercise on By-Products.
8. Demand forecasting over a horizon using various forecasting models.
9. Generating Replenishment plan using Demand Forecast.

COURSE OUTCOMES:

1. Define and understand the basic supply chain concepts, Model building and execution of the same.
2. Planning and managing the Internal Supply Chain during uncertainties.
3. Forecast demand using sales history and perform replenishment planning and reordering.

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ELECTIVES
INDUSTRIAL ENGINEERING STREAM

PR661 Industrial Engineering Economic Analysis

COURSE OBJECTIVES:

- To gain sound knowledge on the need to increase productivity with techniques that eliminate waste, efficient operations, and effective resource utilization.
- To learn methods and tools for improving operations and controlling the production costs and enhancing quality.

Productivity: Concept, Productivity improvement factors, Productivity appraisal, productivity analysis in the enterprise - The Kurosawa structural approach, Lawlor’s approach, Gold’s approach, Quick Productivity Appraisal approach (QPA), Inter-Firm Comparison (IFC).

Work Design: Work study, Method study, Work measurement, Standard output, Time study, Work sampling, Process analysis.

Facility Layout: Principles of layout and facilities planning, Material flow patterns, Material handling systems, Types of material handling equipment.

Value Engineering: Fundamental concepts and applications of value engineering, Function Analysis System Technique (FAST).


REFERENCES:

COURSE OUTCOMES:

1. Define and understand basic Productivity Concepts, Productivity Measurement Approaches of the Organizations.
2. Perform Work design and facility planning.
3. Outline the basics of Value Engineering (VE) and System Engineering.

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PR662  Intelligent Manufacturing Systems

COURSE OBJECTIVES:

- To apply various knowledge based techniques
- To practice diagnosis and trouble shooting
- To adopt intelligent system

Basic concepts of Artificial intelligence and expert systems - System Components - System architecture and Data flow – System Operations.

Knowledge based systems - knowledge representation – knowledge acquisition and optimization - Knowledge based approaches to design mechanical parts and mechanisms and design for automated assembly.

Knowledge based system for material selection – Intelligent process planning system. Intelligent system for equipment selection - Intelligent system for project management & factory monitoring.

Scheduling in manufacturing – scheduling the shop floor – Diagnosis & trouble shooting. The role of Artificial Intelligence in the factory of the future – Intelligent systems.

REFERENCES:


COURSE OUTCOMES:

1. Apply various knowledge based techniques.
2. Practice diagnosis and trouble shooting.
3. Adopt intelligent system.

MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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COURSE OBJECTIVES:

- To familiarize participants with basic of research and the research process.
- To enable the participants in conducting research work and formulating research synopsis and report.
- To familiarize participants with Statistical packages such as SPSS etc.
- To impart knowledge for enabling students to develop data analytics skills and meaningful interpretation to the data sets so as to solve the business/Research problem

Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.

Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statically package (Sigma STAT, SPSS for student t-test, ANOVA, etc.), hypothesis testing.

Computer and its role in research, Use of statistical software SPSS, GRETL etc. in research. Introduction to evolutionary algorithms - Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems.

Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.

REFERENCES:


COURSE OUTCOMES:

1. Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling.
2. Have basic knowledge on qualitative research techniques
3. Have adequate knowledge on measurement & scaling techniques as well as the quantitative data analysis
4. Have basic awareness of data analysis-and hypothesis testing procedures

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PREREQUISITES: Basic probability and statistics concepts

COURSE OBJECTIVES:

To design experiments to a problem situation using traditional experimental designs as well as Taguchi Methods and also to develop skill to conduct experiments and analyze the data to determine the optimal process parameters that optimize the process.


Single Factor Experiments- ANOVA - Sum of squares – Completely randomized design, Randomized block design, effect of coding, Comparison of treatment means – Newman Kuel’s test, Duncan’s Multiple Range test, Latin Square Design.

Factorial Experiments-Main and interaction effects –Two and three Factor full factorial Designs, 2k designs with Two and Three factors- Yate’s Algorithm

Special Experimental Designs- Blocking and Confounding in 2k design

Taguchi Techniques- Fundamentals of Taguchi methods, Quality Loss function, orthogonal designs, application to Process and Parameter design.

REFERENCES:


COURSE OUTCOMES:

1. Appreciate the advantages and disadvantages of a design for a particular experiment
2. Construct optimal or good designs for a range of practical experiments
3. Describe how the analysis of the data from the experiment should be carried out
4. Apply experimental techniques to practical problems to improve quality of processes / products by optimizing the process / product parameters
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PR665 Lean and Agile Manufacturing

COURSE OBJECTIVES:

1. To understand the concepts of lean and agile manufacturing
2. To gain competence on tools/techniques of lean and agile manufacturing
3. To explore the industrial applications of tools/techniques of lean and agile manufacturing

Introduction to Lean Manufacturing, Comparison of Mass Manufacturing and Lean Manufacturing, Lean Principles, Types of Wastes – Seven basic categories, Types of activities – Value Added, Non Value Added and Necessary but Non Value Added activities, Examples


Lean rules, Training and Implementation for lean systems, How to succeed with lean manufacturing, Leanness assessment – Indicators, methods and illustrative example.


Strategic approach to agile manufacturing, Information Technology applications in Agile Manufacturing, Assessment of agility – Activity Based Costing - Application Case studies and Research issues in Lean and Agile Manufacturing.

REFERENCES:

5. Lonnie Wilson, How to implement lean manufacturing, McGraw Hill
COURSE OUTCOMES:

1. Demonstrate the principles of lean and agile manufacturing
2. Recognize the potential applications of lean and agile manufacturing
3. Apply the tools/techniques of lean and agile manufacturing to industrial problems

MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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COURSE OBJECTIVES:
1. To assess the value of facility planning on the strategy of a firm.
2. To describe the product, process and schedule design and their interaction with facility planning and develop a systematic facility layout
3. To explain design and analyze material handling used in the warehousing, manufacturing and supporting operations.

Facilities planning – need and objectives of facilities planning – facilities planning process –
Facilities planning strategies, Facilities Location Analysis- Single facility location models Multi-facility location problems
Facilities Layout design- product design – process design – schedule design - Space and Area
Requirements of Facilities Layout design procedure-Algorithmic approach – Computerized layout planning CRAFT, ALDEP and CORELAP
Group technology - Methods of grouping – Algorithms and models for Group technology – Line Balancing Material handling design – Material handling principles - Classification of material handling equipment - Material handling models

REFERENCES:

COURSE OUTCOMES:
1. Assess the value of facility planning on the strategy of a firm.
2. Describe the product, process and schedule design and their interaction with facility planning and develop a systematic facility layout
3. Explain design and analyze material handling used in the warehousing, manufacturing and supporting operations.
MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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COURSE OBJECTIVES:

To give a fair understanding of the role of production management in business processes and make familiarization of various production processes and service systems.

Productivity: Productivity measurement models, Role of work study, Work measurement techniques, Ergonomics.


Just in Time and Lean Operations: Characteristics of Lean systems for services and Manufacturing, Element of JIT manufacturing, Pull and Push method of work flow, Small lot sizes, Kanban system, Value stream mapping.

Introduction to optimized production technology (OPT) - OPT philosophy improvement tools- Requirement and assumption of OPT. Introduction to product development process.

Value Engineering: Approaches of value analysis and engineering, effective organization for value work function analysis system techniques, FAST diagram, Case Study

REFERENCES:


COURSE OUTCOMES:

1. Explain the role of Production Management System.
2. Identify the recent trend of manufacturing like Just in Time (JIT) and Pull Push system.
3. Outline the basics of Value Engineering.
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PR668 Industry 4.0 and Cloud Manufacturing

COURSE OBJECTIVES:

- To recognize need and trends of Industry 4.0 and Cloud manufacturing
- To understand concepts and technologies supporting Industry 4.0 and Cloud Systems
- To explore challenges and Industrial applications of Industry 4.0 in manufacturing

Various Industrial Revolutions, Compelling Forces and Challenges for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory, Lean Production Systems.

Internet of Things (IoT)- IoT design methods, physical devices and enabling technologies, Industrial Internet of Things (IIoT), Smart Manufacturing.


Introduction to cloud computing and manufacturing- cloud models, cloud manufacturing examples, cloud based manufacturing, Cloud service and platforms for manufacturing.

Industry 4.0 integration with manufacturing systems, Application domains, Case studies on IoT cloud system in manufacturing and other domains

REFERENCE BOOKS

COURSE OUTCOMES:

- Understand trends of Industry 4.0 and cloud manufacturing
- Competence on systems and technologies of Industry 4.0 & cloud system.
- Recognize industrial applications of Industry 4.0 in manufacturing

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COURSE OBJECTIVES:

- To know and apply various productivity measurement techniques in real time situations.
- To understand method study and work management techniques.
- To establish time standards by physiology methods.
- To acquire the basic knowledge in motion economy and ergonomic practices.

Introduction to work study - Productivity – productivity measures-productivity measurement models-Kurosawa structural approach, Lawlor’s approach, Gold’s approach Quick Productivity Appraisal approach (QPA) / American Productivity Centre (APC) model-scope of work study for improving productivity

Methods study -process analysis – process chart – flow diagram – assembly process chart –Man and machine chart – two handed process chart – Photographic Techniques - Micro motion and memo motion study - Cycle Graph – Chrono Cycle Graph


Measuring work by physiological methods – Heart rate measurement– measuring oxygen consumption– Establishing time standards by physiology methods.

Principles of Motion Economy- related to use of human body, related to workplace, related to design of tools and equipment - Ergonomics practices – human body measurement – layout of equipment– seat design - design of controls and compatibility – environmental control – vision and design of displays. Design of work space, chair table

REFERENCES:


COURSE OUTCOMES:

1. Various methods for productivity measurement and improvement
2. To understand the methods study for managing resources
3. To know the work measurement techniques for managing resources
4. To acquire the knowledge in measuring work by physiological methods
5. To analyze the ergonomic methods for workplace design
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COURSE OBJECTIVES:

- To recognize the importance of sustainable manufacturing
- To understand and apply appropriate sustainability tools/techniques
- To explore practical applications of sustainability concepts


Frameworks for measuring sustainability- Indicators of sustainability – Environmental, Economic, Societal and Business indicators - Concept Models and Various Approaches, Product Sustainability and Risk/Benefit assessment – Corporate Social Responsibility.

REFERENCES:

COURSE OUTCOMES:

1. Realize the importance of sustainable manufacturing
2. Exhibit competence on the usage and applicability of sustainability tools
3. Recognize applications of sustainability concepts in various domains

MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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COURSE OBJECTIVES:

To facilitate the students in knowing the application of statistical techniques in Quality control and assurance and also to impart knowledge in reliability concepts, reliability estimation methods and reliability improvement methods


Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables- X , R and S charts, attribute control charts - p, np, c and u- Construction and application. Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

The acceptance sampling fundamental, OC curve, sampling plans for attributes, simple, double, multiple and sequential, sampling plans for variables, MIL-STD-105D and MIL-STD-414E & IS2500 standards.


REFERENCES:

COURSE OUTCOMES:

1. Control the quality of processes using control charts for variables in manufacturing industries.
2. Control the occurrence of defective product and the defects in manufacturing companies.
3. Able to perform process capability studies and to control the occurrence of defects in services through proper sampling methods.
4. able to conduct reliability assessment and failure analysis on any complex systems
5. understand the design concepts for reliable system and prediction aspects in industries

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Course objectives:

- To understand and analyse the theory and methodology of Value Engineering with the Guidelines, Performa and Checklist for a systematic, step by step application of the technique to the current industrial problems.
- To provide the knowledge about Reengineering Principles, the various models and implementation method, which are adopted in the industries.

Definition of Value, Value Analysis, Value Engineering, Value management, Value Analysis versus Value Engineering, Value Analysis versus Traditional cost reduction techniques, uses, applications, advantages and limitations of Value analysis. Brain storming technique, Gordon technique, Feasibility Ranking technique, Morphological Analysis Technique, ABC Analysis, Probabilistic approach, Make or Buy decisions.


References


Course outcomes:

- Use of value engineering and reengineering to the current industrial problem
- Ability to use various models and methods to solve the industrial problem
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COURSE OBJECTIVES:

- To build awareness of phenomena that influence cost of engineering systems across a variety of contexts
- To introduce the basic principles of Productivity Models and the applications of Re-Engineering Concepts required for various organizations.


Productivity concepts – Macro and Micro factors of productivity, productivity benefit model, productivity cycles.

Need for Productivity Planning – Short term and long term productivity planning – Productivity improvement approaches, Principles – Productivity Improvement techniques – Technology based, Material based, Employee based, Product based techniques – Managerial aspects of Productivity Implementation schedule, Productivity audit and control.


References

4. References:

Course outcomes

- Understand the practical application of cost modelling and its role in industries
- Measure, evaluate, Plan and implement various productivity techniques.
- Reengineer the process for improving the productivity
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ELECTIVES
MANAGEMENT STREAM

PR674 Project Management

COURSE OBJECTIVES:

1. To enable the students to understand the methods for project identification and appraisal.
2. To plan and schedule a project with resource and environmental constraints.
3. To develop quantitative methods for project selection, risk assessment, monitoring and control.

Introduction - Project Management: An Overview – Types, Characteristics of Projects – Project life cycle. Identification of investment opportunities - Screening and Selection,


Financial analysis – cash flows for project appraisal- Investment evaluation using capital budgeting techniques - net present value, profitability index internal rate of return, payback period, accounting rate of return

Mathematical Techniques for project evaluation – Linear programming, goal programming, Network technique for Project Management – CPM, PERT, Multiple projects and constraints, scheduling. Performance metrics for project evaluation.

Organization systems for project implementation- Work Breakdown-coordination and control- Project Management Soft wares, Role of AI in project management

REFERENCES:

4. http://nptel.ac.in/courses/110104073/
COURSE OUTCOMES:

1. Understand the process and approaches for executing projects.
2. Develop and analyze quantitative models for project selection and scheduling.
3. Apply engineering and management principles to manage real time projects considering constraints.
4. Apply tools for managing complex projects.
5. Analyse the outcome and offer suggestions for improvement

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COURSE OBJECTIVES:

- To start and manage new business
- To evaluate and monitor short term and long term investments
- To evaluate and monitor current asset

Financial management – An overview - Nature, Scope, Objectives, Decisions -
Management of Current asset - Short and intermediate financing

Capital budget, Nature of capital budgeting- Identifying relevant cash flows -
Evaluation Techniques: Payback, Accounting rate of return, Net Present Value, Internal Rate of
Return, Profitability Index - Comparison of DCF techniques investment and evaluation

Financial and operating leverage - capital structure - Cost of capital and valuation –
designing Capital structure. Dividend policy - Aspects of dividend policy - practical
consideration

Principles of working capital: Concepts, Needs, Determinants, issues and estimation
of working Capital - Accounts Receivables Management and factoring - Inventory
management – Cash Management – Working capital finance

Long term financing -Indian capital and stock market, New issues market Long term
finance: Shares, debentures and term loans, lease, hire purchase, venture capital
financing, Private Equity

REFERENCES:

1. Bhattacharya, S.K. and John Deardon, “Accounting for Management – Text and
Cases”, VikasPublishingHouse, New Delhi, 1996.

2. Charles, T.Horn Green – “Introduction to Management Accounting”, Prentice Hall,
New Delhi, 1996.


COURSE OUTCOMES:

- To start and manage new business
- To evaluate and monitor short term and long term investments
- To evaluate and monitor current asset

MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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PR676  Marketing Management

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COURSE OBJECTIVES:

- To understand the marketing management strategies and segmentation factors.
- To understand the product pricing and marketing research methodologies.
- To understand the techniques of advertising, sales promotion and distribution.


Product Pricing and Marketing Research- Pricing, Decisions and Pricing Methods, Pricing Management-Marketing Planning and Strategy Formulation-Portfolio Analysis, BCG, GEC Grids


REFERENCES:


COURSE OUTCOMES:

1. Explain marketing concepts and segmentation factors
2. Classify various pricing methods
3. Explain various sales promotion aspects

MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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COURSE OBJECTIVES:

1. To realize the importance of TQM in industrial scenario
2. To gain competence on applying TQM tool for the problems
3. To deploy various phases of Six Sigma for real time projects

Principles of Quality Management, Quality Management Gurus and their contributions, Introduction to Total Quality Management (TQM), Concepts of TQM, Obstacles to TQM implementation, Benefits of TQM implementation.

Basic and Advanced Quality Control tools, Quality Function Deployment, Failure Mode and Effect Analysis – Scope, steps, illustrative examples and applications.


Introduction to Six Sigma, Six Sigma DMAIC and DMADV Methodologies, Six Sigma and Lean Management, Benchmarking.

Quality Costing – Cost categories, Prevention, Appraisal and Failure cost, construction of PAF model, TQM and Six Sigma in Service Sector, Application case studies of TQM and SixSigma, Advancements in Six Sigma methodologies

REFERENCES:

COURSE OUTCOMES:

1. Recognize the importance of TQM in industrial scenario
2. Competence to apply specific TQM tool for the problems
3. Execute various phases of Six Sigma for real time projects

MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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COURSE OBJECTIVES:

- To understand individual and Group behavior of decision making in Organization
- To recognize Human Resource Planning for the development of Management

**Individual Behavior** - Personality – Attribute – Perception – Motivation Theories

**Group Behavior** - Group Dynamics, Group decision making, Inter personal Relations - Dynamics of Organizational Behavior - Organizational Climate – Organizational change – the Change Process & Change Management


Values and Ethics - Engineering as experimentation - Engineers as responsible experimenters Social Responsibility, and Sustainability.

REFERENCES:


COURSE OUTCOMES:

1. Evaluate and apply theories of social science disciplines to workplace issues
2. Select, develop, and motivate workers using HRM functional capabilities
3. Express analytical, communication, and decision making skills considering ethics.

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COURSE OBJECTIVES:

- To realize the scope of product life cycle management.
- To explore the possibility of Collaborative Product Development and digital manufacturing in practical applications.
- To develop strategy for PLM applications

Introduction to Product Life Cycle Management(PLM)- Definition, PLM Lifecycle model, Need for PLM, Opportunities and benefits of PLM, Components and Phases of PLM, PLM feasibility study

PLM Concepts, Processes and Workflow - Characteristics of PLM, Environment driving PLM, PLM Elements, Drivers of PLM, Conceptualization, Design, Development, Validation, Production, Support of PLM.

Collaborative Product Development- Engineering vaulting, product reuse, smart parts, engineering change management, Bill of materials and process consistency, Digital mock-up and prototype development, design for environment, virtual testing and validation, marketing collateral

Digital Manufacturing – PLM Digital manufacturing, benefits manufacturing, manufacturing the first-one, Ramp up, virtual learning curve, manufacturing the rest, production planning

Developing a PLM strategy and conducting a PLM assessment- Strategy, Impact of strategy, implementing a PLM strategy, PLM initiatives to support corporate objectives. Infrastructure assessment, assessment of current systems and applications

REFERENCES:

COURSE OUTCOMES:

1. Recognize the importance of Product Life Cycle Management.
3. Competence to develop PLM strategy and conduct PLM assessment

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COURSE OBJECTIVES:

- To understand technology development process
- To recognize technology management issues in the context of advanced manufacturing systems

Definition-scope-components-Issues in managing new technology, Life cycle approach to technology management-Approaches to forecasting, Technology performance parameters.

Use of Experts in technology forecasting, planning technological process, Morphological analysis of a Technology system-Techno-Economic feasibility study

Application of multi-criteria decision making techniques in technologies evaluation and selection- AHP, fuzzy AHP-Modal of global technology transfer- Technology– Human Interface-

Organization structures and Technology Implementation issues in new technology – Technology Management issues in the context of lean, agile and sustainable systems – Intellectual Property Rights

REFERENCES:


COURSE OUTCOMES:

1. Develop an awareness of the range, scope, and complexity of technological innovation, and the issues related to managing technological change.
2. Explain different approaches to managing innovation with multi-criteria decision making techniques
3. Clearly identify drivers and barriers to technological innovation within an organization.
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COURSE OBJECTIVES:

1. To gain the knowledge of Traditional optimization techniques.
2. To gain the knowledge of Non Traditional optimization techniques.

Classification of Optimization Problems - Optimization Techniques

Classical Optimization Techniques - Single-Variable Optimization - Multivariable Optimization with No Constraints - Multivariable Optimization with Equality Constraints - Multivariable Optimization with Inequality Constraints - Transportation


REFERENCES:

COURSE OUTCOMES:

1. To learn the Traditional optimization techniques and apply it in engineering field.
2. To learn the Non Traditional optimization techniques and apply it in engineering field.

MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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PR682 Production Design and Development

COURSE OBJECTIVES:

- To understand the challenges and advancements of product development process.
- Execution of various phases of product development.
- Development of environmental friendly products/processes.

Product development process – various phases, reverse engineering and redesigning product development process, Illustrations of product development process, S-curve, new product development.

Gathering customer needs, organizing and prioritizing customer needs, establishing product function, FAST method, establishing system functionality. Tear Down and Experimentation-Tear down method, post teardown report, benchmarking and establishing engineering specifications, product portfolios.

Generating concepts-Information gathering, brain ball, C-sketch/6-3-5 method, morphological analysis, concept selection, technical feasibility, ranking, measurement theory.
Robust design, Design for Manufacture and Assembly, axiomatic design, TRIZ, value engineering, industrial design Poka Yoke-Lean principles-Six sigma concepts.
Design for the Environment: DFE methods, life cycle assessment, weighted sum assessment method, techniques to reduce environmental impact – disassembly, recyclability, remanufacturing regulations and standards.

REFERENCES:


COURSE OUTCOMES:

- Understand the challenges and advancements of product development process.
- Execute various phases of product development.
- Develop environmental friendly products/processes.
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PR683  E-waste Assessment and Management

PREREQUISITES: Nil

COURSE OBJECTIVES:
1. To enable the students to understand the e-waste management system towards sustainability.
2. To understand models and approaches for material flow assessment of e-waste.
3. To understand models and approaches for quality, functionality and reverse logistics and EPR.

E-waste, types- Materials from E-Waste- Classification- Evolution of e-waste management system- Challenges and Opportunities of E-Waste Management in Developing Countries


Quality issues related to e-waste reuse-remanufacture-models for cost effective refurbishment

Reverse logistics models for e-waste-centralized versus decentralized collection- LP, MILP, stochastic programming – Multi attribute decision making techniques- traditional and non-traditional techniques- simulation models


References:

COURSE OUTCOMES
1. Understand the e-waste management practices
2. Develop and analyze quantitative models for e-waste estimation
3. Apply tools for managing e-waste sustainably
4. Analyse the outcome and offer suggestions for sustainable e-waste management
## Mapping of programme outcomes with course outcomes:

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ELECTIVES

INDUSTRIAL INFORMATION SYSTEM STREAM

PR684 Enterprise Resource Planning

COURSE OBJECTIVES:

To develop a thorough knowledge on ERP and solve related industrial problems

Introduction to ERP: Enterprise – An Overview Integrated Management Information, Business Modelling, Integrated Data Model, Benefits of ERP, ERP and Related Technologies, Business Process Reengineering (BPR), Data Warehousing, Data Mining, OLAP, SCM.

ERP Implementation: ERP Implementation Lifecycle, Implementation Methodology, Organizing the Implementation, Vendors, Consultants and Users, Contracts with Vendors, Consultants and Employees, Project Management and Monitoring. Precautions in ERP Implementation, ERP Post Implementation Options, Guidelines for ERP Implementation


ERP Market: ERP Market Place, SAP AG, PeopleSoft, Baan, JD Edwards, Oracle, QAD, SSA, Enterprise Integration Applications (EIA), ERP and E-Commerce, ERP and Internet.

ERP Present and Future: Future Directions and Trends in ERP.

REFERENCES:

COURSE OUTCOMES:

1. Summarize basic concepts, tools and techniques of Enterprise Resource Planning
2. Describe the key implementation issues of ERP
3. Reorganize the current and future trends in ERP

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COURSE OBJECTIVES:

- To introduce decision support systems and show their relationship to other computer-based information systems.
- To introduce the software systems that coordinate data, modeling, algorithms and user-friendly interfacing to create an environment for automated or interactive decision making.
- To introduce technologies such as OLAP, GSS, AI, Organizational learning and Knowledge management.
- To demonstrate development approaches, and to utilize DSS capacities to support different types of decisions.

DSS components - Data warehousing, access, analysis, mining and visualization - modeling and analysis - DSS development.

Group support systems - enterprise DSS - supply chain and DSS - knowledge management methods, technologies and tools.

Artificial intelligence and expert systems - Representation in logic and schemas, semantic networks, production rules and frames, inference techniques – DSS applications.

REFERENCES:


COURSE OUTCOMES:

1. Recognize the importance of decisions in the work and use DSS Software Tools.
2. Discuss the advantages/disadvantages of different types of decision support systems and evaluate their Success/Failure.
3. Identify the types of problems that may be addressed effectively through the use of Decision Support Systems and Intelligent Systems.
4. Analyze practical cases from different real world problems (technical, management).
5. Recognize the role of Decision (and other Management) Support Systems and their potential for assisting in organizational and individual decision making.

**MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:**

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COURSE OBJECTIVES:

To understand the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.

Knowledge society- Drivers of knowledge management-Intellectual capital- KM and learning organizations-Strategic alignment- Evaluation and strategic alignment

Infrastructural development and deployment- Role of CKO-Analyzing business environment-knowledge audit and analysis – designing KM team, system–Technology components- Intranet and Groupware solutions- tools for collaborative intelligence


REFERENCES:


COURSE OUTCOMES:

1. Appreciate the role and use of knowledge in organizations and institutions, and the typical obstacles that KM aims to overcome
2. Describe the core concepts, methods, techniques, and tools for computer support of knowledge management
3. Apply and integrate appropriate components and functions of various knowledge management systems

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COURSE OBJECTIVES:

To provide an overview of various MCDM techniques and apply this technique to solve industrial engineering problems.


Fuzzy based MCDM methods – Hybrid MCDM methods – Group Decision Making-Graph Theory and Matrix approach – Principle, steps and illustrative examples.

Goal Programming – Balanced Scorecard Approach - MCDM application areas – Case studies on application of MCDM techniques.

REFERENCES:


COURSE OUTCOMES:

1. Recognize the importance of multi criteria decision making.
2. Understand various MCDM methods.
3. Apply MCDM methods for real life applications.
### MAPPING OF PROGRAMME OUTCOMES WITH COURSE OUTCOMES:

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**PR688**  
**Intelligent Industrial System**  
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### Course Objectives:
- To apply various knowledge based techniques
- To practice diagnosis and trouble shooting
- To adopt intelligent system


Components of Knowledge Based Systems – Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

Machine Learning – Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks – Biological Neuron, Artificial Neuron, Types of Neural Networks, Applications in Manufacturing.


Group Technology in Automated Manufacturing System. Structure of Knowledge based system for group technology (KBST) — Data Base, Knowledge Base, Clustering Algorithm.

### REFERENCES:

Intelligent Manufacturing Systems/ Andrew Kusiak/Prentice Hall.
Automation, Production Systems and CIM / Groover M.P./PHI/2007
Neural networks in Computer intelligence/ Li Min Fu/ TMH/2003
Neural networks/ James A Freeman David M S kapura/ Pearson education/2004
COURSE OUTCOMES
1. Apply various knowledge based techniques.
2. Practice diagnosis and trouble shooting.
3. Adopt intelligent system.

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