VISION:

To emerge as a Centre of excellence in the field of Industrial Engineering where the world class practices of teaching, learning and research synergize.

MISSION:

- Development of state-of-the-art curriculum to meet the dynamic industry needs.
- Knowledge dissemination through student centric teaching learning process.
- Enriching laboratories with modern facilities
- Research contribution in the field of Industrial Engineering
- Maintaining continuous interaction with industry
- Cultivate the spirit of Entrepreneurship.
1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

<table>
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<tr>
<th>I.</th>
<th>To prepare students to excel in research or to succeed in Quality engineering and Management profession through global, rigorous post graduate education.</th>
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</thead>
<tbody>
<tr>
<td>II.</td>
<td>To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve quality engineering problems.</td>
</tr>
<tr>
<td>III.</td>
<td>To train students with good scientific and engineering knowledge so as to comprehend, analyze, design, and create novel products and solutions for the real-life problems.</td>
</tr>
<tr>
<td>IV.</td>
<td>To inculcate students in professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate quality engineering issues to broader social context.</td>
</tr>
<tr>
<td>V.</td>
<td>To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career.</td>
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2. PROGRAMME OUTCOMES (POs):

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<tr>
<td>1</td>
<td>An ability to independently carry out research/investigation and development work to solve practical problems to write and present a substantial technical report</td>
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<tr>
<td>2</td>
<td>To demonstrate the knowledge and understanding of Quality Engineering and Management and apply them to improve quality of products and services and achieve optimality in any organization</td>
</tr>
<tr>
<td>3</td>
<td>Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program</td>
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3. PROGRAMME SPECIFIC OUTCOMES (PSOs):

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<td>To use the knowledge of Quality Engineering and Management to design and develop quality management system and environmentally sustainable system to fulfill the needs of society.</td>
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<tr>
<td>2</td>
<td>Graduates should be able to design and develop enterprises and establish themselves as successful entrepreneurs</td>
</tr>
<tr>
<td>3</td>
<td>Graduates should be able to design and manage systems, processes and operations of different sectors of economy.</td>
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Attested

[Signature]

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
4. PEO/PO/PSO Mapping:

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1, 2, 3, -, scale against the correlation PO’s with PEO’s
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**PO1** - Program Outcomes

**PO2** - Program Outcomes

**PO3** - Program Outcomes

**PSO1** - Professional Skills

**PSO2** - Professional Skills

**PSO3** - Professional Skills
## M.E. QUALITY ENGINEERING AND MANAGEMENT
### REGULATIONS – 2023
### CHOICE BASED CREDIT SYSTEM
### CURRICULUM AND SYLLABI FOR SEMESTER I TO IV

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**SEMESTER III**

**SEMESTER IV**

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*Attested*  

**DIRECTOR**

Centre for Academic Courses
Anna University, Chennai-600 025
# RESEARCH METHODOLOGY AND IPR COURSES (RMC)

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## PROFESSIONAL ELECTIVES

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# EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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**TOTAL CREDITS** 19

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## SUMMARY

**M.E. Quality Engineering and Management**

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COURSE OBJECTIVES:
1. To explain the basic probability and statistics concepts
2. To familiarize Hypothesis Testing and ANOVA to compute significance of factors and reach conclusions about effect of factors involved.
3. To develop factorial and fractional factorial designs for product and process optimization
4. To describe experimental design for engineering applications using orthogonal arrays and to use signal to noise ratios to illustrate robust design concepts in process optimization.
5. To impart knowledge on Response Surface Methods and Shainin design of experiments

UNIT I  INTRODUCTION TO PROBABILITY AND STATISTICS
Basic Probability: Experiment, definition of probability, conditional probability, independent events, Bayes' rule, Bernoulli trials, Random variables, discrete random variable, continuous random variable, Two dimensional random variables and their distribution functions, Independent random variables. Standard distributions - Binomial, Multinomial, Poisson, Uniform, exponential, Weibull, Gamma, Beta, Normal- Evaluation of statistical parameters for these distributions-Applications of these distributions- Chebyshev's theorem and central limit theorem - Basic Statistics - Linear Correlation, correlation coefficient, rank correlation coefficient, linear regression model, Bounds on probability, Chebyshev's Inequality.

UNIT II  HYPOTHESIS TESTING AND SINGLE FACTOR EXPERIMENTS
Hypothesis- Types- Steps in Hypothesis Testing, Test of significance: Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, and Difference of standard deviations. Test of significance for small samples: t- Test for single mean, difference of means, t-test for correlation coefficients-Chi-square test for goodness of fit and independence of attributes. Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, ANCOVA, steps in experimentation; Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests. Multivariate analysis of variance (MANOVA) – One way MANOVA

UNIT III  MULTIFACTOR EXPERIMENTS
Two and three factor full factorial experiments, Randomized block factorial design, Experiments with random factors, rules for expected mean squares, approximate F- tests. 2^K factorial Experiments, Blocking and confounding in 2^K designs. Two level Fractional factorial design, nested designs, Split plot design- Factorial MANOVA with 2 factors- Response Surface Methods

UNIT IV  TAGUCHI METHODS
Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design- control and noise factors, S/N ratios, parameter design, Multi-level experiments, Multi-response optimization

UNIT V  RESPONSE SURFACE METHODS AND SHAININ DESIGN OF EXPERIMENT

TOTAL: 60 PERIODS
COURSE OUTCOMES:

The students will be able to

CO1. Explain principles and concepts of design of experiments and quality engineering.
CO2. Illustrate quality engineering and robust design concepts.
CO3. Develop factorial, fractional factorial and orthogonal array designs for product and process optimization.
CO4. Conduct experiments and analyse data for product and process improvements.
CO5. Explain principles and concepts of response surface methodology.

REFERENCES:


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PROGRESS THROUGH KNOWLEDGE

Attested

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Centre for Academic Courses
Anna University, Chennai-600 025
OBJECTIVES:
To impart knowledge on
- Formulation of research problems, design of experiment, collection of data, interpretation and presentation of result
- Intellectual property rights, patenting and licensing

UNIT I  RESEARCH PROBLEM FORMULATION  9
Objectives of research, types of research, research process, approaches to research; conducting literature review- information sources, information retrieval, tools for identifying literature, Indexing and abstracting services, Citation indexes, summarizing the review, critical review, identifying research gap, conceptualizing and hypothesizing the research gap

UNIT II  RESEARCH DESIGN AND DATA COLLECTION  9
Statistical design of experiments- types and principles; data types & classification; data collection - methods and tools

UNIT III  DATA ANALYSIS, INTERPRETATION AND REPORTING  9
Sampling, sampling error, measures of central tendency and variation; test of hypothesis- concepts; data presentation- types of tables and illustrations; guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript; guidelines for writing thesis, research proposal; References – Styles and methods, Citation and listing system of documents; plagiarism, ethical considerations in research

UNIT IV  INTELLECTUAL PROPERTY RIGHTS  9
Concept of IPR, types of IPR – Patent, Designs, Trademarks and Trade secrets, Geographical indications, Copy rights, applicability of these IPR; , IPR & biodiversity; IPR development process, role of WIPO and WTO in IPR establishments, common rules of IPR practices, types and features of IPR agreement, functions of UNESCO in IPR maintenance.

UNIT V  PATENTS  9
Patents – objectives and benefits of patent, concept, features of patent, inventive steps, specifications, types of patent application; patenting process - patent filling, examination of patent, grant of patent, revocation; equitable assignments; Licenses, licensing of patents; patent agents, registration of patent agents.

COURSE OUTCOMES
Upon completion of the course, the student can
CO1: Describe different types of research; identify, review and define the research problem
CO2: Select suitable design of experiment s; describe types of data and the tools for collection of data
CO3: Explain the process of data analysis; interpret and present the result in suitable form
CO4: Explain about Intellectual property rights, types and procedures
CO5: Execute patent filing and licensing

REFERENCES:
COURSE OBJECTIVES
1. Describe the principles of ultrasonication.
2. Summarize the mechanical testing methods.
3. Refer the tribological behaviour and wear reduction methods.
4. Contrast the surface characteristics and video measurement technologies.
5. Describe the types of corrosion and test procedures.

UNIT I  EFFECT OF ULTRASONICATION AND MEASUREMENT
Principles of ultrasonication, applications, parameters. Effect on the hardness, effect on the tensile behaviour and microstructure. Effect on the wear, Corrosion and Tribo-corrosion behaviour of ultrasonicated casted materials.

UNIT II  MECHANICAL TESTING AND MEASUREMENTS
Introduction to mechanical behaviour, standards and procedure for the measurement of mechanical properties. Hardness: Types of hardness, Measurement of micro and bulk hardness. Measurement of tensile properties, strain hardening coefficient, fatigue properties and a fatigue life through a rotary fatigue machine. Creep measurement: Creep life characteristics using immersion creep tester.

UNIT III  MEASUREMENT OF FRICTION AND WEAR BEHAVIOUR

UNIT IV  SURFACE FINISH AND VIDEO MEASUREMENT SYSTEMS
Ideal surface, surface structure and surface roughness parameters. Roughness measurement equipment: Surface meter, grades of roughness, relating roughness parameters to engineering applications. Video measurement systems: Introduction and principles, measurement of wear depth, scratch dimensions, kerf taper angle, delamination factor and corner accuracy.

UNIT V  MEASUREMENT OF CORROSION CHARACTERISTICS
Definition, types, standards and principles. Corrosion test procedures and equipment: Salt spray test, immersion test, electrochemical test, tribocorrosion test, cyclic corrosion test, stress corrosion cracking and high-temperature corrosion test. Corrosion rate measurements.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1. Relate the principles of ultrasonication and measure the effects of ultrasonication methods.

CO2. Experiment the mechanical testing methods and their measurement.

CO3. Outline the friction and wear behaviour of the materials and the wear reduction methods.
CO4. Describe the various surface characteristics and the video measurement methods.

CO5. Assess the corrosion characteristics and the corrosion measurement techniques.

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DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
COURSEOBJECTIVES:
1. To learn the work study and ergonomic principles to design workplaces for the improvement of human performance.
2. To understand the concept of Production and Operations Management in creating and enhancing a firm’s competitive advantages.
3. To gain knowledge on the basic principles in facilities planning and plant location.
4. To teach analytical skills and problem-solving tools to the analysis of the operations problems.
5. To calculate the plant capacity and exercise control on production. Also, to learn JIT implementation and control procedures.

UNIT I WORK SYSTEM DESIGN AND ERGONOMICS 9

UNIT II PRODUCT, PROCESS CAPACITY DESIGN 9
Product Development; Product Design Tools; Design of Services; Process Design: Types of Process, Modern Production Technologies; Process Reengineering, Capacity Management; Economies and Diseconomies of Scale and Learning Curve; Capacity Strategies; Decision Trees.

UNIT III PLANT LOCATION AND LAYOUT 9

UNIT IV PRODUCTION PLANNING 9
Forecasting of Demand- Qualitative and Quantitative Forecasting Methods- Forecast Accuracy Measures - Systems Aggregate Planning and its Process; Master Scheduling; Material Resources Planning; Manufacturing Resource Planning; Inventory Management: Basic Economic Order Quantity (EOQ) Model; Quantity Discount Models; Selective Inventory Control.

UNIT V PRODUCTION CONTROL 9

TOTAL: 45 PERIODS

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DIRECTOR

[Institution Name]
COURSE OUTCOMES:
The students will be able to
CO1. Apply a Method Study and time study to improve the efficiency of the system.
CO2. Apply the techniques to forecast demand for Production and Service Systems
CO3. Examine appropriate location models for various facility types and design various facility layouts

REFERENCES:
2. Martand Telsang,2006, Industrial Engineering and Production Management, S. Chand and Company

CO’s- PO’s & PSO’s MAPPING

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1-low, 2-medium, 3-high, ‘-‘- no correlation
COURSE OBJECTIVES:
1. To develop a clear knowledge in the basics of various quality concepts.
2. To Facilitate the students in understanding the application of control charts and its techniques.
3. To develop the special control procedures for service and process-oriented industries.
4. To analyze and understand the process capability study.
5. To develop the acceptance sampling procedures for incoming raw material.

UNIT I INTRODUCTION

UNIT II QUALITY CONTROL CHARTS
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.

UNIT III SPECIAL CONTROL PROCEDURES
Warning and modified control limits, control chart for individual measurements, multi-vari chart, X chart with a linear trend, chart for moving averages and ranges, cumulative-sum and exponentially weighted moving average control charts.

UNIT IV STATISTICAL PROCESS CONTROL
Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

UNIT V ACCEPTANCE SAMPLING
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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to

CO1. Control the quality of processes using control charts for variables in manufacturing industries.
CO2. Control the occurrence of defective product and the defects in manufacturing companies.
CO3. Control the occurrence of defects in services.
CO4. Analyzing and understanding the process capability study
CO5. Developing the acceptance sampling procedures for incoming raw material.
REFERENCES:


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1-low, 2-medium, 3-high, ‘-‘- no correlation
COURSE OBJECTIVES:
1. To provide knowledge of optimization techniques and approaches.
2. To enable students to formulate real-world problems as mathematical programming models.
3. To develop students’ mathematical, computational, and communication skills required for the practical application of Operations Research.
4. To gain knowledge and skills in solving decision-making and game theory models
5. To understand issues in project management and manage project activities effectively
6. To understand basic working of simulation model

UNIT I  LINEAR PROGRAMMING

UNIT II  NETWORK ANALYSIS
Transportation problems: Northwest corner rule, least cost method, Vogel’s approximation method - stepping stone method - MODI method – Unbalanced transportation – Assignment problem – Hungarian algorithm. TSP- Solving using Hungarian Algorithm- Applications of TSP to other engineering problems

UNIT III  DECISION THEORY AND GAME THEORY
Decision Theory- Decision under certainty-Decision under Risk-Decision under uncertainty – Decision Tree- Game theory – Two person zero sum games – Graphical solution Algebraic solution – Linear Programming solution

UNIT IV  QUEUING THEORY
Queueing Terminology- Single Server Queuing Models- Multi-Server Queuing Model- Calling Source population –Limited and Unlimited- Variations in Queue Length - Limited and Unlimited

UNIT V  SIMULATION

TOTAL: 45 PERIODS

LABORATORY EXPERIMENTS
The following problems are solved using Operation Research software packages and ‘C++’ programming language.

1. LP problems and Sensitive Analysis
2. Solving LPP using Excel
3. Transportation problems
4. Assignment problems  
5. Waiting line problems single server  
6. Waiting Line problems Multiple Server  
7. Random Number Generation  
8. Testing of Random of Generations  
9. Monte Carlo Simulation  

TOTAL:30PERIODS  

SOFTWARE REQUIRED  
1. MS EXCEL  
2. TORA & LINDO/GOOGLE OR TOOLS  
3. Dev C++  
4. Simulation Packages  

COURSE OUTCOMES:  
The students will be able to  
CO1. Convert an abstract real-world problem to an optimization model.  
CO2. Make decision under risk and uncertainty  
CO2. Identify critical activities and expedite project effectively  
CO3. Identify a suitable queuing model for a problem and solve it  

REFERENCES:  

CO's- PO's & PSO's MAPPING  

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COURSE OBJECTIVES:

1. Describe the effect of ultrasonication on squeeze-casted materials.
2. Correlate heat treatment and its effects on materials.
3. Develop specimens, analysis microstructure, physical, and mechanical properties.
4. Use of tribological tests to evaluate wear and friction in various conditions.
5. Contrast the various corrosion tests and examine the surface of different materials.

List of Experiments

1) Effect of ultrasonication on the properties of squeeze casted materials.
2) Influence of heat treatment conditions on the hardness of the Al/Mg composites.
3) Specimen preparation and analysis of microstructure.
4) Measurement of physical and mechanical properties.
5) Determination of friction and wear characteristics using linear reciprocating wear tester.
6) Perform high temperature wear test using pin-on-disc tribometer and analyse the surface temperature distributions.
7) Measure the wear and scratch dimensions on the sample surface using video measuring machine.
8) Examine the electrochemical and tribocorrosion behaviour of Al/Mg test samples.
9) Calculate the salt spray and immersion corrosion rate on the magnesium samples.
10) Determine the compression strength of the copper samples fabricated through powder metallurgy route.

List of Equipment

1) Ultrasonication assisted squeeze casting setup.
2) (a) Muffle furnace with controlled environment (b) Vicker hardness tester.
3) (a) Abrasive cutter (b) Slow speed cutter (c) Moulding machine (d) Polishing machine (e) In-situ metallography kit (f) Optical microscope (g) Portable vision measurement system.
4) (a) Solid material density kit (b) Vicker hardness tester (c) Servo controlled universal testing machine (d) Rotary fatigue testing machine.
5) (a) Linear reciprocating wear tester (b) Weighing balance.
6) (a) Pin-on-disc tribometer with heating chamber (b) Weighing balance (c) Thermal image scanner.

7) (a) Linear reciprocating wear tester (b) Coating thickness measurement apparatus (c) Video measuring machine.

8) (a) Electrochemical workstation (b) Tribocorrosion setup (c) Weighing balance.

9) (a) Salt spray corrosion chamber setup (b) Immersion setup (c) Weighing balance.

10) (a) Planetary ball mill (b) Powder compaction machine (c) Microwave furnace (d) Servo controlled universal testing machine.

TOTAL: 60 PERIODS

COURSE OUTCOMES

The students will be able to

CO1. Examine the effects of ultrasonication on squeeze casted materials.

CO2. Perform the heat treatment on materials to assess the thermal effects.

CO3. Prepare a specimen and perform microstructural, physical, and mechanical test.

CO4. Conduct tribological test under various conditions and determine wear and friction.

CO5. Assess the corrosion behaviour of different materials using various test procedures.

CO’s- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES

1. To understand Lean production principles, eliminate waste, and improve efficiency through case studies.
2. To learn steps for Value Stream Mapping, apply Lean metrics, and implement improvements in value streams.
3. To explore Six Sigma’s relationship with Lean Manufacturing, cultural changes, quality assessment, and cost implications.
4. To gain knowledge of various Six Sigma tools and techniques for problem-solving and project management.
5. To evaluate Six Sigma quality economics, focus on continuous improvement using Lean principles, Kaizen, and 5S methodologies.

UNIT I LEAN MANUFACTURING

UNIT II VALUE STREAM MAPPING
Need for Value Stream mapping; Steps involved in Value stream mapping – Choose value stream – PQ and PR analysis, Current State map, Lean Metrics, Future State Map, Kaizen plans; Lean implementation - Cultural change, Hoshin planning; Lean in the Supply chain.

UNIT III SIX SIGMA
Six sigma - lean manufacturing and six sigma- six sigma and process tolerance – Six sigma and cultural changes – six sigma capability – six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ)

UNIT IV SIX SIGMA SCOPE OF TOOLS AND TECHNIQUES

UNIT V EVALUATION AND CONTINUOUS IMPROVEMENT METHODS
Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates – continuous improvement – lean manufacturing – value, customer focus, Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S

TOTAL: 45 PERIODS
COURSE OUTCOMES:
The students will be able to

**CO1.** Demonstrate understanding of Lean production principles, waste identification, and efficiency improvement.

**CO2.** Apply Value Stream Mapping steps and Lean metrics to enhance organizational performance.

**CO3.** Analyze the relationship between Six Sigma and Lean Manufacturing, evaluate cultural changes, quality levels, and cost implications.

**CO4.** Acquire knowledge of Six Sigma tools and techniques for effective problem-solving and project management.

**CO5.** Evaluate Six Sigma quality economics and demonstrate commitment to continuous improvement through Lean principles, Kaizen, 5S methodologies, and customer focus.

REFERENCES:
3. Fred Soleimannejed, Six Sigma, Basic Steps and Implementation, AuthorHouse, 2004

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COURSE OBJECTIVES:
1. To gain basic understanding on Reliability studies
2. To impart knowledge on the failure data analysis
3. To gain understanding of reliability prediction methods of various structures
4. To impart knowledge on reliability testing and monitoring methods
5. To provide understanding of maintainability/availability/replacement models

UNIT I  RELIABILITY CONCEPT
Reliability definitions – Quality vs. Reliability - Reliability measures – f(t), F(t), R(t) functions – Central tendency of failure time distributions – Design life - Mortality graph - A priori and A posteriori probabilities of failure – Component Mortality – Exponential reliability function – Useful life.

UNIT II  LIFE DATA ANALYSIS

UNIT III  SYSTEM RELIABILITY EVALUATION

UNIT IV  RELIABILITY MANAGEMENT

UNIT V  MAINTAINABILITY AND AVAILABILITY

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Understand the fundamental theory in Reliability Engineering
CO2: Analyse the failure time data and determine the fitness of the data into theoretical distributions
CO3: Estimate system reliability of standard/complex configurations
CO4: Apply reliability allocation, growth monitoring and life testing models
CO5: Demonstrate Maintainability and Availability of system

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COURSE OBJECTIVES:
1. To extract the knowledge on the applications of multivariate statistical analysis.
2. To understand the simple regression, multiple regression and correlation procedures.
3. To apply the factor analysis in real life applications and principal component analysis effectively for data exploration and data dimension reduction.
4. To classify and implement the discriminant analysis to various cases.
5. To find groupings and associations using cluster analysis.

UNIT I  MULTIVARIATE METHODS

UNIT II  REGRESSION ANALYSIS
Inferences about population parameters - Simple Regression, and Correlation – Estimation using the regression line, correlation analysis, Multiple Regression– Logistic Regression - Canonical Correlation Analysis - Multivariate analysis of variance (MANOVA) – Conjoint Analysis – Choice based conjoint (CBC), Adaptive CBC.

UNIT III  FACTOR ANALYSIS
Principal components analysis – Objectives, estimation of principal components, testing for independence of variables, Factor analysis model – Method of estimation – Factor rotation – Factor Scores - EFA - CFA - Path analysis and Path Diagrams, Software tools for development – SEM and ISM.

UNIT IV  DISCRIMINANT ANALYSIS
Discriminant analysis – Classification with two multi-Variate normal populations- Evaluating classification function – Classification with several populations – Fishers Method for Discriminating among several Populations.

UNIT V  CLUSTER ANALYSIS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1  Predict the values of one or more variables on the basis of observations on the other variables.
CO2  Synthesize the specific statistical hypotheses, in terms of the parameters of multivariate populations.
CO3  Construct data reduction or structural simplification as simply as possible without sacrificing valuable information and will make interpretation easier.
CO4  Apply to sort and group the "similar" objects or variables are created, based upon measured characteristics.
CO5  Prepare to understand appropriate use of clustering methods.
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CO’s- PO’s & PSO’s MAPPING
COURSE OBJECTIVES:
1. To study the basic principles and concepts of software quality
2. To effective designing, analyzing and developing the software engineering activities
3. To gain knowledge on software quality assurance and risk management
4. To analyze the principles and applications of software quality management tools
5. To gain knowledge about software quality standards

UNIT I SOFTWARE QUALITY
Definition of Software Quality, Quality Planning, Quality system – Quality Control Vs Quality Assurance – Product life cycle – Project life cycle models - Agile-Scrum

UNIT II SOFTWARE ENGINEERING ACTIVITIES
Estimation, Software requirements gathering, Analysis, Architecture, Design, development

UNIT III SUPPORTING ACTIVITIES
Metrics, Reviews – Software Configuration Management (SCM) – Software quality assurance and risk management.

UNIT IV SOFTWARE TESTING & MAINTENANCE
Definition and Objectives, software testing strategies - Software test Classifications - White & Black box testing process - Test case design - Automated Testing - Alpha and Beta site Testing programs. Activities - Maintenance Phase – Issues - Configuration management - Skillsets, Estimative, Geographically Distributed Teams – Metrics - Maintenance Phase

UNIT V QUALITY ASSURANCE MODELS
Software Quality Standards, ISO systems- CMM, Capability Maturity Model Integration (CMMI) – P-CMM – Case study – Industry Specific Quality Models (Hipaa.Sas)

COURSE OUTCOMES:
The students will be able to
CO1. Understand the basic principles and concepts in software quality
CO2. Effectively design, analyze and develop software engineering activities
CO3. Gain knowledge on software quality assurance and risk management
CO4. Understand the principles and applications of software quality management tools
CO5. Gain knowledge about software quality standards

REFERENCES:
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COURSE OBJECTIVES:
1. To prioritize the alternate, modify and propose the new methods.
2. To develop the graphical tools of method study.
3. To infer the work performance measurement tools.
4. To relate the software products in work measurement and set time standards.
5. To collaborate the students in physical fitness test.

LIST OF EXPERIMENTS
1. Peg Board Experiment.
2. Stopwatch time study.
4. Work sampling and Graphic tools for method study.
5. Effect of speed of walking on treadmill using least rate and energy expenditure.
7. Evaluation of physical fitness using step test.

LABORATORY EQUIPMENTS REQUIREMENTS
1. Time study Trainer.
2. Peg board.
3. Stop watches.
4. Tread mill.
5. Ergo cycle.

TOTAL: 30 PERIODS

COURSE OUTCOMES:
The students will be able to
CO1: Apply the method study tools to record the existing methodology.
CO2: Design a better work place using method study tools.
CO3: Set time standards using work measurement techniques.
CO4: Develop time standards using software’s
CO5: Conduct experiments for physical fitness using appropriate equipment.

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DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
COURSE OBJECTIVES:

1. To develop journal paper reading and understanding skill.
2. To improve communication and presentation skill of students.
3. To enhance critical thinking and analysis.
4. To improve communication and public speaking skills.
5. To explore emerging technologies and trends.

GUIDELINES:

- The students are expected to make a presentation on the state of research on a particular topic based on current journal publications in that topic.
- A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
- Students are encouraged to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

COURSE OUTCOMES:

The students will be able to:

- CO1: Select the method, analysis and optimize the given problem through research articles.
- CO2: Develop the communication and presentation skills.
- CO3: Enhance critical thinking and analysis.
- CO4: Improve the public speaking skills.
- CO5: Get an exposure to the emerging technologies and trends.

TOTAL: 30 PERIODS

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COURSE OBJECTIVES:
1. To get hands on training and exposure on descriptive and Inferential statistics, Hypothesis testing, Regression and Correlation Analysis.
2. To get hands on training and exposure on Factor Analysis, Discriminant Analysis and Cluster Analysis.
3. To get hands on training and exposure to techniques on Single factor experiments, Factorial experiments and 2k design.
4. To get hands on training and exposure on design and Analysis of Taguchi’s DOE
5. To get hands on training on Response Surface Methodology and MANOVA.

LABORATORY EXPERIMENTS
Students will perform analysis of data in the following topics using Python and Data Analysis package:
1. Statistical analysis: Descriptive Statistics • Inferential statistics
2. Testing of Hypothesis
3. Linear Regression and Correlation
4. Discriminant analysis
5. Control charts
6. Process capability
7. Single Factor Experiments
8. Factorial experiments
9. 2k Design
10. Analysis of Variance (ANOVA)
11. Taguchi Design of Experiments
12. Factor analysis
13. Cluster Analysis
14. Response Surface Method
15. MANOVA

TOTAL:60 PERIODS

COURSE OUTCOMES:
The students will be able to:

CO1: Compute descriptive and inferential statistics, Hypothesis testing, Regression and Correlation Analysis for a given data
CO2: Perform Factor Analysis, Discriminant Analysis, Cluster Analysis and develop Process control.
CO3: Perform DOE (Single, Factorial and 2k design) for a given data software.
CO4: Perform Taguchi Design
CO5: Perform Response Surface Methodology and MANOVA for a given data

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DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
COURSE OBJECTIVE:
1. To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
2. To evaluate literature study for analysis review of literature
3. To develop the methodology to solve the identified problem
4. To Conceptualizing a project design
5. To train the students in preparing project reports and to face reviews and viva-voce examination

SYLLABUS:
The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work.

TOTAL: 180 PERIODS

COURSE OUTCOME:
- Understand the current need of the society through detailed review of literature.
- Analyze the methodology of literature reviews to solve the identified problem.
- At the end of the course the students will have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

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DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
COURSE OBJECTIVE:

1. To solve the identified problem based on the formulated methodology.
2. To constructing an instrument for data collection.
3. To writing a project proposal.
4. To processing and displaying the data.
5. To develop skills to analyze and discuss the test results, and make conclusions

SYLLABUS:
The student shall continue (or take up a new) the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department.

COURSE OUTCOME:

- Understand the constructing an instrument for data collection
- Writing a project proposal and displaying the data
- On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.

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TOTAL: 180 PERIODS
COURSE OBJECTIVES:
1. To develop and implement a comprehensive quality management system
2. To optimize machine effectiveness and reliability
3. To evaluate audit plan documents
4. To analyze corrective action responses and their adequacy
5. To apply the process of auditing

UNIT I  QUALITY MANAGEMENT SYSTEMS AND AWARD  9

UNIT II  TOTAL PRODUCTIVE MAINTENANCE (TPM)  9

UNIT III  METHODS IN AUDITING  9

UNIT IV  AUDIT PROGRAM MANAGER AND PREPARATION  9

UNIT V  PERFORMANCE AND REPORTING  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to
CO1. Comprehensive Quality Management System
CO2. Machine effectiveness and Reliability
CO3. Evaluate the documents for audit plan
CO4. Analysing the Corrective action response and adequacy of the response
CO5. Applying the process of auditing
REFERENCES:

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COURSE OBJECTIVES:
1. To Summarize the Overview of Quality
2. To Illustrate the essentials of Quality
3. To Understand and apply Selected Quality Improvement techniques
4. To gain knowledge on research and development (R&D) certification standards
5. To Develop comprehensive knowledge of Quality Management Systems and awards

UNIT I INTRODUCTION

UNIT II ESSENTIALS OF QUALITY MANAGEMENT

UNIT III QUALITY IMPROVEMENT TECHNIQUES

UNIT IV RESEARCH AND DEVELOPMENT STANDARDS

UNIT V QUALITY MANAGEMENT SYSTEMS AND AWARD

TOTAL: 45 PERIODS
COURSE OUTCOMES:
The students will be able to
CO1. Recognition of the importance of Quality
CO2. Acquiring Essentials of Quality
CO3. Application of Quality Improvement tools
CO4. Research and Development standards
CO5. Comprehensive Quality Management System

REFERENCES:
6. Research and Development Evaluation in the Aerospace and Defense Industry &quot; by Matthew Z. Liberatore and Brian J. Lunday
7. ISO 13485:2016 - A Complete Guide to Quality Management in the Medical Device Industry &quot; by Itay Abuhav
8. Good Laboratory Practice: A Question & Answer Reference Guide &quot; by David S. Loseke

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DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
COURSE OBJECTIVES:
1. To understand the basic syntax of C++ programs and to write simple programs
2. To understand OOP concepts and use those concepts in programming
3. To create class in C++ program
4. To derive a class from base class in C++ program
5. To apply C++ concepts in Industrial Problems

UNIT I C++ Basics
Expression and statements, operators, precedence, type conversion, control statements, loops, Arrays structures, functions, argument passing, reference argument, overloaded function. Writing Simple programs - Understanding the Syntax - Troubleshooting Methods.

UNIT II FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING
Elements of OOP, classes, subjects, messaging, inheritance, polymorphism, OOP paradigm versus procedural paradigm, object-oriented design. Use OOPs concepts to write programs for small IE problems.

UNIT III C++ CLASS
Definition, class objects, member functions, class argument, operator overloading, user defined conversions. Application Programs using Classes

UNIT IV CLASS DERIVATION
Derivation specification, public and private base classes, standard conversions under derivation, class scope, initialization and assignment under derivation. Write Programs that are derived from base class.

UNIT V CONSTRUCTORS, DESTRUCTORS AND FILE HANDLING
Constructors - Copy Constructor – Destructors -Default Constructors - Private Destructor-Exception Handling - Catching Base and Derived Classes as Exceptions-Catch block and type conversion - Exception Handling and Object Destruction-File Handling through C++ Classes- Read/Write Class Objects from/to File in C++

COURSE OUTCOMES:
The students will be able to
CO1. Create and execute simple C++ programs.
CO2. Use object oriented programming Concepts in programming.
CO3. Create class in C++ program.
CO4. Derive a class from the basic class.
CO5. Create and execute program for solving the industrial problems.

REFERENCES:
1. E.Balagurusamy, Object oriented programming with C++, Tata Mc Graw Hill, 2020
## CO’s - PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
1. To explain the concept of design thinking for product and service development
2. To explain the fundamental concept of innovation and design thinking
3. To discuss the methods of implementing design thinking in the real world.
4. To acquire the skills to create technical drawings for design ideas.
5. To participate in a design thinking workshop to gain training and practical experience in applying design thinking principles.

UNIT I UNDERSTANDING DESIGN THINKING
Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – Minimum Viable Products (MVP) or Prototyping

UNIT II TOOLS FOR DESIGN THINKING
Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design

UNIT III DESIGN THINKING IN IT DESIGN
Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping

UNIT IV DESIGN THINKING FOR STRATEGIC INNOVATIONS

UNIT V DESIGN THINKING WORKSHOP
Design Thinking Workshop Empathize, Design, Ideate, Prototype and Test

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to
CO1. Appreciate various design process procedure
CO2. Generate and develop design ideas through different technique
CO3. Identify the significance of reverse Engineering to Understand products
CO4. Draw technical drawing for design ideas
CO5. To get training in design thinking workshop

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COURSE OBJECTIVES:
1. To learn basic concepts of the metrology and importance of measurements.
2. To teach measurement of linear and angular dimensions assembly and tolerances.
3. To study the computer aided inspection methods.
4. To develop the knowledge on surface metrology.
5. To provide the knowledge on nanoscale measurements

UNIT I  CONCEPTS OF METROLOGY  9

UNIT II  MEASUREMENT OF LINEAR, ANGULAR DIMENSIONS  9
Linear Measuring Instruments –Gauge blocks, Comparators -mechanical measurements using measuring microscope and Profile projector – Angular measuring instruments –. Measurements on Screw threads Measurements on Gears-Analytical measurement- Functional test on gears.

UNIT III  COMPUTER AIDED INSPECTION  9

UNIT IV  MODERN SURFACE METROLOGY  9
Measurement of Surface finish – Functionality of surfaces, Parameters, Comparative, Stylus based and Optical Measurement techniques, Filters, Introduction to 3D surface metrology- Parameters-Measuring instruments

UNIT V  NANOSCALE MEASUREMENT  9

TOTAL:45 PERIODS

COURSE OUTCOMES:
The students will be able to

CO1. Discuss the concepts of measurements to apply in various metrological instruments.
CO2. Apply the principle and applications of linear and angular measuring instruments, assembly and tolerances
CO3. Apply the computer aided inspection methods for industrial applications.
CO4. Apply the principles and advanced methods for surface metrology.
CO5. Apply the advances in nanoscale measurement of dimensions.
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COURSE OBJECTIVES:
1. To introduce the 8D problem-solving process, tools, and case studies to address root causes of problems.
2. To analyze and interpret various measurement aspects using MSA methods and techniques.
3. To understand APQP tools, reporting requirements, and the role of control plans in the product quality planning cycle.
4. To learn the purpose, requirements, and implementation of the PPAP process in conjunction with APQP.
5. To familiarize with quality awards and performance excellence models to drive organizational excellence.

UNIT I  8D PROBLEM SOLVING

UNIT II  MEASUREMENT SYSTEM ANALYSIS (MSA)
Calculate, analyze, and interpret repeatability and reproducibility (gage R&R) studies, measurement correlation, capability, bias, linearity, precision, stability and accuracy, as well as related MSA quantitative and graphical methods.

UNIT III  ADVANCED PRODUCT QUALITY PLANNING (APQP)

UNIT IV  PRODUCTION PART APPROVAL PROCESS (PPAP)
Purpose of the Production Part Approval Process (PPAP) - PPAP process requirements - Production Part Approval Process (PPAP) Manual - Service Production Part Approval Process (Service PPAP) - Implementing APQP with PPAP.

UNIT V  PERFORMANCE EXCELLENCE MODELS
Quality Awards – Criteria - Most Famous Performance Excellence Models: European Excellence Award (EFQM) - Excellence Canada - ASQ International Team Excellence Award (ITEA) - Malcolm Baldrige National Quality Award (MBNQA) - Deming Prize - Rajiv Gandhi National Quality Award.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to
CO1. Utilize the 8D problem-solving process, tools, and case studies to address root causes of problems.
CO2. Apply MSA methods and techniques to analyze measurement aspects effectively.
CO3. Implement APQP tools, meet reporting requirements, and utilize control plans in product quality planning.
CO4. Apply the PPAP process in conjunction with APQP for production part approval.
CO5. Familiarize with quality awards and performance excellence models to drive organizational excellence.

Attested

[Signature]
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Anna University, Chennai-600 025
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CO's- PO's & PSO's MAPPING

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COURSE OBJECTIVES:
1. To describe the role and drivers of and supply chain management in achieving competitiveness.
2. To explain about Supply Chain Network Design.
3. To illustrate about the issues related to inventory in Supply Chain.
4. To appraise about transportation and sourcing in Supply Chain.
5. To application of Information Technology and Emerging Concepts in Supply Chain.

UNIT I INTRODUCTION TO SUPPLY CHAIN MANAGEMENT

UNIT II DISTRIBUTION NETWORK DESIGN IN SUPPLY CHAIN

UNIT III INVENTORY IN SUPPLY CHAIN
The Role of Cycle inventory in a Supply Chain, Economies of Scale to Exploit Fixed costs, Managing Multi-echelon Cycle Inventory. The Role of Safety Inventory in a Supply Chain, Determining appropriate level of Safety inventory, Impact of supply Uncertainty on Safety inventory, Impact of aggregation on safety inventory, impact of replenishment policies on safety inventory, Managing Safety Inventory in a Multi-echelon Supply Chain, The Role of IT in inventory management.

UNIT IV TRANSPORTATION AND SOURCING IN SUPPLY CHAIN
The role of transportation in a Supply chain, Modes of transportation and their performance characteristics, Transportation infrastructure and policies, Design options for a transportation network, Trade-offs in transportation design, Tailored transportation, The role of IT in transportation, Problems. Sourcing Decisions In A Supply Chain: The role of sourcing in a supply chain, in-house or outsource, Third-and Fourth-party logistics providers, Total cost of Ownership, Supplier selection, Auctions and Negotiations, Sharing Risk and Reward in the supply chain.

UNIT V INFORMATION TECHNOLOGY IN SUPPLY CHAIN
The role of IT in a supply chain, The supply chain IT framework, The supply chain macro processes, Lack of Supply Chain co-ordination and the Bullwhip effect, managerial levers to achieve coordination, continuous replenishment and vendor-managed inventories, collaborative planning, forecasting and replenishment (CPFR).

COURSE OUTCOMES:
The students will be able to
CO1. Understand supply chain concepts, systemic and strategic role of SCM in global competitive environment.
CO2. Evaluate alternative supply and distribution network structures using optimization models.
CO3. Develop optimal inventory policies in the supply chain context.
CO4. Develop optimal sourcing and Transportation decisions in the supply chain.
CO5. Select appropriate information technology frameworks for managing supply chain processes.

REFERENCES:

CO’s-PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
1. To understand the concept of Engineering Economics and apply in the real world.
2. To gain knowledge in the field of value engineering to enable the students to estimate the costing factors.
3. To understand the concept of cash flow and its methods of comparison.
4. To acquire knowledge in the field of cost estimation.
5. To enable the students to estimate the cost of various manufacturing processes.

UNIT I INTRODUCTION TO MANAGERIAL ECONOMICS AND DEMAND ANALYSIS  9

UNIT II PRODUCTION AND COST ANALYSIS  9

UNIT III PRICING  9

UNIT IV ESTIMATION OF MATERIAL AND LABOUR COSTS  9

UNIT V ESTIMATION OF OPERATIONAL COST  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to

CO1. know about method to Perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
CO2. Calculate payback period and capitalized cost on one or more economic alternatives.
CO3. know about method to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
CO4. Prepare the cost estimation report for any project.
CO5. Learn about cost accounting, replacement analysis.

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COURSE OBJECTIVES:
1. To gain the basic concepts of Sequencing and Scheduling theory.
2. To impart knowledge on the Applications of Single Machine Sequencing Algorithms
3. To gain understanding of Parallel Machine Scheduling Algorithms
4. To impart knowledge on Flow Shop Scheduling and its algorithms
5. To provide knowledge on Job Shop Scheduling and its algorithms

UNIT I SCHEDULING BASICS

UNIT II SINGLE MACHINE MODEL

UNIT III PARALLEL MACHINE MODEL

UNIT IV FLOW SHOP MODEL

UNIT V JOB SHOP MODEL

COURSE OUTCOMES:
CO1: Understand the fundamental theory in Sequencing and Scheduling.
CO2: Determine the sequence that minimizes a performance measure in single machine problems
CO3: Design a Parallel Machine schedule to minimize performance measures
CO4: Apply heuristics/algorithms to design a Flow shop
CO5: Demonstrate the use of heuristics for Job shop scheduling

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COURSE OBJECTIVES:
1. To understand the basic principles in facilities planning and plant location
2. To gain knowledge on the basic principles in facility layout design decisions through proper analysis
3. To analyze various modern trends while designing a layout using computerized algorithms
4. To understand the basic principles of group technology and develop knowledge in line balancing concepts to implement improved system
5. To understand basic principles in designing, measuring and analyzing material flow to improve the efficiency of the system

UNIT I  PLANT LOCATION  9
Plant location analysis – factors, costs, location decisions – Single facility location models, Multi facility location models - Mini-sum model - Mini-max model - Gravity location models, Brown & Gibbs model - Multi Criteria location problems - P median model - Developing facilities planning strategies- Examples of inadequate planning

UNIT II  FACILITIES LAYOUT DESIGN  9
Facilities requirement, need for layout study – types of layout - Factors affecting plant layout - P-Q chart - Systematic layout planning - Information gathering, Flow & Activity analysis, Relationship diagram, Space Constraint – OSHA, ADA regulations in facility design

UNIT III  LAYOUT PLANNING ALGORITHMS  9
Computerized layout planning procedure – ALDEP, CORELAP, CRAFT – Trends in computerized layout - Layout software

UNIT IV  GROUP TECHNOLOGY & LINE BALANCING  9
Group technology – OPTIZ classification system - Production Flow analysis , Rank Order Clustering I & II - Product oriented layout- assumptions and types, Assembly line balancing – Objectives, Line balancing techniques – LCR, KWM, RPW, COMSOL - Introduction to Multi-model assembly line - Mixed model assembly line balancing

UNIT V  MATERIALS HANDLING  9
Concept of material handling – Principles - Material handling system design – Models for material handling system design- Classification of material handling equipments, AGV – types, Conveyors – types of conveyors – Palletizers – Warehouse material handling devices - Equipment selection & specification, Packaging – Types & Functions

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to

CO1. Interpret appropriate location models for various facility types
CO2. Examine different type of design and analyze various facility layouts
CO3. Analyze and apply various computerized techniques while designing a layout
CO4. Predict a strategy to level the workload across all the workstations
CO5. Estimate smooth and cost effective system in the material handling process
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COURSE OBJECTIVES:
1. To understand basic maintenance concepts and latest trends
2. To know various maintenance policies for maximizing the profit.
3. To diagnose and analyse maintenance problems.
4. To know effective spare parts management strategies
5. To learn strategies for improving the overall Equipment Effectiveness.

UNIT I MAINTENANCE CONCEPT
Maintenance definition – Maintenance objectives - Maintenance challenges – Tero Technology
Maintenance costs - Scope of maintenance department. –Latest Trends in Maintenance-
Computerized Maintenance Management Software (CMMS)- Role of IoT in Maintenance- Digital
Twins in Maintenance.

UNIT II MAINTENANCE MODELS
Proactive/reactive maintenance - Maintenance policies – Imperfect maintenance Preventive /
breakdown maintenance – Optimal PM schedule and product characteristics – Inspection decisions
- Maximizing profit - Minimizing downtime – Replacement decisions.

UNIT III MAINTENANCE QUALITY
Five zero concept – FMEA- FMECA – Root cause analysis – Repair time distribution – Analysis of
downtime – Maintainability prediction – Design for maintainability – Reliability Centered
Maintenance.

UNIT IV MAINTENANCE MANAGEMENT
Human factors – Maintenance staffing - Learning curves – Simulation – Optimal size of service facility
– Optimal repair effort – Spare parts management – Maintenance planning – Maintenance
scheduling.

UNIT V TOTAL PRODUCTIVE MAINTENANCE
TPM philosopy – Chronic and sporadic losses – Equipment defects – Six major losses – Overall
equipment effectiveness –TPM pillars –Autonomous maintenance.

COURSE OUTCOMES:
The students will be able to
CO1. Describe basic maintenance concepts and latest trends in maintenance
CO2. Extract maintenance policies for maximizing the profit.
CO3. Diagnosis of maintenance problems.
CO4. Improve uptime of machines by effective spare parts management.
CO5. Improve the overall Equipment Effectiveness.
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**Attested**

**Director**

Centre for Academic Courses
Anna University, Chennai-600 025
COURSE OBJECTIVES:
1. Understanding the Basics of accounting and recording of transactions
2. Evaluating P&L statements, Balance sheets and other accounting statements.
3. Learn and apply the various cost accounting methods.
4. Study the various cost control procedures.
5. Sketch and prepare a budget and make investment decisions.

UNIT I INTRODUCTION

UNIT II FINANCIAL ACCOUNTING
Preparation of Companies Financial Statements - Salient features of Balance Sheet and Profit and Loss statement, cash flow and Fund flow Analysis (Elementary), ratio analysis.

UNIT III COST ACCOUNTING
Cost accounting systems: Job Costing, process costing, allocation of overheads, Activity based costing, variance analysis–marginal costing–Break even analysis.

UNIT IV BUDGETING
Requirements for a sound budget, fixed budget – preparation of sales and production budget, flexible budgets, zero based budgets and budgetary control.

UNIT V FINANCIAL MANAGEMENT
Investment decisions – Investment appraisal techniques – payback period method, accounting rate of return, net present value method, internal rate of return and profitability index method-cost of capital.

COURSE OUTCOMES:
The students will be able to
CO1. Analyse the financial transaction and prepare the Trail Balance
CO2. Evaluate the financial statements.
CO3. Ability to apply the management and cost accounting techniques for decision making.
CO4. Construct and analyse a various types of budget
CO5. Examine investment decision based on capital budgeting techniques.
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COURSE OBJECTIVES:
1. Develop basic knowledge on lean manufacturing concepts.
2. Inculcate knowledge in agile manufacturing principles.
3. Solve and analyze various concepts in sustainable manufacturing.
4. Teach the tools and techniques used in sustainable manufacturing.
5. Articulate knowledge about the design, principles and challenges in industry 4.0

UNIT I LEAN MANUFACTURING

UNIT II AGILE MANUFACTURING

UNIT III SUSTAINABLE MANUFACTURING

UNIT IV TOOLS AND TECHNIQUES OF SUSTAINABLE MANUFACTURING

UNIT V INDUSTRY 4.0
Definition, Design, Principles, Challenges

TOTAL: 45 PERIODS
COURSE OUTCOMES:
The students will be able to

**CO1.** Understand the basic philosophies of lean manufacturing concepts  
**CO2.** Effectively gain knowledge in agile manufacturing principles  
**CO3.** Apply and analyze various concepts in sustainable manufacturing  
**CO4.** Understand the tools and techniques used in sustainable manufacturing  
**CO5.** Gain knowledge about the design, principles and challenges in Industry 4.0

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[Signature]

DIRECTOR  
Centre for Academic Courses  
Anna University, Chennai-600 025
COURSE OBJECTIVES:
1. To identify and prevent operational hazard
2. To categorize, analyze and interpret the accidents data based on various safety techniques
3. To use proper safety techniques on safety engineering and management
4. To design the system with environmental consciousness by implementing safety regulation
5. To use safety management practices in Industries

UNIT I INTRODUCTION

UNIT II SAFETY APPRAISAL AND ANALYSIS

UNIT III SAFETY MANAGEMENT

UNIT IV OCCUPATIONAL HEALTH
Concept and spectrum of health functional units and activities of operational health service – occupational and related disease – levels of prevention of diseases – notifiable occupational diseases Toxicology Lead – Nickel, chromium and manganese toxicity – gas poisoning (such as CO, Ammonia Chloride, So2, H2s.) their effects and prevention – effects of ultra violet radiation and infrared radiation on human system.

UNIT V SAFETY AND HEALTH REGULATIONS

TOTAL: 45 PERIODS
COURSE OUTCOMES:

CO1 Inferring safety concepts and identify, prevent operational hazard
CO2 Collect, analyze and interpret the accidents data based on various safety techniques
CO3 Implementing safety management practices in industries.
CO4 Develop proper safety techniques on safety engineering and management
CO5 Design the system with environmental consciousness by implementing safety regulation

REFERENCES:


CO’s- PO’s & PSO’s MAPPING

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COURSEOBJECTIVES:
1. To develop an understanding of the role of logistics in a market-oriented society Examine the major functions of logistics
2. To provide insight into Transportation Mode Selection and its cost structures
3. To impart knowledge on Packaging and Containerization
4. To familiarize Warehousing functions, types, Internal Operations

UNIT I LOGISTICS MANAGEMENT

UNIT II PACKAGING AND CONTAINERIZATION

UNIT III WAREHOUSE FUNCTIONS AND TYPES

UNIT IV WAREHOUSE OPERATIONS
UNIT V  EXPORT & IMPORT PROCEDURES


TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to

CO1. Understand the principles of logistics management
CO2. Understand the logistics role in the economy and the organization
CO3. Gain knowledge about warehouse functions and types
CO4. Understand warehouse operations
CO5. Familiarise about Export & Import Procedures in Logistics and Distribution

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CO’s - PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
1. To know various models used in project selection.
2. To understand the project planning, and demand analysis.
3. To understand the financial analysis of the project.
4. To apply network techniques for project scheduling and resource allocation.
5. To recognize the values of project audit.

UNIT I INTRODUCTION

UNIT II PROJECT PLANNING AND DEMAND ANALYSIS

UNIT III FINANCIAL ANALYSIS
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 - cost versus time, straight-line approximation of variation of cost with reduction in time for activities, direct and indirect costs.

UNIT IV PROJECT SCHEDULING
Scheduling: Gantt chart, milestone chart, Network Techniques PERT and CPM, Crashing a project, Resource loading, leveling, and allocation – GERT - Q-GERT.

UNIT V PROJECT AUDITING
Construction and use of audit report, Project audit life cycle, Essentials of audit and evaluation, Varieties of project termination, the termination process, The Final Report – A project history.

COURSE OUTCOMES:
The students will be able to
CO1. Understand various models used in project selection.
CO2. Acquire knowledge in project planning, and demand analysis.
CO3. Understand the financial analysis of the project.
CO4. Prepare project scheduling and resource allocation.
CO5. Understand the values of project audit.

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COURSE OBJECTIVES:
1. To understand the fundamental terms, concepts and theories associated with the phases of Decision Support Systems.
2. To evaluate the various mathematical models, data warehousing and data mining.
3. To discuss and develop skills in the analysis, design and implementation of group support systems and knowledge management systems.
4. To analyze the expert system as a subsystem of DSS
5. To create the knowledge representation method and implement support systems.

UNIT I DECISION MAKING INTRODUCTION 9
Management Support System - Managerial decision making, System modeling and support - preview of the modeling process - phases of decision-making process - DSS Architecture, Analysis, Design, Requirements, and Validation

UNIT II MODELING AND ANALYSIS 9
DSS components - Modelling and Analysis - Database Organization and Structures, Data Warehousing, Data Marts, Business Intelligence/ Analytics, Online Analytical Processing, Data Mining - DSS development - Software tools for Development - AHP.

UNIT III KNOWLEDGE MANAGEMENT 9
Group support systems - Enterprise DSS - supply chain and DSS - Knowledge management methods - Organizational Learning and Transformation, technologies and tools.

UNIT IV KNOWLEDGE REPRESENTATION 9

UNIT V SUPPORT SYSTEM IMPLEMENTATION 9
Representation in logic and schemas, semantic networks, production rules and frames, inference techniques, intelligent system development, implementation and integration of management support systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Choose decisions in the semi structured and unstructured problem situations.
CO2 Illustrate the data warehousing and data mining principles in basic applications.
CO3 Develop a knowledge management system with simple tools and techniques.
CO4 Construct intelligent based DSS and gain knowledge on AI expert systems.
CO5 Express logical and analytical thinking in making decisions.

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COURSE OBJECTIVES:
1. To practice the various software modeling tools and techniques.
2. To study the various performance measurement tools and techniques.
3. To estimate time and cost of projects.
4. To select an appropriate monitoring plan.
5. To study the importance of software design and software testing.

UNIT I SOFTWARE ENGINEERING AND MODELS

UNIT II REQUIREMENTS ANALYSIS
Software requirements specifications – Structured tools for Software development – Structured analysis.

UNIT III SOFTWARE COST ESTIMATION
Planning a Software project – Cost Estimation and models – Software configuration management plans – Project monitoring plans.

UNIT IV SOFTWARE DESIGN

UNIT V SOFTWARE TESTING

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to
CO1. Practice the various software modeling tools and techniques.
CO2. Study the various performance measurement tools and techniques.
CO3. Estimate time and cost of projects.
CO4. Select appropriate monitoring plan.
CO5. Study the importance of software design and software testing.

REFERENCES:
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COURSE OBJECTIVES:
1. Relate product development integrated with value engineering.
2. Summarize the development of new products through conceptualization, design and development phases.
3. Relate various aspects of product development with industrial design and manufacturing.
4. Describe the value of a product using tools and techniques.
5. Design products which are suitable for the needs of the society.

UNIT I VALUE ENGINEERING BASICS
Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity in Value Engineering.

UNIT II VALUE ENGINEERING JOB PLAN AND PROCESS
Seven phases of job plan, Functional Analysis and System Technique - Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

UNIT III IDENTIFYING CUSTOMER NEEDS AND PRODUCT SPECIFICATIONS

UNIT IV CONCEPT GENERATION, SELECTION AND PRODUCT ARCHITECTURE
The activities of concept generation, Clarify the problem – Search internally – Search externally – Explore systematically. Concept Screening – Concept scoring-Concept testing. Product architecture – Implication of architecture –Establishing the architecture – Related system level design issues. Design for Manufacture, Assembly, Maintenance and Environment

UNIT V INDUSTRIAL DESIGN, PROTOTYPING AND ECONOMICS
Need for industrial design – Impact of industrial design – Industrial design process – Management of industrial design process – Assessing the quality of industrial design. Prototyping: Prototyping basics, principles of prototyping, technologies, planning for prototypes. Product development economics: Elements of economic analysis, sensitive analysis

TOTAL: 45 PERIODS

COURSE OUTCOMES:
The students will be able to
CO1. Understand the basic concept of product development.
CO2. Design and develop new products in a systematic manner considering the concept of value engineering.
CO3. Understand customer requirements.
CO4. Understand product architecture.
CO5. Gain knowledge and create the prototype models.
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COURSE OBJECTIVES:
1. To understand the concepts of supervised and unsupervised learning.
2. To analyze models such as support vector machines, kernel SVM, Naïve Bayes, decision tree classifier, random forest classifier, logistic regression, K-means clustering.
3. To implement and work with state-of-art tools in machine learning.

UNIT I INTRODUCTION TO MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE 9

UNIT II MODELLING, EVALUATION AND FEATURE ENGINEERING 9

UNIT III BAYESIAN METHODS 9
Bayesian Concept Learning: Introduction, Importance, Bayes’ Theorem and Concept Learning, Brute-force Bayesian algorithm, Concept of consistent learners, Bayes optimal classifier, Naïve Bayes classifier, Applications of Naïve Bayes classifier, Handling Continuous Numeric Features in Naïve Bayes Classifier, Bayesian Belief Network, Independence and conditional independence, Use of the Bayesian Belief network in machine learning.

UNIT IV SUPERVISED LEARNING- CLASSIFICATION AND REGRESSION 9
Classification- Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms, k-Nearest Neighbour (KNN), Decision tree, Random forest model, Support vector machines. Regression-Introduction, Example of Regression, Common Regression Algorithms, Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

UNIT V UNSUPERVISED LEARNING 9

TOTAL: 45 PERIODS
COURSE OUTCOMES:
The students will be able to

CO1. Explore and apply the fundamentals of machine learning techniques.
CO2. Understand different techniques of data pre processing.
CO3. Analyze the strength and weakness of different machine learning models to solve real world problems.
CO4. Implement and apply different supervised and unsupervised machine learning algorithms.

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