ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
M.E. INDUSTRIAL ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. Prepare students to get competency in creating, implementing, improving and managing the financially viable/sustainable integrated socio-technical systems.

II. Prepare students to acquire necessary skills and knowledge to understand and formulate real world problems in the Industrial Engineering domain and can apply problem-solving skills to obtain valid realistic solutions.

III. Prepare students to build and lead cross-functional teams, demonstrate professional leadership upholding ethical values.

IV. Prepare students to pursue research and engage themselves in life-long learning and growth in the field of Industrial Engineering with professional and ethical responsibility in the context of technological changes.

PROGRAMME OUTCOMES (POs):

On successful completion of the programme, the students will exhibit ability to:

1. apply knowledge of mathematics, science, and engineering.

2. design and improve integrated systems of people, materials, information, facilities, and technology.

3. identify, formulate, and solve industrial engineering problems.

4. design and conduct experiments, as well as analyse and interpret data.

5. function as a member of a multi-disciplinary team.

6. understand and respect professional and ethical responsibility.

7. communicate effectively both orally and in writing.

8. understand the impact of engineering solutions in a global and societal context.

9. recognize the need for, and an ability to engage in life-long learning.

10. have a knowledge of contemporary issues.

11. use updated techniques, skills and tools of industrial engineering throughout their professional careers.
Mapping of PEOs with POs

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EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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OBJECTIVE:
- To impart knowledge in the areas of production planning and control applicable to various types of manufacturing systems.

UNIT I INTRODUCTION:

UNIT II FORECASTING:
Need for forecasting, the forecasting process, Forecasting methods- qualitative methods, Quantitative models-Time series forecasting models, moving averages, exponential smoothing with trend and seasonal adjustment, multi-item forecasting, Simple and multiple linear regression models, monitoring and controlling forecasts.

UNIT III INVENTORY MANAGEMENT:
Types of inventory, Inventory classification methods, Inventory costs Inventory models- deterministic models, probabilistic models - safety stock and reorder points – Inventory control systems.

UNIT IV PLANNING ACTIVITIES:
Capacity planning- short term and long term capacity, capacity of facilities, break even capacity, use of decision trees, aggregate production planning - strategies, methods, Master Production Schedule, MRP- lot sizing, MRP II, CRP, ERP.

UNIT V PRODUCTION CONTROL ACTIVITIES:
Production Activity Control, Just-in-time systems, Scheduling in Manufacturing, Theory of constraints and synchronous manufacturing.

OUTCOMES
- Upon completion of this course, the students will be able to demonstrate the knowledge in fundamental concepts and issues of operations management in creating and enhancing a firm’s competitive advantages.

REFERENCES:

OBJECTIVE:
- To impart knowledge in the area of Method study and Time study so that students can implement these principles and techniques to improve productivity in manufacturing and Service sectors.
UNIT I  METHOD STUDY  9
Work design and Productivity – Productivity measurement - Total work content, Developing methods – operation analysis, motion & micro motion study, graphic tools.

UNIT II  WORK MEASUREMENT  9
Stop watch time study, Performance rating, allowances, standard data-machining times for basic operations, learning effect

UNIT III  APPLIED WORK MEASUREMENT  9
Methods time measurement (MTM), Work sampling, organization and methods (O & M), Wage incentive plans.

UNIT IV  PHYSICAL ERGONOMICS  9
Physical work load and energy expenditure, Anthropometry – measures – design procedure, Work postures-sitting, standing - measurement – ergonomic implications. Design of displays and controls,

UNIT V  ENVIRONMENTAL FACTORS  9

TOTAL: 45 PERIODS

OUTCOMES:
• The Students should be able to measure productivity of a work system through work system design and apply various above mentioned techniques.

REFERENCES:
3. Introduction to work study, ILO, 3rd edition, Oxford & IBH publishing,2001

IL 7151  FACILITIES DESIGN  L T P C
3 0 0 3

OBJECTIVE:
• To explain the basic principles in facilities planning, location, layout designs and materials Handling systems

UNIT I  PLANT LOCATION  9
Plant location analysis – factors, costs, location decisions – single facility location models, multi facility location models- set covering problem – warehouse location problems.

UNIT II  FACILITIES LAYOUT  9
Facilities requirement, need for layout study – types of layout, Designing product layout. Legal aspects in Layout design.
UNIT III  LAYOUT DESIGN  9  
Design cycle – SLP procedure, computerized layout planning procedure – ALDEP, CORELAP, CRAFT

UNIT IV  GROUP TECHNOLOGY AND LINE BALANCING  9  
Group technology – Production Flow analysis (PFA), ROC (Rank Order Clustering) – Line balancing.

UNIT V  MATERIALS HANDLING  9  
Principles, unit load concept, material handling system design, handling equipment types, selection and specification, containers and packaging.

TOTAL: 45 PERIODS

OUTCOMES:  
• Students must analyse, design and apply layout principles for layout product, material handling and packaging.

REFERENCES  

IL 7152  OPERATIONS RESEARCH  L T P C  4 0 0 4

OBJECTIVE:  
• To learn the basics of deterministic optimization tools.

UNIT I  INTRODUCTION-LP  9  
Concepts of OR, development, applications, LP Definitions, assumptions, formulation, graphical method, Simplex algorithm.

UNIT II  LP-EXTENSIONS  9  
Duality- primal dual relationships -Dual Simplex — sensitivity analysis, Data Envelopment Analysis.

UNIT III  NETWORKS  9  
Transportation, Assignment, Maximal flow, Shortest route, Spanning tree problems, Project Net Works.

UNIT IV  DYNAMIC PROGRAMMING  9  
Dynamic Programming-Concepts, formulation, recursive approach; applications

UNIT V  WAITNG LINES AND GAME THEORY  9  
Queuing characteristics and terminology, Poisson and non-Poisson models. Introduction to Game Theory

TOTAL: 60 PERIODS
OUTCOME:
- The students can solve optimization problems of deterministic nature

REFERENCES:

MA7159 PROBABILITY AND STATISTICAL METHODS

OBJECTIVE:
- To introduce the basic concepts of one dimensional and two dimensional Random Variables.
- To provide information about Estimation theory, Correlation, Regression and Testing of hypothesis.
- To enable the students to use the concepts of multivariate normal distribution and principal components analysis.

UNIT I ONE DIMENSIONAL RANDOM VARIABLES 12
Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12
Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY: 12

UNIT IV TESTING OF HYPOTHESES: 12
Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V MULTIVARIATE ANALYSIS: 12

TOTAL: 60 PERIODS

OUTCOMES:
- The course aims at providing the basic concepts of Probability and Statistical techniques for solving mathematical problems which will be useful in solving Engineering problems.
TEXTBOOKS:

REFERENCES:

IL7111 WORK DESIGN AND ERGONOMICS LAB

OBJECTIVES:
- To understand the theory better and apply in practice, practical training is given in the following areas:

LIST OF EXPERIMENTS
1. Graphic tools for method study
2. Performance rating exercise
3. Stop watch time study
4. Peg board experiment
5. Work sampling
6. MTM practice
7. Study of physical performance using tread mill and Ergo cycle
8. Physical fitness testing of individuals
9. Experiments using sound level and lux meters
10. Experiments using Ergonomics software

TOTAL: 30 PERIODS

LABORATORY EQUIPMENTS REQUIREMENTS
1. Time study Trainer
2. Peg board
3. Stop watches
4. Tread mill
5. Ergo cycle
6. Any one Ergonomics software (Eg.: Ergomaster, Human CAD)

OUTCOMES:
- Students should able to design, analyse and apply the above mentioned techniques to measure productivity
IL7201 LOGISTICS AND SUPPLY CHAIN MANAGEMENT  L  T  P  C
3  0  0  3

OBJECTIVE:

- To impart the fundamental knowledge in logistics and supply chain management.

UNIT I INTRODUCTION  9

UNIT II LOGISTICS MANAGEMENT  9

UNIT III SUPPLY CHAIN NETWORK DESIGN  9
Distribution in Supply Chain – Factors in Distribution network design –Design options-Network Design in Supply Chain – Framework for network Decisions

UNIT IV SOURCING AND REVENUE MANAGEMENT IN SUPPLY CHAIN  9
Supplier selection and Contracts - Design collaboration - Procurement process. Revenue management in supply chain

UNIT V COORDINATION AND INFORMATION TECHNOLOGY IN SUPPLY CHAIN  9
Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work- E Business and SCM. Metrics for SC performance – Case Analysis

TOTAL: 45 PERIODS

OUTCOMES:

- The students should apply information, demand forecasting, inventory management, transportation, warehousing & distribution, protective packaging, order processing, material handling, purchasing & sourcing management techniques to manufacturing systems

REFERENCES:
4. David J.Bloomberg, Stephen Lemay and Joe B.Hanna, Logistics, PHI 2010
OBJECTIVES:
- To introduce the students different models used to describe the manufacturing systems and use of them for effective operations of manufacturing industries

UNIT I INTRODUCTION
Manufacturing systems – types and concepts, manufacturing automation - Performance measures – types and uses of manufacturing models.

UNIT II FOCUSSED FACTORIES
GT/CMS, FMS planning, design and control. Process planning – variant and generative approaches of CAPP, general serial systems – analysis of paced and unplaced lines.

UNIT III LEAN SYSTEMS
Characteristics of Lean systems for services and Manufacturing, Pull method of work flow, Small lot sizes, Kanban system, Value stream mapping, JIT

UNIT IV QUEUING MODELS OF MANUFACTURING
Basic Queuing models, Queuing networks, application of queuing models for AMS.

UNIT V MARKOV AND PETRINET MODELS OF MANUFACTURING

TOTAL: 45 PERIODS

OUTCOMES:
- The Student must be able to apply the principles behind focused factory, Markov and Petrinet Models, Queuing models, lean system to model modern manufacturing systems

REFERENCES:

OBJECTIVE:
- To cover various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer
UNIT I  INTRODUCTION  3
Systems, modeling, general systems theory, concept of simulation, simulation as a decision making tool, types of simulation.

UNIT II  RANDOM NUMBERS AND VARIATES  5
Pseudo random numbers, methods of generating random variates, testing of random numbers and variates.

UNIT III  DESIGN OF SIMULATION EXPERIMENTS  8
Problem formulation, data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation.

UNIT IV  SIMULATION LANGUAGES  14
Comparison and selection of simulation languages, study of any one simulation language.

UNIT V  CASE STUDIES / MINI PROJECT  15
Development of simulation models using the simulation language studied for systems like, queuing systems, production systems, inventory systems, maintenance and replacement systems, investment analysis and network.

TOTAL: 45 PERIODS

OUTCOMES:
• Will be able to analyse, models and simulate experiments to meet real world system and evaluate the performance.

REFERENCES:

QE7253  STATISTICAL QUALITY CONTROL  L T P C  3 0 0 3

OBJECTIVES:
• To facilitate the students in knowing the application of statistical techniques in Quality control and assurance.

UNIT I  INTRODUCTION  7

UNIT II  CONTROL CHARTS  12
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 8
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 8
Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

UNIT V ACCEPTANCE SAMPLING 10
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

OUTCOMES:
- Control the quality of processes using control charts for variables in manufacturing industries.
- Control the occurrence of defective product and the defects in manufacturing companies.
- Control the occurrence of defects in services.

REFERENCES:
4. IS 2500 Standard sampling plans

IL 7211 COMPUTER APPLICATIONS LAB L T P C 0 0 4 2

OBJECTIVES:
- To understand the theory better and apply in practice, practical training is given in the following areas.

UNIT I 12
Development of Simple Programs for Statistical analysis: Frequency distribution, Applications of Graphics. (Charts, Graphs etc).

UNIT II 12
Programs for OR applications like Initial solution of Transportation Problems, Net Works etc

UNIT III 12
Solving optimization problems using software packages like LINDO, LINGO, TORA. Excel Solver.

UNIT IV 12
Development of Random number generator, Testing of random number generator. Non-uniform Random varieties generation and testing. Single server Queueing simulation, Case Studies
UNIT V  
Program for Simulation of Single server Queuing System – Use of Simulation software. Case studies.  

TOTAL: 60 PERIODS

LABORATORY EQUIPMENTS REQUIREMENTS

1. TURBO C++ Software
2. LINDO Software
3. LINGO Software
4. TORA Software
5. GPSS Software
6. MS EXCEL

OUTCOMES:
- Due to the practical exposure, to the theoretical knowledge gained earlier, the students are capable of selecting the right tool to solve optimization problems.

IL 7301 ROBUST DESIGN  

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

UNIT I EXPERIMENTAL DESIGN FUNDAMENTALS  
Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression models.

UNIT II SINGLE FACTOR EXPERIMENTS  
Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests.

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.

UNIT IV SPECIAL EXPERIMENTAL DESIGNS:  
Blocking and confounding in 2^K designs. Two level Fractional factorial design, nested designs, Split plot design, Response Surface Methods.

UNIT V 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.

TOTAL: 60 PERIODS
OUTCOMES:
- Able to apply experimental techniques to practical problems to improve quality of processes / products by optimizing the process / product parameters.

REFERENCES

IL7311 TECHNICAL SEMINAR
OBJECTIVES:
- To enhance the students in the technical writing and communication.

OUTCOMES:
- This will help the students to get confidence in facing interview process and enhance employment opportunity.

IL 7312 PROJECT WORK PHASE I
OBJECTIVES:
- To apply the principles or techniques the students have learnt to a new or existing problem situations leading to a solutions.

OUTCOMES:
- This will help the students in real time problem identification, critical examination, solution development and presentation of results in the form of report.

IL7411 PROJECT WORK PHASE II
OBJECTIVES:
- To apply the principles or techniques the students have learnt to a new or existing problem situations leading to a solutions.
OUTCOMES:
- This will help the students in real time problem identification, critical examination, solution development and presentation of results in the form of report.

IL 7001 ADVANCED OPTIMIZATION TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:
- Understand the nonlinear problem.
- Know about multi-objective problem.
- To create awareness of meta heuristic algorithms

UNIT I INTRODUCTION 5
Classification of optimization problems, concepts of design vector, Design constraints, constrains surface, objective function surface and multi-level optimization, parametric linear programming

UNIT II DECISION ANALYSIS 10
Decision Trees, Utility theory, Game theory, Multi Objective Optimization, MCDM- Goal Programming, Analytic Hierarchy process, ANP

UNIT III NON-LINEAR OPTIMIZATION 15
Unconstrained one variable and multi variable optimization, KKT Conditions, Constrained optimization, Quadratic programming, Convex programming, Separable programming, Geometric programming, Non-Convex programming

UNIT IV COMPLEXITY OF ALGORITHMS 5
Classes P and NP, Polynomial time reductions, Introduction to NP- Hard problems,

UNIT V NON-TRADITIONAL OPTIMIZATION 10

TOTAL: 45 PERIODS

OUTCOMES:
- The students will gain familiarity with some of the well-known optimization techniques and their applicability in a real setting.
- The students will gain awareness on the usefulness and limitation of optimization.

REFERENCES:
OBJECTIVES:
- To learn the basic concepts in design and analysis of algorithms.

UNIT I  INTRODUCTION:  
Algorithms, basic steps in development.

UNIT II  REVIEW OF THE STRUCTURED LANGUAGES  
C++ Basics, Expression, operators, control statements, structures, multi-dimensional array, functions, arguments, overload function.

UNIT III  BASIC TOOLS:  
Top down, Structured programming, networks, data structure.

UNIT IV  METHODS OF DESIGN:  
Sub goals, hill climbing and working backward, heuristics, back track programming, Branch and bound recursion process, program testing, documentation, Meta heuristics.

UNIT V  APPLICATION:  
Development of sorting, searching, algorithms- combinatorial problems, shortest path, probabilistic algorithms.

TOTAL: 45 PERIODS

OUTCOMES:
- The students will get the skills to design and develop algorithms for solving industrial engineering related problems.

REFERENCES:

OBJECTIVES:
- To explain the general principles that govern the interaction of human and their working environment for improving worker performance and safety.

UNIT I  PHYSIOLOGICAL PERFORMANCE  
Factors affecting physiological performance, physical work load and energy expenditure, heat stress, manual lifting, shift work
UNIT II WORK SPACE DESIGN
Anthropometry, Workspace designs for standing and seated workers, arrangement of components within a physical space, interpersonal aspect of workplace design.

UNIT III DESIGN OF EQUIPMENT
Ergonomic factors to be considered in the design of displays and control, design for maintainability, design of human computer interaction.

UNIT IV COGNITIVE ERGONOMICS
Information Theory, Information processing, signal detection theory, Human response, human errors, cognitive task analysis.

UNIT V DESIGN OF ENVIRONMENT
Vision and Illumination design – Noise and Vibration

TOTAL: 45 PERIODS

OUTCOMES:
- The students will get knowledge on human factor issues in the design of workplace layout.

REFERENCES:

IL 7004 KNOWLEDGE ENGINEERING AND MANAGEMENT

OBJECTIVES:
- To study and understand the concept of knowledge models, management and its implementations.

UNIT I INTRODUCTION

UNIT II KNOWLEDGE MODELS

UNIT III TECHNIQUES OF KNOWLEDGE MANAGEMENT
Knowledge Elicitation Techniques – Modeling Communication Aspects – Knowledge Management and Organizational Learning.

UNIT IV KNOWLEDGE SYSTEM IMPLEMENTATION
UNIT V  ADVANCED KNOWLEDGE MANAGEMENT

TOTAL: 45 PERIODS

OUTCOMES:
- The students will be able to use Knowledge Models for System Implementation Advanced Knowledge Modeling to apply in real world.

REFERENCES:

IL 7005  MAINTAINABILITY ENGINEERING

OBJECTIVE:
- To provide maintenance concepts and maintenance policies with maintenance management tools and techniques.

UNIT I  MAINTENANCE CONCEPT

UNIT II  MAINTENANCE MODELS

UNIT III  MAINTENANCE LOGISTICS
Human factors – Maintenance staffing: Learning curves – Simulation – Maintenance resource requirements: Optimal size of service facility – Optimal repair effort – Maintenance planning and scheduling – Spare parts planning...

UNIT IV  MAINTENANCE QUALITY

UNIT V  TOTAL PRODUCTIVE MAINTENANCE
TPM features – Chronic and sporadic losses – Equipment defects – Six major losses – Overall Equipment Effectiveness – TPM pillars – Autonomous maintenance – TPM implementation

TOTAL: 45 PERIODS

OUTCOMES:
- The students would gain knowledge on maintenance logistics, fault diagnosis and TPM.
REFERENCES:

IL 7006 MANUFACTURING AUTOMATION L T P C
3 0 0 3

OBJECTIVES:
- This course introduces the fundamental concepts and elements of computer-integrated manufacturing.
- The course exposes students to various aspects of automated manufacturing such as fixed automation and programmable automation.

UNIT I AUTOMATION
Types of production – Functions – Automation strategies – Production economics – Costs in manufacturing – Break-even analysis.

UNIT II AUTOMATED FLOW LINES
Transfer mechanism - Buffer storage – Analysis of transfer lines - Automated assembly systems.

UNIT III NUMERICAL CONTROL AND ROBOTICS

UNIT IV AUTOMATED HANDLING AND STORAGE
Automated material handling systems – AGV- AS/RS – carousel storage – Automatic data capture – bar code technology- RFID

UNIT V MANUFACTURING SUPPORT SYSTEMS
Product design and CAD, CAD/CAM and CIM, Computer aided process planning- variant and generative approaches, Concurrent engineering and design for manufacture, Lean production, Agile manufacturing.

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to
- Select automated equipment based on break-even quantity and compute cost per component.
- Analyze an automated flow line without and with buffer for its performance measures.
- Identify the elements of manufacturing automation; these include CNC, Robotics, automated assembly and material handling.
- Understand manufacturing planning and control systems.

REFERENCES:

IL7007 SCHEDULING ALGORITHMS

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OBJECTIVE:
- To impart knowledge on various scheduling algorithms applicable to single machine, parallel machines, flow shop and job shop models.

UNIT I SCHEDULING THEORY
- Scheduling background
- Scheduling function
- Sequencing
- Ready time
- Flow time
- Tardiness
- Weighted flow time
- Inventory
- Regular measures of performance
- Dominant schedules
- SPT, EDD, WSPT sequences
- Scheduling Theorems.

UNIT II SINGLE MACHINE SCHEDULING
- Pure sequencing model
- Hodgson’s algorithm
- Smith’s rule
- Wilkerson Irwin algorithm
- Neighborhood search
- Dynamic programming technique
- Branch and Bound algorithm
- Non simultaneous arrivals
- Minimizing \( T \) and \( F \) for dependent jobs
- Sequence dependent set up times.

UNIT III PARALLEL MACHINE SCHEDULING
- Preemptive jobs: McNaughton’s algorithm
- Non preemptive jobs: Heuristic procedures
- Minimizing \( w \_F \): \( H_1 \) & \( H_m \) heuristics
- Dependent jobs
- Hu’s algorithm
- Muntz Coffman algorithm.

UNIT IV FLOW SHOP SCHEDULING
- Characteristics
- Johnson’s algorithm
- Extension of Johnson’s rule
- Campbell Dudek Smith algorithm
- Palmer’s method
- Start lag
- Stop lag
- Mitten’s algorithm
- Ignall Schrage algorithm
- Despatch index heuristic.

UNIT V JOB SHOP SCHEDULING
- Characteristics
- Graphical tools
- Jackson’s algorithm
- Feasible, Semi-active and Active schedules
- Single pass approach
- Non delay schedule
- Priority dispatching rules
- Heuristic schedule generation
- Open shop scheduling.

TOTAL: 45 PERIODS

OUTCOMES:
- Students will be able to design, analyse and implement single machine, parallel machine, flowshop, and job shop scheduling algorithms.

REFERENCE:
OBJECTIVES:

- This course is intended to introduce the student to the systems engineering process used to create multidisciplinary solutions to complex problems.

UNIT I SYSTEMS SCIENCE CONCEPTS 9

UNIT II SYSTEMS ENGINEERING PROCESSES 9

UNIT III ANALYSIS OF ALTERNATIVES 9
Uncertain/ Imperfect information; Cross-impact analysis, Hierarchical inference, logical reasoning inference; Structural modeling; System Dynamics.

UNIT IV INTERPRETATION OF ALTERNATIVES AND DECISION MAKING 9
Types of decisions – descriptive, prescriptive, normative; Decision assessment efforts types – under certainty, probabilistic uncertainty, probabilistic imprecision, information imperfection, conflict and cooperation; Prescriptive normative decision assessments; Utility theory; Group decision making, Game Theory.

UNIT V SYSTEMS ENGINEERING MANAGEMENT CONCEPTS 9
Organizational structures, SE management plan; Network based systems planning and management methods; Cognitive factors in SE.

TOTAL: 45 PERIODS

OUTCOMES:

- This course will enable the students to better understand the functions, capabilities and limitations of systems engineering in the context of large developmental programs.

REFERENCES:

OBJECTIVES:

- To teach the basic concepts of object oriented programming.
UNIT I FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING 5
Elements of OOP, classes, subjects, messaging, inheritance, polymorphism, OOP paradigm versus procedural paradigm, object-oriented design.

UNIT II C++ Basics 15
Expression and statements, operators, precedence, type conversion, control statements, loops, Arrays structures, functions, argument passing, reference argument, overloaded function.

UNIT III C++ CLASS 5
Definition, class objects, member functions, class argument, operator overloading, user defined conversions.

UNIT IV CLASS DERIVATION 10
Derivation specification, public and private base classes, standard conversions under derivation, class scope, initialization and assignment under derivation.

UNIT V APPLICATION 10
OOP’s applications in Industrial Engineering.

TOTAL: 45 PERIODS

OUTCOMES:
- The students will acquire exposure in logical thinking and programming skills in solving real time problems.

REFERENCES

IL7072 BUSINESS EXCELLENCE MODELS L T P C 3 0 0 3

OBJECTIVES:
- To make the students to understand the business excellence models, which are applied in all aspects of business like manufacturing, software(IT) as well as service industry oriented organization like health centre, hospitality, etc.

UNIT I BUSINESS EXCELLENCE MODELS 8
Business Excellence Concepts – Need for BE models – Pioneers in the model MBNQA, EFQM and DEMING award

UNIT II MBNQA 12
Criteria :: LEADERSHIP, Strategic planning, Customer and Market focus, Measurement analysis and Knowledge Management, Human resource focus, process management, business results

UNIT III BUSINESS EXCELLENCE AWARDS IN INDIA 7
Models in Business excellence: RBNQA CII EXIM Award, Tata BE Model etc
UNIT IV IMPLEMENTING BUSINESS EXCELLENCE MODEL 10
Basic concepts – Training -Report writing – Internal audit-Report submission – Initial assessment -Site visit – Scoring – Criteria for Award, Award finalization

UNIT V CASE STUDY/mini projects 8
Development of business excellence model for industrial application in production systems, inventory systems, maintenance and replacement systems, supply chain management etc.

TOTAL: 45 PERIODS

OUTCOMES:
• After studying this subject, the students will get a clear idea about the business excellence models applied in the industries.

TEXT BOOK:

REFERENCES:
http://www.baldrige.nist.gov
http://www.baldrige21.com/
www.imc.org
www.qimpro.com
www.imcrbnqa.com
www.efqm.org
www.juse.or.jp/e/deming/index.html

IL7073 CELLULAR MANUFACTURING SYSTEMS 3 0 0 3

OBJECTIVE:
• To impart knowledge on planning, design, implementation, and control of group technology and cellular manufacturing.

UNIT I INTRODUCTION 8

UNIT II CMS PLANNING AND DESIGN 10
Problems in GT/CMS - Design of CMS – Production Flow Analysis, Optimization Models, traditional approaches and non-traditional approaches- Simulated Annealing, Genetic Algorithms,

UNIT III IMPLEMENTATION OF GT/CMS 10
Inter and intra cell layout and capacity planning. Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS. Linkages to JIT systems

Attended
S. Balaji
DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025
UNIT IV PERFORMANCE MEASUREMENT AND CONTROL


UNIT V ECONOMIC OF GT/CMS


TOTAL: 45 PERIODS

OUTCOME:

- The students should apply the various tools, techniques and methodology used in planning, design, implementation and control of group technology and cellular manufacturing.

REFERENCES:


IL7074 DATA ANALYSIS TECHNIQUES

OBJECTIVES:

- To introduce basic statistical and multivariate methods.

UNIT I STATISTICAL DATA ANALYSIS


UNIT II BASIC CONCEPTS

Introduction – Basic concepts – Uni-variate, Bi-variate and Multi-variate techniques – Types of multivariate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation – Approaches to multivariate model building.

UNIT III REGRESSION AND FACTOR ANALYSIS

Simple and Multiple Linear Regression Analysis – Introduction – Basic concepts – Multiple linear regression model – Least square estimation – Inferences from the estimated regression function – Validation of the model.
Canonical Correlation Analysis - Objectives – Canonical variates and canonical correlation – Interpretation of variates and correlations.

UNIT IV DISCRIMINANT AND CLUSTER ANALYSIS

Discriminant Analysis - Basic concepts – Separation and classification of two populations - Evaluating classification functions – Validation of the model.
Cluster Analysis – Definitions – Objectives – Similarity of measures – Hierarchical and Non Hierarchical clustering methods – Interpretation and validation of the model.
UNIT V ADVANCED TECHNIQUES
Multi Dimensional Scaling – Definitions – Objectives – Basic concepts – Scaling techniques – Attribute and Non-Attributes based MDS Techniques – Interpretation and Validation of models.
Advanced Techniques – Structural Equation modeling

TOTAL: 45 PERIODS

OUTCOMES:
• The students will gain knowledge on statistical data analysis and interpretation which help in effective decision making.

REFERENCES

IL7075 DECISION SUPPORT SYSTEMS

OBJECTIVE:
• To impart knowledge on basics of DSS and Knowledge based systems.

UNIT I DECISION MAKING
Managerial decision making, system modeling and support-preview of the modeling process-phases of decision making process.

UNIT II MODELING AND ANALYSIS
DSS components- Data warehousing, access, analysis, mining and visualization-modeling and analysis-DSS development.

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

UNIT IV INTELLIGENT SYSTEMS
Artificial intelligence and expert systems-concepts, structure, types-knowledge acquisition and validation, knowledge representation

UNIT V IMPLEMENTATION
Implementation, integration and impact of management support systems.

TOTAL: 45 PERIODS
OUTCOMES:
- The students will be able to make decisions in the semi structured and unstructured problem situations using systems and semantic networks.

REFERENCES:

OUTCOMES:
- Students will become familiar with principles of micro economics and cost estimation.
- They will be able to apply these principles to appreciate the functioning of product and input market as well as the economy.

REFERENCES:
4. Jawaharlal, Cost Accounting, Tata McGraw Hill,

IL7077 INDUSTRIAL SAFETY AND HYGIENE L T P C
3 0 0 3

OBJECTIVES:
- To impart knowledge on fundamentals of safety engg. and hygiene.

UNIT I OPERATIONAL SAFETY 9

UNIT II SAFETY APPRAISAL AND ANALYSIS 9

UNIT III OCCUPATIONAL HEALTH 9
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 IV SAFETY AND HEALTH REGULATIONS 9

UNIT V SAFETY MANAGEMENT 9

TOTAL: 45 PERIODS
OUTCOMES:
- The students will get awareness on safety appraisal, analysis techniques, regulations and issues in occupational health and safety manager practices in industries.

TEXTBOOKS:

REFERENCES:
1. Occupational Safety Manual BHEL.
2. Industrial Safety and the law by P.M.C Nair Publishers, Trivandrum.

IL 7078 LEAN MANUFACTURING AND SIX SIGMA L T P C
3 0 0 3

OBJECTIVES:
- To make the students acquire basic knowledge in lean and six sigma and make them understand the various phases involved in the implementations.

UNIT I INTRODUCTION TO LEAN MANUFACTURING AND SIX SIGMA
Introduction to Lean- Definition, Purpose, features of Lean, top seven wastes, Need for Lean, Elements of Lean Manufacturing, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six sigma, origin of six sigma, six sigma concept, critical success factors for six sigma.

UNIT II INTEGRATION AND INITIATION FOR LEAN SIX SIGMA
The Evolution, synergy of Lean and six sigma, Definition of lean six sigma, the principles, Scope and features of lean six sigma. The laws of lean six sigma, key elements of LSS, The LSS model and the Benefits of lean six sigma. Initiation – Top management commitment, Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition and Infrastructure tools. Structure of transforming event and Launch preparation

UNIT III RESOURCE PROJECT SELECTION AND TEAM BUILDING
Resource and project selection, Selection of Black belts, Training of black belts and champions, Identification of potential projects, top down (Balanced score card) and bottom up approach –Methods of selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Predicting and improving team performance, Nine team roles and Team leadership.
UNIT IV THE DMAIC PROCESS AND TOOLS
The DMAIC Process – Toll gate reviews; The DMAIC tools; Define tools – project definition form, SIPOC Diagram. Measure tools – process mapping, lead time/Cycle time, pareto chart, cause & effect matrix, FMEA, IDEA – generating and organizing tools – Brain storming, Nominal Group technique, Multivoting; Cause & effect diagram, Data collection and accuracy tools; check sheet, Gauge R&R; Understanding and eliminating variation – Run charts, control charts, process capability analysis. Analyze tools – scatter plots, ANOVA, Regression analysis, time trap analysis. Improve tools – Mistake proofing, kaizen, Reducing congestion and delay, pooling, triaging, backup capacity, setup time reduction (SMED), TPM, DOE and the pull system. Control tools – Statistical process control.

UNIT V INSTITUTIONALIZING AND DESIGN FOR LSS
Institutionalizing lean six sigma – Improving Design velocity, creating cycle time base line, Valuing projects, gating the projects, reducing product line complexity, design for lean six sigma, Quality function deployment, theory of inventive problem solving (TRIZ), Robust Design – case study presentations.

OUTCOMES:
• To develop a comprehensive set of skills that will allow students to function effectively by using lean techniques and six sigma for quantitative analysis.

REFERENCES:
5. Rother M. and hook J., Learning to See: Value Stream Mapping to add value and Eliminate Muda, Lean Enterprise Institute, Brookline, MA

IL7079 LOGISTICS AND DISTRIBUTION MANAGEMENT  L T P C
3 0 0 3

OBJECTIVES:
• To gain understanding on principles and activities of logistics and Distribution Management.

UNIT I CONCEPTS OF LOGISTICS AND DISTRIBUTION
Introduction to logistics and distribution- Integrated logistics and the supply chain- Integrated logistics and the supply chain- Customer service and logistics- Channels of distribution - Key issues and challenges for logistics.

UNIT II PLANNING FOR LOGISTICS
Planning framework for logistics -Logistics processes -Supply chain segmentation- Logistics network planning - Logistics management and organization - Manufacturing and materials management

UNIT III WAREHOUSING AND STORAGE
Principles of warehousing Storage and handling systems (palletized and non-palletized) - Order picking and replenishment- Receiving and dispatch - Warehouse design- Warehouse management and information
UNIT IV FREIGHT TRANSPORT
International logistics: modal choice - Maritime transport - Air transport - Rail and intermodal transport - Road freight transport: vehicle selection, vehicle costing and planning and resourcing - International transportation systems in Global perspective.

UNIT V OPERATIONAL MANAGEMENT
Cost and performance monitoring - Benchmarking - Information and communication technology in supply chain - Outsourcing: services and decision criteria, the selection process - Outsourcing management - Security and safety in distribution - Logistics and the environment.

TOTAL : 45 PERIODS

OUTCOMES:
- The students will gain knowledge on importance of logistics and distribution and various activities performed including Warehousing, transportation and operations management.

REFERENCES:

IL7080 MANAGEMENT ACCOUNTING AND FINANCIAL MANAGEMENT

OBJECTIVE:
- To enable students to understand the accounting procedure, interpretation of financial accounting with cost account.

UNIT I FINANCIAL ACCOUNTING

UNIT II COST ACCOUNTING

UNIT III BUDGETING
Requirements for a sound budget, Fixed budget – Preparation of sales and Production budget, Flexible budgets, Zero base budgeting and budgetary control.

UNIT IV FINANCIAL MANAGEMENT
Investment decisions – Capital investment process, Type of investment proposals, Investment appraisal techniques – Payback period method, Accounting rate of return, Net present value method, Internal rate of return and Profitability index method.
UNIT V  FINANCIAL DECISIONS
Cost of capital – Capital structure – Dividend policy – Leasing.

OUTCOMES:
- To possess the principles and techniques of accounting and managing finance in an organization

REFERENCES

IL7081  MULTI VARIATE DATA ANALYSIS

OBJECTIVE:
- To impart knowledge on the applications of multivariate statistical analysis

UNIT I  REGRESSION
Simple Regression and Correlation – Estimation using the regression line, Correlation analysis, Multiple regression and Correlation analysis – Finding the Multiple Regression equation, Modelling techniques, Making inferences about the population parameters.

UNIT II  MULTIVARIATE METHODS
An overview of Multivariate methods, Multivariate Normal distribution, Eigen values and Eigen vectors.

UNIT III  FACTOR ANALYSIS

UNIT IV  DISCRIMINANT ANALYSIS
Discriminant analysis – Discrimination for two multivariate normal Populations – Discriminant functions.

UNIT V  CLUSTER ANALYSIS
Cluster analysis – Clustering methods, Multivariate analysis of Variance.

OUTCOMES:
- Can apply the multivariate, regression, factor, discriminent and cluster analysis techniques for statistical analysis.
REFERENCES

IL7082 PRODUCTIVITY MANAGEMENT AND RE ENGINEERING L T P C
3 0 0 3

OBJECTIVE:
- To introduce the basic principles of Productivity Models and the applications of Re-Engineering Concepts required for various organizations

UNIT I PRODUCTIVITY
Productivity Concepts – Macro and Micro factors of productivity – Dynamics of Productivity - Productivity Cycle Productivity Measurement at International, National and Organisation level - Productivity measurement models

UNIT II SYSTEMS APPROACH TO PRODUCTIVITY MEASUREMENT
Conceptual frame work, Management by Objectives (MBO), Performance Objectivated Productivity (POP) – Methodology and application to manufacturing and service sector.

UNIT III ORGANISATIONAL TRANSFORMATION
Elements of Organisational Transformation and Reengineering-Principles of organizational transformation and re-engineering, fundamentals of process re-engineering, preparing the workforce for transformation and re-engineering, methodology, guidelines, LMI CIP Model – DSMC Q & PMP model.

UNIT IV RE-ENGINEERING PROCESS IMPROVEMENT MODELS
PMI models, PASIM Model, Moen and Nolan Strategy for process improvement, LMICIP Model, NPRDC Model.

UNIT V RE-ENGINEERING TOOLS AND IMPLEMENTATION
Analytical and process tools and techniques – Information and Communication Technology – Implementation of Reengineering Projects – Success Factors and common implementation Problem – Cases.

TOTAL: 45 PERIODS

OUTCOMES:
The Student must be able to:
- Measure and evaluate productivity
- Plan and implement various productivity techniques.
- Reengineer the process for improving the productivity
- Implement BPR tools for improving the productivity.

REFERENCES:

IL 7083 PROJECT MANAGEMENT

OBJECTIVES:
- To outline the need for Project Management
- To highlight different techniques of activity planning

UNIT I STRATEGIC MANAGEMENT AND PROJECT SELECTION
Project selection models, Project portfolio process, Analysis under uncertainty, Project organization, Matrix organization

UNIT II PROJECT PLANNING
Work breakdown structure, Systems integration, Interface coordination, Project life cycle, Conflict and negotiation,

UNIT III PROJECT IMPLEMENTATION
Estimating Project Budgets, Process of cost estimation, Scheduling: Network Techniques PERT and CPM, Risk analysis using simulation, CPM- crashing a project, Resource loading, leveling, and allocation

UNIT IV MONITORING AND INFORMATION SYSTEMS
Information needs and the reporting process, computerized PMIS, Earned value analysis, Planning-Monitoring-Controlling cycle, Project control: types of control processes, design of control systems, control of change and scope

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

TOTAL: 45 PERIODS

OUTCOMES:
- To apply project management principles in business situations to optimize time and resource utilization

TEXTBOOKS
1. R.Panneer selvam.P. Senthil Kumar, Project Management, PHI,2010

REFERENCES:
OBJECTIVE:
- To impart knowledge in reliability concepts, reliability estimation methods and reliability improvement methods

UNIT I  RELIABILITY CONCEPTS

UNIT II  LIFE DATA ANALYSIS

UNIT III  RELIABILITY ASSESSMENT
Different configurations – Redundancy – k out of n system – Complex systems: RBD – Baye’s approach – Cut and tie sets – Fault Trees – Standby systems.

UNIT IV  RELIABILITY MONITORING

UNIT V  RELIABILITY IMPROVEMENT

OUTCOMES
- Students will be able to conduct reliability assessment and failure analysis on any complex systems.

REFERENCES:

OBJECTIVES:
- To increase students’ understanding of the nature and importance of the service sector in the economy.
- To increase students’ analytical abilities in solving problems that service manager’s face

UNIT I  INTRODUCTION TO SERVICES
Manufacturing and Services, Definition of Service, Characteristic of Service, Nature of Services, Importance of Activity, Impact of technology
## UNIT II  GLOBALIZATION AND STRATEGY
Types of Globalized Services, Outsourcing, issues in Globalization, Service strategies

## UNIT III  OPERATIONS ISSUES
Forecasting, Inventory, capacity Planning, Scheduling

## UNIT IV  SERVICE QUALITY AND PRODUCTIVITY
Importance of Quality, Models for Service Quality, GAPS model, issues in productivity measurement, Work measurement

## UNIT V  TOOLS FOR SERVICES
Data Envelopment Analysis, Queuing models, Vehicle Routing models

**TOTAL: 45 PERIODS**

### OUTCOMES:
- The students become effective decision maker in the management of a service organization.
- Students become aware of the environmental impacts and ethical issues involved in a service organization’s actions.

### REFERENCES:

### OBJECTIVES:
- To give a basic knowledge and system analysis, design and implementation.

### UNIT I  SYSTEMS ANALYSIS FUNDAMENTALS
Information systems analysis overview, Classification of information systems, Systems development life cycle, Role of systems analyst, and Role of case tools

### UNIT II  INFORMATION REQUIREMENT ANALYSIS
Sampling and investigating hard data, Interviewing, Using Questionnaires, Developing prototype, System requirements specification, Feasibility analysis

### UNIT III  ANALYSIS PROCESS
Data flow diagrams, Data dictionary, Process specifications, Presenting the systems proposal

### UNIT IV  ESSENTIALS OF DESIGN
Designing effective output, designing the database, designing the user interface, Designing data entry procedures
UNIT V SOFTWARE ENGINEERING AND IMPLEMENTATION 9
Quality assurance through software engineering, Implementation approaches, Implementing distributed systems, Object oriented systems analysis and design

TOTAL: 45 PERIODS

OUTCOMES:
- The students will be able to design and manage information system and to apply them for business organizations.

REFERENCES:

IL7087 TECHNOLOGY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:
- Study of this subject provides an understanding of the Technology Management principles to the various organizations.

UNIT I INTRODUCTION 9
Technology management - Scope, components, and overview. Technology and environment, Technology and society, Technology Impact analysis, environmental, social, legal, political aspects, techniques for analysis - steps involved. Technology policy strategy: Science and technology Policy of India, implications to industry, The dynamics of technology change

UNIT II TECHNOLOGY FORECASTING 9

UNIT III TECHNOLOGY CHOICE AND EVALUATION 9
Issues in the development new high tech products, Methods of analyzing alternate technologies, Techno-economic feasibility studies, Need for multi-criteria considerations such as, social, environmental, and political, Analytic hierarchy method, Fuzzy multi-criteria decision making, and other methods.

UNIT IV TECHNOLOGY TRANSFER AND ACQUISITION 9
Import regulations, Implications of agreements like Uruguay Round and WTO, Bargaining process, Transfer option, MOU- Technology Adoption and Productivity - Adopting technology-human interactions, Organisational redesign and re-engineering, Technology productivity.

UNIT V TECHNOLOGY ABSORPTION AND INNOVATION 9
Present status in India, Need for new outlook, Absorption strategies for acquired technology, creating new/improved technologies, Innovations, Technology Measurement- Technology Audit, Risk and exposure, R&D portfolio management

TOTAL:45 PERIODS
OUTCOMES:
Upon completion of the course, students will be able to
- Have clear understanding of managerial functions like planning, organizing, staffing, leading and controlling
- Have same basic knowledge on international aspect of management

REFERENCES:
5. Irvin M. Rubin, Organisational behavior an experimental approach, Prentice Hall, 1995

QE7072 PRODUCT INNOVATION AND DEVELOPMENT

OBJECTIVES:
- To get knowledge of Innovation in Product design and development.

UNIT I PRODUCT DEVELOPMENT AND CONCEPT SELECTION

UNIT II PRODUCT ARCHITECTURE
Product architecture – Implication of the architecture – Establishing the architecture – Related system level design issues.

UNIT III INDUSTRIAL AND MANUFACTURING DESIGN
Need for industrial design – Impact of industrial design – Industrial design process. Assessing the quality of industrial design- Human Engineering consideration -Estimate the manufacturing cost – Reduce the component cost – Reduce the assembly cost – Reduce the support cost – Impact of DFM decisions on other factors

UNIT IV PROTOTYPING AND ECONOMIC ANALYSIS
Principles of prototyping – Planning for prototypes - Elements of economic analysis – Base case financial model – Sensitivity analysis – Influence of the quantitative factors

UNIT V MANAGING PRODUCT DEVELOPMENT PROJECTS
Sequential, parallel and coupled tasks - Baseline project planning – Project Budget- Project execution – Project evaluation- patents- patent search-patent laws-International code for patents.

TOTAL: 45 PERIODS

OUTCOMES:
- The need for innovation in Product design and development and the technology developed can be known by this subject.
TEXTBOOK:

REFERENCES:

QE7151 TOTAL QUALITY MANAGEMENT

OBJECTIVES:
- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
Leadership, Customer Satisfaction, Employee Involvement, Continuous Process Improvement, Supplier Partnership, Performance Measures, Cost of Quality.

UNIT III TOOLS AND TECHNIQUES – 1
Benchmarking, Information Technology, Quality Management Systems and environmental management systems.

UNIT IV TOOLS AND TECHNIQUES
QFD, FMEA, Quality Circles, TPM, Traditional Quality Tools and Management tools.

UNIT V IMPLEMENTATION OF TQM
Steps in TQM implementation, national and international quality awards, case studies.

TOTAL: 45 PERIODS

OUTCOMES:
- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

REFERENCES:
OBJECTIVES:
- To gain Knowledge in the application of Quality Engineering in software industries.

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

UNIT II SOFTWARE ENGINEERING ACTIVITIES

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

UNIT IV SOFTWARE QUALITY MANAGEMENT TOOLS
Seven basic Quality tools – Checklist – Pareto diagram – Cause and effect diagram – Run chart – Histogram – Control chart – Scatter diagram – Poka Yoke – Statistical process control – Failure Mode and Effect Analysis – Quality Function deployment – Continuous improvement tools – Case study.

UNIT V QUALITY ASSURANCE MODELS

OUTCOMES:
- The Practice of Quality control and Assurance in Software industries can be best understood after studying this subject.

TEXTBOOK

REFERENCES