EVALUATION SCHEME & SYLLABUS

For

B. Tech. 3\textsuperscript{rd} Year

MECHANICAL AND INDUSTRIAL ENGINEERING

ON

CHOICE BASED CREDIT SYSTEM (CBCS)

[Effective from session 2018-19]
### DR. A.P.J ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

**EVALUATION SCHEME**

**MECHANICAL AND INDUSTRIAL ENGINEERING**

#### V SEMESTER

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<th>Subject Code</th>
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**Department Elective Course –I**

1. RME052: Mechtronics & Microprocessor.
2. RMI051: Value Engineering.
3. RMI052: Maintenance Engineering & Management
DESIGN OF MACHINE ELEMENTS

UNIT I

Introduction
Design requirements of machine elements, Principles of mechanical design, Modes of failures and Factor of Safety. Systematic design process, Aesthetic and Ergonomic considerations in design, Use of standards in design, Manufacturing consideration in design, Selection of preferred sizes, Indian Standards designation, Designation of carbon & alloy steels, Selection of materials for static and fatigue loads.

UNIT II

Design for Static and Fluctuating Loads
Cyclic stresses, Fatigue and endurance limit, Notch sensitivity, Stress concentration. Design for finite and infinite life, Soderberg, Goodman & Gerber criteria.

Shafts, Keys and Couplings
Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads. Types of keys, splines, Selection of keys, Strength of keys, Design of rigid and flexible couplings.

UNIT III

Design of Mechanical Drives
Introduction to power transmission and drives. Classification of gears, Terminology, Gear tooth proportions, Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Failure of gear tooth, Design considerations, AGMA and Indian standards, Beam strength and wear strength of gear tooth, Design of spur and helical gears.

UNIT IV

Mechanical Springs
Classification of springs, Material for helical springs, End connections for compression and tension helical springs, Design of helical springs subjected to static and fatigue loading.

Power Screws
Forms of threads, multiple threads, Efficiency of square threads, Trapezoidal threads, Stresses in screws, Design of screwjack.

UNIT V

Basic of Finite Element Method, Variational calculus, Integral formulation, variational methods: Methods of weighted residuals, Approximate solution using variational method, Modified Galerkin method, Boundary conditions.

**Note:** Design data book is allowed in the examination

**Text Books:**
2. Design of Machine Elements, Sharma and Purohit, PHI.
9. P Seshu, Finite Element Analysis, PHI publications, Delhi


**References:**
1. Design of Machine Elements-M.F. Spott, PearsonEducation
4. Design of Machine Elements, Gope PHI.
5. Finite Element Method with Applications in Engineering Y M Desai, Pearson Publication
7. Introduction to Finite Element Analysis by Tirupathi R. Chandrupatla & Ashok D Belegundu, Pearson Publication
THERMAL AND HYDRAULIC MACHINES

UNIT-I

Thermodynamic equilibrium, cyclic process, enthalpy, Zero, first and second laws of thermodynamics, Carnot cycle, concept of entropy, properties of steam, processes involving steam in closed and open systems, Enthalpy. Vapour Pressure Cycles: Rankine cycle, reheat cycle, Regenerative cycle

UNIT-II

Steam Turbine: Theoretical approach only of Classification, impulse and reaction turbines their velocity diagrams and related calculations, work done and efficiencies, re-heat factor, staging, bleeding and governing of turbines. Gas Turbine: Theoretical approach only of Classification, Brayton cycle, working principle of gas turbine, gas turbine cycle with intercooling, reheat and regeneration, stage and polytrophic efficiencies.

UNIT-III

Otto, Diesel .and Dual cycles, introduction to 2-stroke and 4-stroke SI and CI engines

UNIT-IV

Impact of Jet: Introduction to hydrodynamic thrust of jet on a fixed and moving surface ( flat and curve). Hydraulic Turbines: Classification, heads and efficiencies, construction, working, work done and efficiency of impulse turbines.

UNIT-V

Centrifugal Pump: Classification, construction, working. Reciprocating Pump: Classification, construction, working.

Text Books:

2. Steam & Gas Turbine by R. Yadav, CPHAllahabad

Reference Books:

APPLIED PROBABILITY AND STATISTICS

Unit I

**Introduction to statistics:** Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display.

Unit II

**Discrete Random Variables and Probability distributions:** Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Poisson distribution, Applications.

Unit III

**Continuous Random Variables and Probability Distributions:** Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poisson distribution, Exponential distribution.

Unit IV

**Testing of Hypothesis:** estimation theory, Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion, Testing for Goodness of Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions.

Unit V

**Simple Linear Regressions and Correlation:** Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Transformations to a straight line, Correlation

**Multiple linear regressions:** Multiple linear regressions model, least square estimation of parameters, Correlation- types, correlation coefficients, properties of least square estimators and estimation of variance.

Text books:

References:
DESIGN AND SIMULATIONLAB

1. Design & Modeling of Cotterjoint.
2. Design & Modeling of Knucklejoint
3. Design & Modeling of riveted joint applied to boilerjoints.
4. Study of a FEA package and modeling stress analysis of
   a. Bars of constant cross section area, tapered cross section area and stepped bar
   b. Trusses,
   c. Beams – Simply supported, cantilever, beams with UDL, beams with varying load etc

5. **Mini Project:** Will take up problems from real life applications and optimize using
   modeling and analysis software
   Each student will be given a real life problem for the complete design of a subsystem/system
   Using either manual calculation with the help of design handbook or through computer
   Programme or through software tools. This assignment should be done in groups, which
   will be submitted at the end of the semester.

**Text Books:**

2. Design of Machine Elements, Sharma and Purohit, PHI.
6. P Seshu, Finite Element Analysis, PHI publications, Delhi


**References:**

1. Design of Machine Elements-M.F. Spott, Pearson Education
4. Design of Machine Elements, Gope PHI.
5. Finite Element Method with Applications in Engineering Y M Desai, Pearson Publication
6. Introduction to Finite Element Analysis by Tirupathi R. Chandrupatla & Ashok D Belegundu, Pearson Publication
THERMAL & HYDRAULIC MACHINE LAB

Experiments: Minimum 10 experiments out of following:

1. Study and working of Two stroke petrol Engine
2. Study and working of Four stroke petrol Engine
3. Study and working of two stroke Diesel Engine
4. Study and working of four stroke Diesel Engine.
5. Study of compounding of steam turbine
6. Study of Impulse & Reaction turbine
8. Turbine experiment on Pelton wheel.
9. Turbine experiment on Francis turbine.
10. Turbine experiment on Kaplan turbine.
11. Experiment on Reciprocating pump.
12. Experiment on centrifugal pump.
APPLIED PROBABILITY AND STATISTICS LAB

Software: MS Excel
1. Determining the measures of central tendency and dispersion of a given process
2. Graphical/ Pictorial representation of data – Histogram, Ogive curve, Bar Chart, Column chart, Pie chart, Line chart
3. Interval estimation and hypothesis testing on single population mean
4. Interval estimation and hypothesis testing on Two population means
5. Interval estimation and hypothesis testing on single population Proportion
6. Interval estimation and hypothesis testing on Two population Proportions
7. Hypothesis testing using paired t-test
8. Construction of scatter plot and determination of Karl Pearson’s correlation coefficient
9. Determination of Spearman’s Correlation Coefficient
10. Conduction of simple linear regression analysis
11. Testing the goodness of fit using Normal Distribution
12. Testing the goodness of fit using Binominal distribution calculation through
13. Testing the goodness of fit using Poisson distribution MS Excel
14. Testing the goodness of fit using Uniform Distribution

Software: statistical software package
1. Determination of basic statistics and construction of histogram for a given quality characteristic
2. Determining the probability for discrete probability distributions – Hypergeometric, Binominal and Poisson distributions
3. Determining the probability for Continuous probability distributions – Normal and Exponential distributions
4. Interval estimation and Hypothesis testing on single population mean.
5. Interval estimation and Hypothesis testing on two population means
6. Interval estimation and Hypothesis testing on single population Proportion.
7. Interval estimation and Hypothesis testing on two population Proportions
8. Hypothesis testing using paired t-test.
9. Construction of scatter plot and determining Karl Pearson’s correlation coefficient.
11. Conduction of Multiple linear regression analysis.
12. Case study on engineering and management related problems

Suggested software packages: MS Excel or LibreOffice Suite Calc (Using Spoken Tutorial MOOCs), SYSTAT / MINITAB 17 - Statistical Software Package etc
MECHATRONICS AND MICROPROCESSOR

UNIT I

Introduction to Mechatronic Systems: Measurement and control systems their elements and functions, Microprocessor based controllers.


UNIT II

Electrical Actuation Systems: Electrical systems, Mechanical switches, solid-state switches, solenoids, DC & AC motors, Stepper motors and their merits and demerits.


UNIT III

Introduction to Microprocessors: Evolution of Microprocessor, Organization of Microprocessors (Preliminary concepts), basic concepts of programming of microprocessors.

Review of concepts - Boolean algebra, Logic Gates and Gate Networks, Binary & Decimal number systems, memory representation of positive and negative integers, maximum and minimum integers. Conversion of real, numbers, floating point notation, representation of floating point numbers, accuracy and range in floating point representation, overflow and underflow, addition of floating point numbers, character representation.

UNIT IV

Logic Function: Data word representation. Basic elements of control systems 8085A processor architecture terminology such as CPU, memory and address, ALU, assembler data registers, Fetch cycle, write cycle, state, bus, interrupts. Micro Controllers. Difference between microprocessor and micro controllers. Requirements for control and their implementation in microcontrollers. Classification of micro controllers.
UNIT V

Organization & Programming of Microprocessors: Introduction to organization of INTEL 8085-Data and Address buses, Instruction set of 8085, programming the 8085, assembly language programming.

Central Processing Unit of Microprocessors: Introduction, timing and control unit basic concepts, Instruction and data flow, system timing, examples of INTEL 8085 and INTEL 4004 register organization.

REFERENCE BOOKS:

5. Mechatronics Principles & applications, Godfrey C. Onwubolu,Elsevier..
UNIT – I

INTRODUCTION TO VALUE ANALYSIS: Definition of Value, Value Analysis, Value Engineering, Value management, Value Analysis versus Value Engineering, Value Analysis versus Traditional cost reduction techniques, uses, applications, advantages and limitations of Value analysis. Symptoms to apply value analysis, Coaching of Champion concept.

TYPE OF VALUES: Reasons for unnecessary cost of product, Peeling cost Onion concept, unsuspected areas responsible for higher cost, Value Analysis Zone, attractive features of value analysis. Meaning of Value, types of value & their effect in cost reduction. Value analysis procedure by simulation. Detailed case studies of simple products.

UNIT – II


PROBLEM SETTING & SOLVING SYSTEM: A problem solvable stated is half solved, Steps in problem setting system, Identification, Separation and Grouping of functions. Case studies.

UNIT – III

VALUE ENGINEERING JOB PLAN: Meaning and Importance of Value Engineering Job plan. Phases of job plan proposed by different value engineering experts, Information phase, Analysis phase, Creative phase, Judgement phase, Development planning phase, and case studies. Cost reduction programs, criteria for cost reduction program, Value analysis change proposal.

VALUE ENGINEERING TECHNIQUES: Result Accelerators or New Value Engineering Techniques, Listing, Role of techniques in Value Engineering, Details with Case examples for each of the Techniques.
UNIT-IV

ADVANCED VALUE ANALYSIS TECHNIQUES: Functional analysis system technique and case studies, Value Analysis of Management Practice (VAMP), steps involved in VAMP, application of VAMP to Government, University, College, Hospitals, School Problems etc., (service type problems).

UNIT-V

TOTAL VALUE ENGINEERING: Concepts, need, methodology and benefits.
APPLICATION OF VALUE ANALYSIS: Application of Value analysis in the field of Accounting, Appearance Design, Cost reduction, Engineering, manufacturing, Management, Purchasing, Quality Control, Sales, marketing, Material Management Etc., Comparison of approach of Value analysis & other management techniques.

TEXT BOOKS:

REFERENCE BOOKS:
MAINTENANCE ENGINEERING & MANAGEMENT
LTP 3-0-0

Unit-I

Introduction, operating life cycle, reliability, Failure data analysis, failure rate curve, hazard models, elements in series, parallel, mix, logic diagrams, improving reliability, redundancy-element, unit, standby, maintainability, availability, reliability and maintainability trade off.

Unit-II

Maintenance Strategies: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency.

Unit-III

Replacement planning maintain or replace decision, replacement of items that deteriorate identical equipment, replacement of items that fail without deterioration individual, group replacement, replacement in anticipation of failure.

Unit-IV

Break down maintenance planning, assignment model, waiting time models expected waiting time, minimum cost service rate, PERT.

Unit-V

Maintenance Management, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management.

Books:

ADVANCE MACHINING PROCESSES

Unit I

Introduction: Limitations of Conventional machining processes, Need of advanced machining processes and its classification.

Mechanical Type Metal Removal Processes: Ultrasonic machining; Elements of the process; Tool design and economic considerations; Applications and limitations, Abrasive jet and Abrasive water jet machining principles; Mechanics of metal removal; Design of nozzles; applications, Abrasive finishing process, Magnetic abrasive finishing process

UNIT II

Thermal Type Advance Machining Processes: Classification, General principles and applications of Electro discharge, Plasma arc, Ion beam, Laser beam, Electron beam machining, Mechanics of metal removal in EDM, selection of EDM pulse generator dielectric, machining accuracy, surface finish and surface damage in EDM, Generation and control of electron beam for machining applications, advantages and limitations

UNIT III

Chemical and Electro-chemical Type Metal Removal Processes: Principle, working advantages, disadvantages and applications of Electrochemical, Chemical machining, Economy aspects of ECM, Electro-chemical deburring and honing

UNIT IV

Hybrid Unconventional Machining Processes: Introduction to ECDM, ECAM, Abrasive EDM etc.

UNIT V

Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro Discharge forming, water hammer forming, explosive compaction etc.

Electronic-device Manufacturing: Brief description of Diffusion and Photo- Lithography process for electronic-device manufacturing

Books:
1. Advance Machining Processes V.K. Jain NewAge
2. Modern Machining Processes P.C. Pandey NewAge
3. Manufacturing Processes Degarmo-
INVENTORY MANAGEMENT

Unit I

Introduction: Definition & importance of materials management, MM at micro level & macro level, systems approach to MM, functions, interfaces & benefits of integrated systems approach.

Unit II

Purchasing: Principles, procedure, source & supplier selection, learning curve, negotiation, hedging, forward buying, make or buy decision, legal aspects of buying, vendor vendee relations & vendor development.

Unit III

Inventory management: Definition, types, need & functions of inventory management, cost elements, Economic Ordering Quantity, ABC, FSN, VED analysis and spare parts management.

Deterministic models: Instantaneous replenishment model with & without shortages, production lot size model with & without shortages.

Unit IV

Deterministic/ Probabilistic models: With price breaks and quantity discounts, multi item deterministic model- restriction on floor space, total value and number of items, Probabilistic model, LIMIT technique.

Unit V


Text books:


References:

### VI SEMESTER

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**Department Elective Course –2**

RMI061: Human Factors in Engineering.
RMI062: Facilities Planning and Design.
RME065: Product Data Management
RMI063: Software Engineering and Management.
WORK STUDY & ERGONOMICS

Unit I

**Productivity:** Definition of productivity, individual enterprises, task of management. Productivity of materials, and, building, machine and power. Measurement of productivity, factors affecting the productivity, productivity improvement programs.

**Work Study:** Definition, objective and scope of work study. Human factor in work study. Work study and management, work study and supervision, work study and worker.

Unit II

**Introduction to Method Study:** Definition, objective and scope of method study, activity recording and exam aids. Charts to record moments in shop operation – process charts, flow process charts, travel chart and multiple activity charts. (With simple problems)

**Micro and Memo Motion Study:** Charts to record moment at work place – principles of motion economy, classification of movements, two handed process chart, SIMO chart, and micro motion study. Development, definition and installation of the improved method.

Unit III

**Introduction to Work Measurement:** Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling: need, confidence levels, sample size determinations, with simple problems.

**Time Study:** Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating, Systems of rating.

Unit IV

Scales of rating, factors affecting rate of working, allowances and standard time determination. Predetermined motion time study – Method time measurement (MTM)

**Wages and Incentives:** introduction, definition, wage differentials, methods of wage payment, Advantages, disadvantages, Financial incentives, non-financial incentives.

Unit V


Text Books:


References Books:


SIMULATION MODELING AND ANALYSIS

Unit I

**Introduction to Simulation:** Simulation, advantages, Disadvantages, Areas of application, System environment, components of a system, Model of a system, types of models, steps in a simulation study.


Unit II

**Simulation Examples:** Simulation of Queuing systems, Simulation of Inventory System, Monte Carlo simulation, General Principles, Concepts in discrete - events simulation, event scheduling / Time advance algorithm.

Unit III

**Introduction to Probability distributions:** Weibull, Triangular, Erlang and Gamma distributions and their applications (No analytical treatment)

**Random Variate Generation:**
Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and lognormal Distributions
Convolution Method – Erlang distribution Acceptance and Rejection technique – Poisson and Gammadistributions

Unit IV

**Input Modeling:** List of steps involved in input modeling – no analytical treatment Selecting input models without data, Multivariate and time series input models – Covariance and correlation, multivariate input models, time series input models.

**Verification and Validation of Simulation Model:** Model Building, Verification and validation, Verification of simulation models, Calibration and Validation of Models, Naylor and Finger’s validation process.

Unit V

**Output analysis for a single model:** types of simulations, stochastic nature of output data, Output analysis of terminating simulations, Output analysis of steady state simulations

**Optimization via simulation:** What does “optimization via simulation” mean? Why is optimization so difficult? Basic GA and TS.
Text books:


Reference:

MACHINE TOOL DESIGN

Unit-I

Introduction: Developments in machine tools, types of machine tools surface, profits and paths produced by machine tools. Features of construction and operations of basic machine tools e.g. lathe, drill, milling shapes and planers, grinding machine etc. General requirement of machine tool design. Machine tool design process. Tool wear, force Analysis.

Unit-II

Machine Tools Drives: Classification of machine tool drives, group Vs individual drives, election of electric motor, A brief review of the elements of mechanical transmission e.g. gear, belt and chain drives, slider-crank mechanism, cam mechanism, nut & Screw transmission, Devices for intermittent motion, reversing & differential mechanisms. Couplings and clutches Elements of hydraulic transmission system. e.g. pumps, cylinder, directional control valves, pressure valves etc. Fundamentals of Kinematics structure of machinetools.

Unit-III

Regulation of Speed and Feed rates: Laws of stepped regulation, selection of range ratio, standard progression ratio, selection of best possible structural diagram, speed chart, Design of feed box, Developing gearing diagrams. Stepless regulation of speed and feed in machine tool, speed and feed control.

Unit-IV

Design of Machine Tool Structure: Requirements and design criteria for machine tool structures, selection of material Basic design procedure for machine tool structures, design of bed, column and housing, Model technique in design. Design of guideways and power screws: Basic guideway profiles, Designing guideway for stiffness a wear resistance & hydrostatic and antifriction guideways. Design of sliding friction power Screws. Design of spindlier & spindle supports. 3 Layout of bearings, selection of bearings machinetools.

Unit-V

Books:


WORK STUDY & ERGONOMICS LAB

List of Experiments

1. Construction of Outline Process Chart for simple assembly
2. Recording the given activity using Flow Process Chart
3. Recording the given activity using Multiple Activity Chart
4. Constructing the String Diagram for a shop-floor activity
5. Construction of Two Handed Process Chart for pin board / Nut and Bolt assembly.
6. Rating practice using walking simulator
7. Rating practice for dealing a deck of cards
8. Determination of standard time/ rating of pin board assembly using centi minute stop watch.
9. Determination of standard time for simple operation using Timer Pro Software
10. Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
11. Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergometer
12. Conduct of work sampling in office environment to determine standard time.

Text Books:

SIMULATION MODELING & ANALYSIS LAB

1. Introduction to Simulation Packages and selection.
2. Understanding the Simulation Package
3. Identifying probability distributions for given data
4. Building simulation models for manufacturing operations (Electronic assembly – With Basic templates)
5. Building simulation models for manufacturing operations (Electronic assembly – With Common templates)
6. Building simulation models for manufacturing operations with transport System
7. Building simulation models for manufacturing operations with layout
8. Building simulation models for manufacturing operations with layout and transport System
9. Building simulation Models for Banking service (Bank teller problem)
10. Building simulation Models for Mortgage application problem
11. Building simulation Models for food processing problem
12. Building simulation Models for Post office animation
13. Statistical Analysis of Simulation models (input analysis)
14. Statistical Analysis of Simulation models (output analysis)
15. Simulation model for foundry exercise.

Text books:
Minimum eight experiments out of the following:

1. Measurement and analysis of cutting forces in orthogonal turning.

2. Flank wear – time characteristics for single point cutting tools.

3. (i) Checking the level of installation of a lathe in horizontal & vertical planes (ii) Checking the bed ways for straightness and parallelism.

4. Testing the main spindle of a lathe for axial movement and truer running.

5. Process capability determination of a center lathe.

6. Flatness checking of a surface plate.

7. A study of devices for intermittent motion used in machine tools e.g. ratchet gear & Geneva Mechanism.


9. A study of the drives for reciprocation used in machine tools.

10. Development the speed chart and gearing diagram for a gassed head lathe.

11. A study of the cone pulley drive in center lathe and development of its ray diagram for the speed structure.

12. Efficiency testing of lathe at various parameters-values.

13. Accuracy analysis of finished cylindrical work-pieces produced on a lathe.

14. Cutting (turning) with inclined placed tool (in tool fixture).

15. Turning with two simultaneously cutting tool (one from front on usual tool post and the other tool from back on tool fixture on carriage)
Department Elective Course –2

1. Human Factors in Engineering.
2. Facilities Planning and Design.
3. Product Data Management
4. Software Engineering and Management.
5. Quality Engineering In Manufacturing.

HUMAN FACTORS IN ENGINEERING

Unit – I

Introduction
Introduction to Human factors, History of Human factors, Human machine systems, Displaying information, coding of information, information processing, memory, decision making, age and information processing, mental workload.

Unit – II

Visual Displays: The process of seeing, Visual acuity types, quantitative visual displays, Dynamic quantitative displays, Qualitative visual displays, Representational displays

Unit – III

Auditory, Tactual & Olfactory Displays: The nature and measurement of sound, The anatomy of ear, Auditory displays, principles of auditory displays, Tactual display types, The Olfactory sense and displays.

Unit – IV

Human activities: Muscle physiology, Measure of physiological strain, physical work load, factors affecting, energy consumption, Strength and endurance, Biomechanics of human motion, Function of controls, factors in control design, C/R ratio, Optimum C/R ratio, Principles of hand tool and device design.

Unit – V

Work space and arrangement: Anthropometry, use of anthropometric data, work spaces, design of work surfaces, science of seating, example of individual work place, human error, accidents and warnings
Applications: use of ergonomics in service sector and IT sector.
Introduction to BIS on Human factors.
Text Books:


References:

FACILITIES PLANNING AND DESIGN

Unit I

Plant Location and layout: Factors influencing plant location, location economics - problems. Objectives of plant layout, Principles of plant layout, types of plant layout, their merits and demerits. Line Balancing

Unit II

Material Handling: Objectives and principles of Material handling, Unit load concept, classification and types of material handling equipment, Modern material handling concepts and equipment, RFID. Muther’s Systematic Layout Planning procedure – problems.

Unit III

Space Determination and Area Allocation: Factors for consideration in space planning, area allocation factors to be considered, Plot plan, Sequence demand Straight line and non directional methods – Analytical treatment. Determination of manpower and equipment requirement, use of travel chart for layout planning, analytical treatment.

Unit IV

Layout Evaluation: Methods of constructing the layout, efficiency indices.
Layout models: Single facility and multi facility location models, warehouse layout models, Warehouse design as per International standards. Conveyor and Storage models (discussion only)
Unit V

Layout for software and service organizations: An over view

Text Books:


References:

UNIT I

Introduction: Introduction to PDM-present market constraints need for collaboration-Internet and developments in server-client computing, Collaborative product commerce

UNIT II

Components of PDM: Components of a typical PDM set-up hardware and software-document management creation and viewing of documents -creating parts-version control of parts and documents –case studies.

UNIT III

Configuration Management: Base lines-product structure configuration management -case studies.

UNIT IV

Change Management: Change issue -change request-change investigation- change proposal-change activity-case studies.

UNIT V

Generic Products and Variants: Products configuration comparison between sales configuration mild products generic-generic product modeling in configuration mode1er-use of order generator for variant creation –registering ofvarian1s in product register-case studies.

REFERENCE BOOKS:
SOFTWARE ENGINEERING & MANAGEMENT

Unit I


Unit II

**Software Project Management Concepts:** The Management Specification, People, Problem, Process.

**Software Project Planning:** Objectives, Scope, Resources, Project estimation, Decomposition Techniques, Empirical Estimation Models, Make-buy decision, Automated estimation tools.

Unit III

**Risk Management:** Reactive v/s Proactive Risk Strategies, Software Risks, Risk identification, Risk projection, Monitoring.

**Software Project Scheduling and Tracking:** Basic concepts, defining a task set selection, Defining Scheduling, Project Plan.

Unit IV

**Software Quality Assurance/Quality Control:** Quality assurance concept, Cost impact of software defects, Technical review, statistical Quality assurance, software reliability, ISO 9000 Quality standards.

**System Analysis Concept and Principles:** Requirement analysis, Principles, software prototyping, specifications, Data Modeling, Functional Modeling and Information Flow, Structured Analysis, Data Dictionary.

Unit V


**Text Book:**

**Reference:**
QUALITY ENGINEERING IN MANUFACTURING

UNIT I
Quality Value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design of production processes. Loss Function and Quality Level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances.(N-type, S-type and L-type)

UNIT II
Tolerance Design and Tolerancing: Functional limits, tolerance design for N-type, L-type and S-type characteristics, tolerance allocation for multiple components. Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT III
Analysis of Variance (ANOVA): NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F test, ANOVA for four level factors, multiple level factors.

UNIT IV
Orthogonal Arrays: Typical test strategies, better test strategies, efficient test strategies, steps in designing, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contributor, estimating the mean.

UNIT V
IS()-9000 Quality System, BDRE, 6.-sigma, Bench making, Quality circles Brain Storming — Fishbone diagram — problem analysis.

Text Book:

Reference Books: