Faculty of Engineering & Technology

Study and Evaluation Scheme

Of

Bachelor of Technology

B.Tech. – Mechanical Engineering

(Applicable w.e.f Academic Session 2015-18, till revised)

AKS UNIVERSITY, SATNA

Study and Evaluation Scheme

** The University Authorities reserve all the rights to make any additions/ deletions or changes/ modifications to this syllabus as deemed necessary.
Faculty of Engineering & Technology  
Department of Mechanical Engineering  
B.Tech. (Mechanical Engineering)  

(Session 2015 onward)  

III Semester  

TEACHING & EXAMINATION SCHEME  

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Paper Code</th>
<th>Semester- III</th>
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IV Semester  

TEACHING & EXAMINATION SCHEME

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Practical

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VI Semester  

TEACHING & EXAMINATION SCHEME  

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**VII Semester**

**TEACHING & EXAMINATION SCHEME**

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VIII Semester  

TEACHING & EXAMINATION SCHEME

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Unit – I: Function of Complex variable
- Definition, derivatives of complex function, Analytic function.
- Cauchy-Riemann equations, in Cartesian form and polar form.
- Conjugate function, Harmonic function, Methods for finding the analytic function.
- Cauchy’s integral theorem, Cauchy’s integral formula for analytic function.
- Poles and singularities of analytic function, Residue theorem (without proof) and its application.

Unit – II: Numerical Techniques – I
- Finite differences: Difference table [Forwarded Difference operator, Backward Difference operators and central Difference operator]
- Interpolation: Newton-Gregory forward and backward interpolation formula for equal intervals, Gauss’s forward and backward interpolation formula for equal intervals, Gauss’s central difference formula for equal intervals.
- Stirling’s formula, Bessel’s formula, Everett’s formula for equal intervals.

Unit – III: Numerical Techniques – II
- Numerical Differentiation : Newton’s forward difference formula and Newton’s backward difference formula for derivative, Gauss’s forward difference formula for derivative, Newton’s divide difference formula for derivative.
- Lagrange’s interpolation formula for unequal intervals and Newton’s divided difference interpolation for unequal intervals.
- Numerical integration: Trapezoidal rule, Simpson’s one third rule, Simpson’s three-eight rules, and Weddle’s rule.

Unit – IV Numerical Techniques – III
- Solution of simultaneous algebraic equation: Gauss- Seidal method, Gauss elimination method, Guass-jordan method.

Unit – V Probability Distribution
- Binomial Distribution: Hypothesis, characteristics, mean, variance and standard deviation and moments.
- Poisson distribution: Hypothesis, characteristics, condition for Poisson distribution, mean, variance and standard deviation.
- Normal Distribution: Standard normal distribution, properties of normal curve.
- Curve fitting: Method of least squares, Fitting of straight lines, and parabola of second degree.

**Text Books:**
1. D.C. Agrawal, Engineering Mathematics-III, Sai prakasan

**Reference Books:**
UNIT - I Introduction
Basic of stress & strain, Elastic constant, Stress-strain diagram, Hooke’s law, Stresses in the components subjected to multi-axial forces, Temperature stresses, Statically indeterminate system.

UNIT – II Bending of beams
Bending of beams with symmetric section, boundary condition, Pure bending, Bending equation, traverse shear stress distribution in circular, hollow circular, I & T section.

UNIT - III Deflection of beam
Relation between slope deflection and radius of curvature, solution of beam deflection, problem by Macaulay’s method, Direct integration method, Method of super position, Moment Area Method.

UNIT - IV Torsion
Deformation in circular shaft due to torsion, Basic assumption, Torsion equation, Stresses in elastic range, Angular deflection, hollow and stepped circular shaft. Spring: Closed and open coil helical spring subjected to axial load, spring in parallel & series.

UNIT – V Principle stresses and strain
Transformation of plane stresses, Principle stresses, Maximum shear stresses, Mohr’s circle for plane stresses, Plain strain and its Mohr’s circle representation, Principle strains, Maximum shear strain. Combined Loading: Components subjected to bending, torsion & axial loads.

Text Books:
1. Elements of strength of material – Timoshenko & young- EWP press

Reference Books:
1. Strength of material – Rider–ELBS
2. Introduction to Solid Mechanics – I.H.Shames–PHI
EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)
1. To study the Universal Testing Machine.
2. To perform the Tensile Test of Mild Steel on U.T.M and To Draw Stress–Strain Curve.
3. To determine strength of wood on U.T.M (i) Along the Grain (ii) Across the Grain.
4. To determine shear strength of Mild Steel on U.T.M.
5. To observe Flexural Behavior of Timber specimen and to determine it’s strength under transverse loading on U.T.M.
6. To study the Impact Testing Machine and test specimen of Izod and Charpy.
7. To determine Izod and Charpy Value of the given mild steel specimen.
8. To study the Fatigue Testing Machine and to discuss the procedure to find out endurance limit of given material.
10. To determine modulus of rigidity for the material of open and closed Coiled Helical Spring Subjected to Axial Load by spring testing machine.
11. To study the Torsion Testing Machine
12. To determine ultimate shear stress and modulus of rigidity under Torsion.
13. To study the Cupping Test Machine and to determine Erichsen value of Mild Steel sheet.
14. To study the Rockwell Hardness Testing Machine and to determine the Rockwell Hardness of the given material.
15. To study the Brinell Hardness Machine and to determine the Brinell hardness of the given material.
16. To study the Vickers Hardness Machine and to conduct a test on the machine.
17. Buckling of column
UNIT - I Second Law Analysis

UNIT - II Thermodynamic Relationships
Helmholz and Gibbs functions, Coefficient of Volume expansion and isothermal compressibility, Differential relations of internal energy, Maxwell’s Relation, Cp Cv relations, T-ds equations, Clapreyon equation, Kelvin coefficient.

Equation of state:
Ideal gas equation of state, Real gas deviation with ideal gas, Vander waals equation, Evaluation of its constants, Virial expansions, Limitations of the equation. The law of corresponding states.

UNIT – III Vapour and Vapour Power Cycle
Properties and processes in ideal vapour, Use of steam tables and Molier’s diagram in determination of steam properties, energy and entropy calculations. Carnot and Rankine cycle as applied to steam power plants, Reheat cycle, Ideal regenerative cycle, Practical regenerative cycle, Characteristics of ideal working fluids, Binary vapour cycle.

Unit – IV Reciprocating Air Compressors

Unit – V Thermodynamics of Compressible Fluids

Text Books:

Reference Books:
3. Thermodynamics – S.C. Gupta – Pearson Education
5. Engineering Thermodynamics – K. Ramakrishna – Anuradha Agencies
EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)
1. To study Mountings & Accessories of a Boiler.
2. To study the Cochran Boiler and it’s Accessories and Mountings.
3. To study the Lancashire and it’s Accessories and Mountings.
4. To study the Babcock Wilcox and it’s Accessories and Mountings.
5. To study a Simple Steam Engine.
6. To study a Simple Steam Engine With D-Slide Valve.
7. To study a Compound Steam Engine.
8. To study Meyer’s Expansion Valve of Steam Engine.
9. To study Drop Valve of Steam Engine.
10. To study Two Stroke Petrol Engine.
11. To study Four Stroke Petrol Engine.
13. Performance and testing of steam jet condenser.
14. Study of Steam Turbines
15. Study of Reciprocating Compressor
B.TECH. (Mechanical Engineering)
III SEMESTER
MECHANICAL MEASUREMENT AND CONTROL

UNIT - I
Generalized Measurement System: Introduction - Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, Units of measurement, Static and dynamic performance characteristics of measurement devices, Calibration, Concept of error, Sources of error, Statistical analysis of errors sensors and Transducers – Types of sensors, Type of transducers and their characteristics.

UNIT - II
Measurement of temperature: Measurement of temperature by thermometers, Bimetallic, Thermocouples, Thermistors and pyrometers-total radiation and optical pyrometry, Thermocouples, RTDs, Pyrometers, Pyrometeric Cones.
Measurement of Strain: Type of strain gauges and their working, Strain gauge circuits, Mcleod guage, Pirani guage, Temperature compensation. Strain rosettes, Analysis of strains, Measurement of force and torque.

UNIT- III
Data acquisition system: Introduction to data acquisition systems, Single and multi channel systems, Microprocessors and PC based data acquisition systems. Input – output devices signal transmission and Processing, Devices and systems.

UNIT- IV
Metrology: Standards of measurement, Linear and angular measurement devices and systems limit gauges, Gauge blocks. Measurement of geometric forms like straightness, Flatness, Roundness and Circularit y, principles and application of optical projectors, Tool makers, M icroscope, Autocollimators etc. Principle and use of interferometers, Comparators, Measurement of screw threads and gears, Surface texture measurement.

UNIT- V
Control: Open Loop and Close Loop control, Transfer function, Stability Equations, Feed back systems.

Text Books:-
4. Automatic Control Systems-Kuo
Reference Books:-
1. Engineering Metrology – K.J. Hume - MacDonald and Company

EXPERIMENTS TO BE PERFORMED
MEASUREMENT LAB TO BE PERFORMED (MINIMUM 7 NUMBERS)
1. To Measure Pressure Using Bourdon Pressure Gauge.
2. To Calibrate Pressure Gauge Using Dead Weight Pressure Gauge Tester.
3. To Measure Displacement Using LVDT
4. To Measure Temperature Using Thermister
5. To Measure Flow Rate Using Rotameter.
6. To Measure Angle Using Angular Sensor.
7. To Measure Torque Using Torque Transducer
8. To Measure Pressure Using Pressure Transducer.
9. To Measure Strain Using Strain Cantilever Beam.
10. To Measure Temperature Using RTD.
11. To Measure Temperature Using Thermo Couple.
12. To perform the following experiments using Data Acquisition System
   a) To measure Temperature by Themocouple
   b) To measure Temperature by Thermistor
   c) To measure Temperature by RTD.
   d) To measure Strain.

METROLOGY LAB TO BE PERFORMED (MINIMUM 5 NUMBERS)
1. Measurements of lengths, heights, diameter by Vernier Calipers, Vernier Height Gauge, Micrometers.
3. Determining the accuracy of Electrical and Optical Comparator.
4. Determine the Surface Flatness and Contour using Interferometer.
5. Determine the Effective Diameter of screw threads by using Two wire & Three wire methods.
UNIT - I  
**Structure of Materials:** Crystalline structure of solid: Concept of unit cell and space lattice, Miller Indices, Crystal structure determination by X-ray diffraction, Crystal imperfections. 

**Solidification of Metals and Alloys:** Mechanism of solidification, nucleus formation and crystal growth, Metal ingot structure-dendritic and columnar grains, grain boundaries, grain growth, effect of grain size on properties of metals, polytropic transformation.

UNIT - II  
**Elastic and Plastic Deformation:** Material properties like strength, hardness, toughness, ductility, brittleness etc. and their importance in manufacturing. Quantitative evaluation of these properties with destructive testing methods. Mechanism of plastic deformation, role of dislocations, slip and twinning. Strain hardening, Seasons cracking, Baushinger effect, yield point phenomena and related effects, Cold working and Hot working processes, effect on properties like recovery, recrystallization, grain growth, grain size etc.

UNIT - III  
**Phase Diagrams:** Phase and phase equilibrium: solidification of pure metals and alloys, Phase diagrams of monotectic, eutectic, eutectoid, peritectic and peritectoid & other systems. Allotropy of iron and Fe-C diagram.

UNIT - IV  
**Heat Treatment:** Introduction, purpose of heat treatment, T-T-T curve and micro constituents in steel heat treatment processes like hardening, tempering, annealing, normalizing, Effects of heat treatment on properties of materials. Surface treatment processes.

UNIT - V  
**Engineering Materials:** Classification, structure, general properties and applications of Cast Iron, Steel, brass, Bronze, bearing metals, light metal alloys, sintered carbide.

UNIT-VI  
**Composite materials:** structures and method of preparation of fibres and fibre-reinforced composites.

**Text Books:**
Reference Books:

2. Physical Metallurgy - Clark & Varney, East West Edn., New Delhi
UNIT -1
**Display device:** Refresh Cathode ray Tubes, Random Scan and Raster Scan monitors, Colour CRT Monitors, Direct view Storage Tubes, Continuous Refresh and Storage display, LED and LCD Monitors.

**Graphic primitives:** Points & Lines, Line drawing Algorithm, DDA and Bresenham’s Algorithm.

UNIT -2
**Attributes of primitives:** Line style, Type, Width, Colour, Character Attributes, Area Filling, Antialiasing.

**Fill Algorithm:** Scan-Line Polygon Fill algorithm, Boundary Fill Algorithm, Flood Fill Algorithm, Seed fill algorithm.

UNIT -3
**Analytical & Synthetic curve:** C₀, C₁ & C₂ Continuity, Convex hull, Parametric & non parametric representation of curves. Analytic curves: Circle, Ellipse, Parabola, Hyperbola, Splines: linear, quadratic, cubic, hermite, Bezier curves, Synthetic Curves: Circle and ellipse drawing, Parametric and Breshenham’s algorithm.

UNIT -4
**2D Transformation:** Basic transformation- Translation, Scaling, Rotation, Reflection, Twist, Matrix Representation, Composite Transformations.

**3D Transformation:** Basic Transformations, 3D Display parallel & perspective projection.

UNIT -5
**Viewing:** Viewing world co-ordination system, Normalized co-ordinate system, Device/Image co-ordination system, Window definitions, View port definitions, Viewing transformation.

**Clipping:** Point clipping, Line clipping, Cohen- Sutherland clipping, Mid point clipping method, Sutherland and Hodgman Clipping.

**Note:** All the algorithms are to be practiced in the computer Programming Laboratory and practice any computer aided drafting software.

**Text Books:**

**Reference Books:**
2. CAD-CAM Theory and Practice-Ibrahim Zeid- TMH Publication.
EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)

1. To develop the concept of Computer Graphics in C
2. DDA Line drawing algorithm
3. Bresenham’s Line drawing algorithm
4. Bresenham’s Circle drawing algorithm
5. Mid point circle drawing algorithm
6. Bezier curve
7. Cohen Sutherland Clipping algorithm
8. Mid point clipping algorithm
9. Mid point Ellipse drawing algorithm
10. Matrix Multiplication
11. 2-D Transformation (Move, Rotate, Scale)
12. Cubic Spline
UNIT-I

UNIT-II
Fluid kinematics: Description of fluid motion, Langragian and Eulerian approach, Type of fluid flow, Type of flow lines-path line, S treak line, S tream line, S tream tube, Continuity equation, Acceleration of a fluid particle, Motion of fluid particle along curved path, Normal and tangential acceleration, Rotational flow, Rotation and Vorticity, Circulation, Stream and potential function, Flow net, Its characteristics and utilities, Vortex motion.

UNIT-III
Fluid dynamics: Euler’s Equation, Bernoulli’s equation and its practical application, Venturimeter, Orifice meter, Nozzle, Pitot tube, Impulse momentum equation, Momentum of Momentum equation, Kinetic energy and Momentum correction factor. Reynold’s transport theorem.

UNIT-IV
Laminar & Turbulent flow: Reynold’s experiment, Shear stress and pressure gradient relationship, Flow of viscous fluids in circular pipe and between two parallel plates, Coutte flow, Shear stress & velocity distribution for turbulent. Flow through pipes: Loss of energy in pipes, Hydraulic gradient and total energy line, pipe in series and parallel, Equivalent pipe power transmission through pipe, Water hammer in pipes.

UNIT-V
Internal flows: Friction factor, Darcy-Weisbach friction factor, Moody’s diagram, Boundary Layer theory, Boundary layer equation, Laminar and turbulent boundary layer and its growth over flat plat. Momentum boundary layer and its solutions, separation of boundary layer and its control. Dimensional analysis: Methods of dimensional analysis, Rayleigh’s method, Buckingham’s theorem, Limitations, Model analysis, Dimensionless number and their significance, model laws, Reynolod’s model law, Fraude’s model law, Euler’s model law, Weber’s model law, Mach’s Model law.

REFERENCE BOOKS
1. Fluid Machines by M. Manohar
2. Hydraulics & Hydraulic Machines by Dr. Jagdish lal (Metropolitan)
3. Hydraulics & Hydraulic Machines by Priyani.
**TEXT BOOK:**
1. Fluid Mechanics by Dr. M.L. Mathur (Std. Publications).
2. Taral Yantriki Avum Machinery (Hindi) by G.B. Bamanker. (Deepak Prakashan, Gwalior).

**EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)**
1. To determine the meta-centric height of a ship model.
2. To verify Bernoulli’s Theorem.
3. To verify Impulse Momentum Principle.
4. To calibrate a Venturimeter and study the variation of coefficient of discharge.
5. To calibrate an orifice-meter.
6. Experimental determination of critical velocity in pipe.
7. To determine of head loss in various pipe fittings.
9. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds’ number.
10. To determine the hydraulic coefficients (Cc, Cd and Cv) of an orifice.
11. To determine the coefficient of discharge of a mouth piece.
12. To obtain the surface profile and the total head distribution of a forced vortex.
13. To study the velocity distribution in pipe and to compute the discharge by integrating velocity profile.
14. To study the variation of friction factor for pipe flow.
15. To determine the roughness coefficient of an open channel.
UNIT-I

UNIT-II
Relative Acceleration: Synthesis of mechanism, Pantograph, Lower pair mechanism, Relative acceleration diagram, Kliens construction, Coroillis component of acceleration.

UNIT-III
(a) Inertia force analysis: Effective force and inertia force on link, Inertia force on reciprocating engine. Inertia force in four bar chain mechanism.
(b) Turning moment diagram and flywheel: Turning moment diagram for single and multi cylinder internal combustion engine, Coefficient of fluctuation of speed. Coefficient of fluctuation of energy. Flywheel.

UNIT-IV

UNIT-V
(a) Friction: Friction in turning pair, Application of friction circle in slider crank and four mechanism, Pivot and collar friction, Thrust bearing.
(b) Brakes and dynamometer: Simple block and shoe brake, Band brake, Band and block brake, and internal expanding shoe brake, Absorption dynamometer, Transmission dynamometer.

Text Books:

Reference Books:
2. Theory of Machine – Shigley, JE
3. Theory of Machine Jagdish Lal
EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)
1. To determine the jump phenomena of cam follower apparatus.
2. To draw displacement, velocity and acceleration curve of cam motion.
3. To find out the load carrying capacity of bearing.
4. To find out the Coefficient of friction of bearing.
5. To find out the frictional horse power of bearing.
6. To find out the Pressure around the bearing by journal bearing apparatus.
7. To measure co-efficient of friction, power transmitted with varied belt tension by slip & creep apparatus.
8. To find out the percentage slip at fixed belt tension by varying load with slip & creep apparatus.
9. To find out belt slip and creep by slip and creep measurement apparatus.
10. To verify the corioli’s component of acceleration with theoretical and practical results.
11. To find the speed and torque of different gear in an epicyclic gear train.
12. To find the speed and torque of different gear in a simple, compound and reverted gear train.
13. Study and analysis of Pantograph.
14. To study Four-bar mechanism and its inversions.
15. To study internal expanding and external contracting shoe brakes.
16. To study rope brake dynamometer and calculation of torque and power.
UNIT I:
Drawing conventions; drawing and dimensioning IS codes, sectional views and sectioning, surface finish and tolerances, representation of machine parts such as external and internal threads, slotted heads, square ends, and flat radial ribs, slotted shaft, splined shafts, bearings, springs, gears. Rivet heads and Riveted joints, types of welded joints and representation.

UNIT II
Assembly Machine Drawing: Basic concept, plotting technique, assembly and blow up of parts, bill of materials, product data; Cotter and Knuckle joints, pedestal and footstep bearings, crosshead, stuffing box, IC engines parts – piston and connecting rods; lath machine parts.

UNIT III
Introduction to Computer Aided Drafting software for 2D and 3D Modeling, Basic design concepts, design process, stages/phases in design, flowchart, problem formulation, design considerations (strength, manufacturing, maintenance, environment, economics and safety); design for recycle and reuse, Design and safety factors for steady and variable loads, impact and fatigue considerations, reliability and optimization, standardization in design..

UNIT IV
Design of components subject to static loads: riveted joints, welded joints threaded joints, pin, key knuckle, and cotter joints

References:
1. Bhat, ND; Machine Drawing; Charotar
2. Singh A; Machine Drawing; TMH
4. Agarwal and agrawal; Engineering Drawing; TMH
5. Shigley JE et al; Mechanical Engineering Design, TMH
7. Kulkarni SG; Machine Design; TMH
8. Mubeen and Mubeen; Machine Design.
9. Bhandari VB; Design of Machine elements; TMH
10. Sharma PC, Agarwal DK; Machine Design; Katson
11. Luzzader WJ, Duff JM; Fundamental of Engg Drawing Interactive Graphics; PHI.
12. PSG Design data book
13. Mahadevan and Reddy’s Mechanical design data book

List of Experiments:
1. Computer Aided Drafting of simple machine parts
2. 3D modeling of simple solid shapes
3. Design and drawing of parts contained in the syllabus
UNIT – I

Foundry Practice Pattern making - Types, material, allowances, core – types, materials and its properties.

Mould Making and Casting - Types of sand moulding, design considerations, moulding machines & moulding procedure, moulding sand – types, properties, composition and applications. Casting defects.

Special Casting Processes: Investment casting, centrifugal casting, shell moulding, CO2 moulding, slush casting, die casting.

UNIT – II
Welding: Principles of Welding, survey and allied processes

Arc Welding: TIG and MIG processes and their parameter selection, atomic hydrogen welding, welding of cast iron, welding electrode – types, composition, specification.


UNIT – III: Machine Tool Technology
Cutting Tool – Types, requirements, specification & application

Geometry of Single Point Cutting Tool – Tool angel, Tool angle specification system, ASA, ORS and NRS Mechanics of Metal Cutting: Theories of metal cutting, Chip formation, types of chips, chip breakers, Orthogonal and Oblique cutting, stress and strain in the chip, velocity relations, power and energy requirement in metal cutting.

UNIT – IV: Machine Tools
Lathe: Introduction, type, specification, construction, work holding devices & tools, mechanism and attachments for various operations, taper turning, thread cutting operations, capston and turret lathe.

Shaper: Introduction, type, specification, Quick return Mechanisms, Table feed mechanism, work holding devices, shaper operations.

Slotter & Planner: Introduction, specification, types of drives, types of machines.


UNIT – V
Drilling: Introduction, drill nomenclature, types of drilling machines, other operations like counter boring, counter sinking, spot facing etc.

Reaming: Introduction, description of reamers, type of reaming operations.

Boring: Introduction, types of boring machines, boring operations, boring tools

Broaching: Introduction, types of broaches, nomenclature of broach, types of broaching machines.

Surface finishing operations: Honing, lapping, super finishing, polishing, buffing, process parameters and attainable grades of surface finish.
Text Books:

Reference Books:

EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)
Shaper Machine
1. Study of Quick Return Mechanism and Table feed mechanism.
2. V groove in C.I. Block.

Milling Machine
3. Study of indexing mechanism (simple and differential)
4. Study of different milling cutters and operations.(End cutter, Face cutter & T-Slot cutter)
5. Gear Cutting

Lathe
7. Facing, straight turning, step turning & taper turning.
8. Thread cutting and knurling.
9. Boring

Welding
11. Joining of metals by Arc welding
12. Joining of metals by Spot welding (Metallic sheets)
13. Joining of metals by Soldering & Brazing (Metallic wires)
14. Joining of metals using MIG welding (Metallic plates)

Molding
15. Preparation of solid & split pattern.
16. Preparation of non-ferrous casting using solid and split pattern.

Advanced Fitting
17. Drilling, Filing tapping and assembly of casting produced on a base plate.
UNIT - 1 : HISTORICAL DEVELOPMENT

UNIT - 2 : PLANNING

UNIT - 3 : ORGANISING

UNIT - 4 : DIRECTING

UNIT - 5 : CONTROLLING
System and process of Controlling - Requirements for effective control - The Budget as Control Technique - Information Technology in Controlling - Use of computers in handling the information - Productivity - Problems and Management - Control of Overall Performance - Direct and Preventive Control - Reporting - The Global Environment - Globalization and Liberalization - International Management and Global theory of Management.

TEXT BOOKS

REFERENCES
UNIT-I
**General Considerations:** Selection of Materials, Design Stress, Factor of Safety, Stress concentration factor in tension, bending and torsion, Theories of failures. Notch sensitivity, Design for variable and repeated loadings, Fatigue stress concentration factor, Endurance diagrams, Introduction to fracture mechanics.

UNIT-II
**Basic Elements Design:** Types of keys and Splines, Design of Socket-Spigot, Cotter joint, Sleeve and Cotter joint, Gib and Cotter joint, Design of Knuckle joint, Design of Splines.
**Couplings:** Types of couplings, Design of flange and flexible couplings, Compression coupling, Muff coupling.
**Shaft and Axles:** Transmission shaft, Design against static load, Design for strength, Rigidity and stiffness, Design under continuous loading for fatigue.

UNIT-III
**Threaded fasteners:** Geometry of thread forms, Terminology of screw threads and thread standards, Specifications of steel bolts, Initial tension, Relation between bolt tension and torque, Design of statically loaded tension joints, Design of bolted joints due to eccentric loading.
**Power Screws:** Power screws, Force analysis for square and trapezoidal threads, Collar friction, Stresses in screw, Coefficient of friction, Efficiency of thread, Design of power Screw.

UNIT-IV
**Riveted Joints:** Types of rivet heads, Types of riveted joints, Failure of riveted joint, Strength of rivet joint, Efficiency of riveted joint, Design of riveted joint, Eccentrically loaded riveted joint.
**Welded joint:** Types of welded joints, Stresses in butt and fillet welds, Strength of welded joints, Location and dimension of weld design, Eccentrically loaded joint, Welded joint subjected to bending moment, Design procedure, Fillet welds under varying loads, Stress relieving techniques.

UNIT-V
**Pulley & Flywheel:** Flywheel Inertia, Stresses in Flywheel and pulleys, failure criterion.
**Chain Drives:** Chain drives, Roller chains, Geometric relationships, Dimensions of chain components, Polygonal effect, Power rating of roller chains, Selection of Chain drives.
**Belt & Rope Drive:** Design of Flat and Round belt drives, V-Belt, Timing belt, Wire Rope.

**Text Book:**
2. Design of Machine Elements by V.B. Bhandari, TaTa McGrahill, New Delhi
B.Tech. (Mechanical Engg.)
V Semester
MECHANICS OF SOLID-II

Unit-I

Energy Methods: Introduction, Principles of superposition, Strain energy, Reciprocal relations, Maxwell Betti theorem, Elastic strain energy in tension and compression, Strain energy in beams subjected to bending and shafts to torsion. Impact loading in tension and bending, first & second theorem of Castigliano and its applications.

Unit-II

Fixed Beams: Fixed beam subjected to different types of loads and couples, Calculations of fixing moments and reactions at supports, deflection. Effect of sinking of support.
Continuous beams: Continuous beams subjected to different type of loads and couples, beams with overhang, beams with one end fixed, Clapeyron’s theorem. Effect of sinking of supports.

Unit-III

Bending of curved bars: Stresses in bars of small initial curvature, Winkler-Bach theory, Stresses in bars of large initial curvature, Deflection of Crane hooks, Chain links, circular rings, stresses in circular rings.

Unit-IV

Unsymmetrical Bending: Introduction to unsymmetrical bending, Stresses and deflection in unsymmetric bending, Shear center for angle, Channel and I-sections.
Columns: Struts and Columns, Stability of columns, Euler’s formula for different end conditions, Equivalent load, Eccentric loading, Rankine’s formula.

Unit-V

Thin Pressure Vessel: Thin Pressure Vessels, Circumferential and longitudinal stresses in thin cylindrical shells and thin spherical shell under internal pressure,
Thick Pressure Vessel: Stresses in thick and compound cylinders.

Text Books

Reference Books:
UNIT- I

UNIT – II
Gear: Types of gears, Gear terminology, Law of gearing, Gear tooth forms, Involute and Cycloid tooth profile, Interference and Undercutting of Involute teeth, Minimum number of teeth on pinion to avoid interference. Gear trains: Simple, Compound, Reverted, and Epicyclical gear trains, computation of velocity ratio in gear trains by different methods.

UNIT - III

UNIT- IV
Gyroscope: Gyroscopic forces and couple, Gyroscopic effect in Airplanes, Ship motion and Vehicles moving on curved path.

UNIT- V

Text Books:
2. The Theory of Machines - Thomas Bevan, - CBS/ Cengage Publishers

Reference Books:
EXPERIMENTS TO BE PERFORMED (MINIMUM TEN EXPERIMENTS)
1. To find out the oscillations of simple pendulum with universal vibration apparatus.
2. To find out the oscillations of Compound pendulum with universal vibration apparatus.
3. To find out the radius of gyration of bi-filler suspension with universal vibration apparatus.
4. To find out undamped torsional vibrations of single rotor system with universal vibration apparatus.
5. To find out the frequency of damped torsional vibration of single rotor system with universal vibration apparatus.
6. To measure the frequency of torsional vibrations of single rotor system with universal vibration apparatus.
7. To measure the frequency of torsional vibrations of double rotor system with universal vibration apparatus.
8. To find out free vibration of helical coiled spring with universal vibration apparatus.
9. To study forced damped vibration of a spring mass system and simple supported beam with universal vibration apparatus.
10. To find out the Gyroscopic couple and prove the Gyroscopic law with Gyroscope apparatus.
11. To find out the Power and effort of Proel, Porter & Hartnell Governor with Governor Apparatus.
12. To find out the critical speed for different diameters of shaft by whirling of shaft apparatus.
13. To verify the static and dynamic balancing for different planes and masses by balancing apparatus.
B.Tech. (Mechanical Engg.)

V Semester

INTERNAL COMBUSTION ENGINE

Unit-I


Cycles: Reasons for deviation of actual cycle from air standard cycles, Variation specific heats and cycle analysis, Fuel air cycles and their analysis, Actual cycles and their analysis, Purpose and Thermodynamic cycle of supercharging.

Unit-II


Liquid alternative fuels: vegetable oils, biodiesel, emulsified fuels. Gaseous alternative fuels-hydrogen, CNG, LPG


Unit-III

Carburetor: Properties of air-petrol mixtures, Mixture requirement, Simple carburetor, limitation of simple carburetor, Modern carburetor, Main metering system, Idling system, Economizer system, Acceleration pump and cold starting system. Nozzle lip, Venturi depression, Calculation of fuel jet and venturi throat dia for given air fuel ratio. Petrol Injection system, Electronic fuel injection, advantage and disadvantage of petrol injection, Multi point Fuel Injection System.

Unit-IV

Ignition System: Battery and magneto ignition system and their comparative study, Spark plug heat range, Electronic ignition system, Firing order, Ignition timing, Centrifugal and vacuum ignition advance.

Injection System: Requirement, type, Fuel pump, Type of fuel injector, Type of nozzle, Atomization, Spray penetration and spray direction, Multiple point fuel injection system.

Cooling System: Cooling requirement, Air cooling, liquid cooling, Type of liquid cooling system, Advantage and disadvantage of air cooling and water cooling system, Antifreeze mixture.

Lubrication System: Function of lubricating system, Properties of lubricating oil, Wet sump, Dry sump and mist lubrication system.

Unit-V


**Emission and Pollution:** SI Engine and CI Engine emissions and its control and comparison. Effect of pollution on Human health and bio sphere

**Text Books:-**
2. Internal Combustion Engine – V. Ganeshan – TMH

**Reference Books:-**

**LIST OF EXPERIMENTS TO BE PERFORMED (MINIMUM SIX EXPERIMENTS AND FOUR STUDIES)**

1. Study of IC Engine models
2. Study of working of four stroke petrol engine and four stroke diesel engine with the help of cut section models.
3. Study of working of two stroke petrol and two stroke diesel engine with the help of cut section models.
4. Study of fuel supply system of a petrol engine (fuel pump and simple carburettor)
5. Study of complete caurburettor (Solex caurburettor)
7. Study of fuel supply system of a Diesel engine (fuel pump and fuel injector)
8. Study of Ignition systems of an IC Engine (Battery and Magneto ignition system) and Electronic ignition system.
9. Study of Lubrication system of an IC Engine (mist, splash and pressure lubrication)
10. Study of cooling systems of an IC Engine (air cooling and water cooling)
11. To conduct a performance test on diesel engine to draw heat balance sheet for given load and speed
12. To determine friction power of diesel engine by Willan’s line or fuel rate extrapolation method.
13. To conduct a performance test on the variable compression ratio engine and to draw the heat balance sheet for given compression ratio, speed and load and plot the performance curves.
14. To conduct a performance test on a four cylinder four stroke petrol engine and to draw the heat balance sheet and performance curves.
15. To calculate the indicated power, friction power and mechanical efficiency of four stroke four cylinder petrol engine at full load and rated speed by Morse test.
16. To draw the valve timing diagram of a Four stroke S.I. or C.I. Engine using experimental setup.
B.Tech. (Mechanical Engg.)
V Semester
FLUID MACHINERY

Unit-I
Impact of Free Jets: Impulse momentum principle, Force exerted by the jet on stationary flat and curved plate, Hinged plate, Moving plate and Moving curve vanes, Jet propulsion of ship.
Flow around submerge bodies: Force exerted by flowing fluid on a body, Drag and lift, stream lined and bluff body, Drag on sphere and cylinder, Circulation and lift on circular cylinder, Lift of an air foil.

Unit-II
Introduction to turbo machinery, Basic principles, Classification, Impulse & Reaction type, Fundamental equations, Euler’s equation, Introduction to hydro-electric power plants, major components, Surge tanks etc.
Impulse Turbine: Classification of turbine, Impulse turbine, Pelton wheel, Construction working, work done, Head efficiency and Design aspects, Governing of impulse turbine.

Unit-III
Reaction Turbine: Radial flow reaction turbine, Francis turbine: construction, working, work done, efficiency, design aspect, advantages & disadvantages over pelton wheel.
Axial flow reaction turbine: Propeller and Kaplan turbine, Bulb or tubular turbine, Draft tube, Specific speed, Unit quantities, Cavitation, Degree of reaction, Performance characteristics, Surge tanks, Governing of reaction turbine.

Unit-IV
Centrifugal Pumps: Classification of Pumps, Centrifugal pump, Construction, working, Work done, Heads, Efficiencies, Multistage centrifugal pump, Pump in series and parallel, Specific speed, Characteristic, Net positive suction head, Cavitation.

Unit-V
Reciprocating Pumps: Classification, Component and working, Single acting and double acting, Discharge, work done and power required, Coefficient of discharge, Indicator diagram, air vessels.

Text Books:

Reference Books:
EXPERIMENTS TO BE PERFORMED (MINIMUM SEVEN EXPERIMENTS AND THREE STUDIES)
1. Performance characteristics of Pelton wheel turbine.
2. Performance characteristics of Francis turbine.
3. Performance characteristics of Kaplan turbine.
4. Performance characteristics of variable speed centrifugal pump.
5. Performance characteristics of rated speed centrifugal pump.
6. Performance characteristics of multistage centrifugal pump.
7. Study of Wind Tunnel (Open Circuit blower type)
8. Determination of Lift and drag force over an air foil.
9. To study the working of fluidic devices (Analog and Digital)
10. To study the Hydraulic Accumulator
11. To study the Hydraulic Intensifier
12. To study the Hydraulic Crane
13. To study the Hydraulic lift
14. To study the Hydraulic Ram
15. To study the Jet Pump
16. To study the Air Lift Pump
17. To determine the coefficient of discharge of a Venturi-flume.
UNIT-I

**Introduction:** Various modes of heat transfer, Fourier’s, Newton’s and Stefan Boltzman’s Law, Combined modes of heat transfer, Thermal transfer, Thermal diffusivity, Overall heat transfer coefficient.

**Conduction:** The thermal conductivity of solids, Liquids and gases, Factors influencing conductivity measurement. The general differential equation of conduction, One dimensional steady state conduction, Linear heat flow through a plane and composite wall, Tube and sphere, Critical thickness of insulation, Effect of variable thermal conductivity, Conduction with heat generation in slab and cylinders, Spheres.

UNIT-II

**Fins:** Conduction convection system, Extended surfaces rectangular, Triangular, Circumferential and pin fins, General conduction analysis, Fins of uniform and non-uniform cross sectional area. Heat dissipated by a fin. Effectiveness and efficiency of fins, Approximate solution, Design of fins for maximum heat transfer, Solution for different boundary condition, Use of fin analysis for measuring temperature error of Thermometer.

**Transient/Unsteady State Heat Conduction:** System with negligible internal resistance, Lumped capacity method and its Validity. Unsteady state conduction through finite and semi-infinite slab without surface resistance, convection boundary conditions. Solution through Heisler’s chart.

UNIT-III

**Forced Convection:** Physical Mechanism of Forced Convection, Dimensional analysis for forced convection, velocity and Thermal Boundary layer, Flow over plates, Flow across cylinders and spheres, Flow in tubes, Reynold’s analogy.

**Natural Convection:** Physical Mechanism of Natural Convection, Dimensional analysis of natural convection; Empirical relationship for natural convection.

UNIT-IV

**Two Phase Heat Transfer:** Boiling heat transfer, Pool boiling, Boiling regimes and boiling curve, Next transfer correlations in pool boiling, Condensation heat transfer, Film condensation, Derivation for the average heat transfer coefficient ‘h’ for the case of laminar film condensation over vertical plate, Heat transfer correlation for inclined plates, Vertical tubes, Horizontal bank tubes.

**Heat Exchangers:** Different types of heat exchangers; Determination of heat exchanger performance, Heat exchanger transfer units, Analysis restricted to parallel and counter flow heat exchanger (LMTD and NTU method)
UNIT-V


**Introduction to Mass Transfer:** Mass and mole concentrations, Molecular diffusion, Eddy diffusion, Molecular diffusion from an evaporating fluid surface, Introduction to mass transfer in laminar and turbulent convection Combined heat and mass transfer, the wet and dry bulb thermometer.

**Text Books:**

**Reference Books:**

**EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)**
1. To Determine Thermal Conductivity of Insulating Powders.
2. To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).
3. To Measure the thermal Conductivity of Liquid.
4. To determine the transfer Rate & Temperature Distribution For a Pin Fin.
5. To Measure the Emmissivity of the Test plate Surface.
6. To Determine Stefan Boltzman Constant of Radiation Heat Transfer.
7. To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection.
12. To Find the Heat transfer Coefficient in Forced Convection in a tube.
13. To determine the total thermal conductivity and thermal resistance of the given compound resistance in series.
14. To find out the thermal conductivity of given slab material.
15. To determine the individual thermal conductivity of different lagging in a lagged pipe.
16. To study the rates of heat transfer for different materials and geometries
17. To understand the importance and validity of engineering assumptions through the lumped heat Capacity method.
UNIT – I
Forging: Principle, types, tools and fixture of forging, forging dies, forging machines, forging design, drop forging die design, upset forging die design, forging practice and process capability, forging defects, Inspection and testing of forged parts.
Extrusion: Principle, extrusion processes, process parameters, extrusion equipment, extrusion defects.

UNIT – II
Rolling: Principle, classification of rolled products, types of rolling, rolling mill train components, roll pass design for continuous mill.
Drawing: Wire drawing, tube drawing: Principle, setup, types.

UNIT – III
Machinability: Concept and evaluation of Machinability, Mechanism of Tool failure, Tool wear mechanism, Tool life, Taylor’s Tool life equation, Machinability index, factors affecting Machinability.
Thermal Aspects in Machining and Cutting Fluid: Source of heat in metal cutting and its distributions, temp measurement in metal cutting, function of cutting fluid, types of cutting fluid.
Jigs & Fixtures: Degree of freedom, principles of location and clamping, locating, clamping and indexing devices, principles of design, design of simple jigs and fixtures.

UNIT – IV
Grinding: Processes, machines, design consideration for grinding, specification of grinding wheel, process parameters, economics of grinding.

UNIT – V
Unconventional Machining: Advantages, application and limitation, mechanics of metal removal, specific application of following processes - EDM, ECM, USM, EBM and LBM.
Thread Rolling: Principle, Processes, Types of Thread Rolling, and Grinding, advantages and disadvantages.

TEXT BOOKS:

Reference Books:
2. Production Technology – R.K. Jain – Khanna Publisher – New Delhi
UNIT I

General Linear Programming Problems: Introduction, Maximization and minimization of function with or without Constraints, Formulation of a linear programming problem, Graphical method and Simplex method, Big M method, Degeneracy, Application of Linear Programming (LPP) in Mechanical Engineering.

UNIT – II
The Transportation Problems: Mathematical formulation, Stepping stone method, Modified Distribution Method, Vogels Approximation Method, Solution of balanced and unbalanced transportation problems and case of Degeneracy.


UNIT - III
Waiting Line Theory: Basic queuing process, Basic structure of queuing models, Some commonly known queuing situations, Kendall’s notation, Solution to M/M/1: ∞/FCFS models.

Network Analysis: CPM/PERT, Network Representation, Techniques for drawing network, Resource smoothing and levelling, Project cost, Optimum project duration, Project crashing, Updating, Time estimation in PERT

UNIT – IV
Decision Theory and Game Theory: Decision making, Steps in decision theory approach, Decision making under certainty, Uncertainty and under condition of risk, Decision Tree, Theory of Games, Two person zero sum game, Methods for solving two person zero sum game.

Simulation: Basic concept of simulation, Applications of simulation, Merits and demerits of simulation, Monte Carlo simulation, Simulation of Inventory system, Simulation of Queuing system.

Text Books:
1. Operation Research, Sasien Yaspan
2. Operation Research – N. D. Vohra – TMH
UNIT-I
Production Management: Definition, Objectives, Scope, Benefits, Functions of production management, Place of production management in an organization, Types of production system, Product life cycle, Product design and development, production cycle.
Costing and Cost Analysis: Elements of costs, Break even analysis, Incremental costs, make or buy decision.
Sales Forecasting: Purposes, Methods – Delphi, Linear regression, Economic indicators, Time-series analysis, Adjustment for seasonal variations, Moving average, Exponential smoothing.

UNIT-II
Material Management: Objectives and functions of materials management, Organization of materials management, MRP I and MRP II.
Procurement: Objectives of purchase department, Purchase responsibilities and organization, Types of purchasing, Purchase procedures, Import and Export.
Stores Keeping: Stores management, Functions of stores, Classification of materials, Standardization of materials, Identification and maintenance of layout of stores, Physical control of materials, Pricing of stores, Issuing of stores.

UNIT-III
Production Planning and Control: Functions, Organization, Master Scheduling, Aggregate planning and strategies, Materials requirement planning, Product structure tree, Routing, Loading, Scheduling – forward and backward, Dispatching – priority rules, Sequencing, Johnson’s algorithm for n jobs and two machines, Gantt’s chart, Bar chart, Flow process chart.
Materials Handling: Principles of materials handling, Unit load, Types of materials handling equipment, Relation between materials handling and plant layout.

UNIT – IV
Inventory Control: Objective, Scope and functions of inventory control, Inventory control techniques, Economic ordering quantity, Periodic ordering quantity, A.B.C. analysis, General idea regarding inventory control under risk and uncertainty.
Supply Chain Management: Introduction, Definition of supply Chain, Major derivers of supply chain, Supply Chain Strategies, A model for strategy formulation in SCM. Information Systems in supply chain.

UNIT – V
Quality Control: Difference between inspection and quality control, Acceptance sampling, Procedure’s risk and Consumer’s risk, Operating characteristic curve for single sampling plan, AOQL Quality of conformance, Quality of design, Economics of quality, SQC charts for variables and attributes.

Text Books:
2. Industrial Engineering & Production Management – Martand Telsang – S. Chand & Co.,
Reference Book:
2. Quality Planning and Analysis, Juran and Gryna
3. Production and operations Management by – Adam and Ebert – PHI –
UNIT – I

UNIT – II
Impulse Reaction Turbine: Velocity diagram, Degree of reaction, Impulse-reaction turbine with similar blade section and half degree of reaction (Parson’s turbine), Height of reaction Turbine blade section, Internal losses in steam turbine Nozzle, Losses, Blade friction losses, Disc friction losses, Blade windage losses or partial admission losses, Gland leakage or clearance losses, Leaving velocity or residual loss, Carry loss.

UNIT – III
State Point Locus and Reheat Factor: Factor-Stage, Efficiency of impulse turbines, Stage point locus of an impulse turbine, State point locus for multistage turbine reheat factor. Internal efficiency, Overall Efficiency, Relative efficiency, Governing of steam turbine. Throttle governing, Nozzle governing, Bypass governing, Combination of throttle and nozzle, Governing and combination of bypass and throttle governing. Effect of governing on the performance of steam turbine.

UNIT – IV
Gas Turbine: Classification of gas turbine, Simple open cycle gas turbine, Ideal and actual cycle (Brayton Cycle) for gas turbine, Optimum pressure ratio for maximum specific output in actual gas turbine, Regeneration, Reheat and inter cooling and effect of these modification on efficiency and output, Closed cycle gas turbine.

UNIT – V

Text Books:

Reference Books:
1. Turbine compressors and Fans – S.M. Yahya – TMH
2. Gas Turbine – V. Ganeshan – TMH
UNIT-1
Spur gears: Introduction, Types of failure, design requirements, gear terminology, design analysis, stress concentration, dynamic load, surface compressive stress, beam strength, plastic deformation, gear materials, design procedure, design as recommended by AGMA. Gear Lubrication.

UNIT-2
Helical Gears: Terminology of Helical Gears, Virtual number of teeth, Tooth proportions, Force analysis, Beam strength, Effective Load on gear tooth, design procedure.
Bevel Gears: Terminology of Bevel Gears, Force Analysis, Beam strength, effective load on gear tooth, design procedure, design as recommended by AGMA.

UNIT-3
Rolling Contact Bearings: Types of ball and roller bearing, Selection of bearing for radial and axial load, Bearing life, design procedure, mounting and lubrication.

UNIT-4
Spring: Spring Materials and their Mechanical Properties, Equation for stress and deflection, Helical coil springs of circular section for tension, compression and torsion, Dynamic loading, Fatigue loading, Wahl line. Leaf spring and disc springs.

UNIT-5
Brakes: Introduction, Block Brake, design procedure, Internal Expanding Shoe Brake, design procedure, Band brakes, design procedure, Disc brake, design procedure.
Clutches: Introduction, Friction materials, Torque transmitting capacity, Single & Multiple plate clutch, Centrifugal clutches, Cone clutch.

Text Books :-

Reference Books :

EXPERIMENTS TO BE PERFORMED
Each student shall submit two-assembly design report along with the drawing for assembly/sub assembly for any mechanical system consisting of not less than four machine elements included in the syllabus.
UNIT-I

**Introduction:** Introduction of CAD/CAM, Definition of CAD & CAM Tools, CAD/CAM Tools based on their constituents and their implementation in a design environment, Benefits of CAD/CAM. 2D & 3D Transformations, Perspective and Parallel Projection, Hidden surface Removal.

**Geometric Modeling of Curves:** Parametric and Non-parametric, Explicit and Implicit, Representation of curves. **Analytical Curve:** Line, Circle, Conics. **Synthetic curve:** Hermite Cubic Splines, Bezier Curves, B-Spline Curves.

UNIT-II


**Solid Modeling:** Solid modeling techniques, Geometric and Topology, Valid solid, Types of solid modeling, Algorithms, Basic set theory, Solid Representation Schemes. CSG representation, 3D base primitives, Unary Operation, Boolean’s Operation, Sweeping Operation and CSG tree.

UNIT-III


UNIT IV

**Group Technology:** Introduction to group technology, Part families, Part and classification, Three Parts Classification & Codes system, Group technology Machine cell design, Benefits and Limitation of Group technology.

**Data base Management:** Design Database concept, Objective, Data structures, Creation of Data Files in application Program and relational Database management system.

UNIT-V

**Computer Aided Design of Planer Mechanism:** Kinematic synthesis, Type, Number, Dimension Synthesis: Function generation, Path generation, Motion generation, Approximate synthesis and Tchebyshev’s spacing of accuracy points, Freudenstein’s equation for four bar link mechanism and slider crank mechanism by displacement method and vector method; Angular velocities and acceleration, coupler curves.
Text Books:
2. CAD/CAM-Milkel P. Groover, Emory W.Zimmer-Pearson Education
3. Theory of mechanism and Machine-Ghosh and Malik-EWP

Reference Books:
1. Computer numeric control-T.Jeyapoovan, Robert Quesada-Pearson Education

EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)
1. Introduction to integrated development environment of AutoCAD release 2000 or higher version
2. Basic drawing commands example: - LINE, POLYLINE, MULTILINE, POLYGON, CIRCLE, ELLIPSE, etc.
3. Basic editing commands e.g. - COPY, MOVE, ROTATE, MIRROR, CHAMFER, FILLET and array command as well as zoom and pan command.
4. Text command, TEXT, DTEXT, MTEXT.
5. Creation and insertion of blocks
6. Concept of layers and view ports
7. Creation of assembly drawing of stuffing box using above commands.
8. Dimensioning of stuffing box and showing the assembled view and its components in different view ports.
11. Conversion of assembly drawing of stuffing box from 2D to 3D.
12. Placement of 3D assembly drawing of stuffing box and placing views in different view ports
UNIT – I
Introduction: Definition of Industrial engineering, History & development, Objective of Industrial Engineering, Contribution of Industrial Engineering, Function of Industrial engineer, Place of Industrial engineering in an organization, Related discipline, Management, OR, Statistics, Ergonomics.

Plant Location, Site Selection and Plant Layout: Need for a suitable location, Urban, Suburban, Systems approach, Factors affecting location, Quantitative method for evaluation of plant location, Objectives & Principles of plant layout, Types of layout and their suitability, Software packages for layout analysis.

UNIT – II
Work Study: Productivity and work study, Introduction and definition of Work-study, Prerequisites of conducting a work study.


UNIT – III
Industrial Engineering and Information Technology: Role of IT/ IS in Industry, increasing value of Information Technology, IT as a New Business tool, IT as Business Enabler, IT as business driver, Internet worked enterprise, Internet, Intranet and Extranet, Globalization and IT, Competitive advantage with IT.


UNIT IV
Forms of Business Organization: Types of Industrial Enterprise, Sole proprietorship, Partnership form, Joint stock company, Company’s Act, The Capital and Shares, Private and Public Sector.

Trade Union: Meaning and Origin, Objectives of Trade Union, History of Trade Union in India, Laws related to Trade Union.

UNIT V
Maintenance Management: Objectives and need for maintenance, Types of maintenance, Breakdown, Predictive and Preventive Maintenance, Condition based maintenance system.

Equipment replacement policy: Reasons for replacement, Deterioration, Obsolescence, Depreciation, Methods for depreciation calculation.

Value Engineering & Value Analysis: Definition, Objectives & use of value analysis, Application & techniques.

Text Books:
1. Introduction to Work Study : International Labour Organization Geneva
2. Industrial Engineering and Production Management - Martand Telsang – S Chand & Company

Reference Books:
1. Industrial Engineering & Management –A new perspective, Philip E Hicks, Mcgraw Hill
EXPERIMENTS TO BE PERFORMED (MINIMUM TEN EXPERIMENTS)

1. To prepare the charts & diagrams for a selected problem according to the existing method and an improved method - men type flow process chart.
2. To prepare the charts & diagrams for a selected problem according to the existing method and an improved method - material type flow process chart.
3. To prepare the charts & diagrams for a selected problem according to the existing method and an improved method - machine type flow process chart.
4. To prepare the charts & diagrams for a selected problem according to the existing method and an improved method - multiple activity chart.
5. Study of principles of fundamentals of hand motion.
6. Study & applications of principles of motion economy.
10. Calculation of allowance for a job.
13. Case study of an industrial/service organization using a method study techniques.
UNIT- I
Fundamentals of vibrations: Simple harmonic motion, combination of two simple harmonic motions, beats, Fourier analysis
Single degree of freedom system: Free un-damped vibrations: Equivalent systems linear and torsional, natural frequency estimation, energy methods
Damped vibrations: Damping models, structural, coulomb, and viscous dampings, critically, under and over-damped system, logarithmic decrement
Forced vibrations: Harmonic excitation, support motion, vibration isolation, critical speeds of shafts in bending

UNIT- II
Two degree of freedom system: Free vibrations of spring coupled system, general solution, torsional vibrations, two degree of freedom mass coupled system, bending vibrations in two degree of freedom system, forced vibrations of an undamped two degree of freedom system, dynamic vibration absorber, forced damped vibrations

UNIT- III
Multi-degree of freedom system: Free un-damped analysis.
Numerical methods: Dunkerley’s, Rayleigh, Holzer methods.
Experimental methods in vibration analysis: Vibration measurement devices and analysers, balancing of rigid rotors

UNIT- IV
Analysis and measurement of sound: One dimensional waves in a gas, sound perception and the decibel scale, the ear, combining sound levels in decibels, octave bands, loudness, weightings, directionality of acoustic sources and receivers, directivity index

UNIT- V
Noise control: Noise criteria, sound absorption and insulation, noise barriers, acoustic enclosures, silencers

TEXT BOOKS
1. Mechanical Vibrations – W.T. Thomson W.T.- Prentice Hill India

REFERENCE BOOKS
1. Mechanical Vibrations – G.K. Grover - S. Chand & CO.
2. Acoustics for Engineers - Turner & Pretlove - Macmillan
4. Industrial Noise Control: Fundamentals and Applications - Bell and Bell, Marcel-Dekker
UNIT-I

UNIT-II
Multi-stage systems: Concept of flash gas removal using flash tank, inter cooling, with flash gas removal and inter cooling, use of flash tank for flash gas removal only, limitations of multi-stage systems.
Multi-Evaporator systems: Applications, Comparison, advantages, Systems using single compressor and a pressure reducing valve with: Individual expansion valves & multiple expansion values, Systems with multi compression, inter cooling and flash gas removal, with individual compressors and multiple expansion valves, Cascade systems.

UNIT-III
Gas Cycle Refrigeration: Limitation of Carnot and reversed Carnot Cycle, Modified Cycle, Reversed Bell-Colemann, Actual Bell-Colemann Cycle, Application of Aircraft Refrigeration, Different methods: Simple, Evaporative, Boot Strap, Boot Strap with evaporative, Reduced ambient, Regenerative and comparison of different air cooling system in Air Craft.
Cooling Tower: Types and performance evaluation, efficient system operation, Flow control strategies and energy saving opportunities, Assessment of cooling towers.

UNIT-IV
Psychrometry, estimating properties of moist air, psychrometry chart, Straight line law, adiabatic saturation and thermodynamic wet bulb temperature, psychrometer and the precautions, psychrometric processes and their representation, various psychrometric processes, equations for heat and mass transfer rates, Concept of SHF, By pass factor and ADP, Air washer and its use.

UNIT-V
Inside and Out Side Design Condition:
Fixing suitable indoor and outdoor design conditions, criteria, thermal comfort, metabolic rate, heat balance equation, equations for all modes of heat losses from the skin, thermo-regulatory mechanism. Factors affecting thermal comfort, thermal indices, presents ASHRE comfort chart, Concept of Predicted Mean Vote (PMV) and percent of people Dissatisfied(PPD),criteria used for selecting outside design conditions and present typical summer design conditions. Psychometric calculations, Simple summer air conditioning system with 100% re-circulated air, various Summer air conditioning systems with ventilation and with zero and non zero by pass factor, with re-heat for high latent cooling load applications, Selection guidelines for supply air conditions.
Text Books:
1. Refrigeration And Air Conditioning by C.P. Arora, Tata McGraw-Hill
2. Refrigeration And Air Conditioning by R.K. Rajput Kaston Publication
3. Refrigeration And Air Conditioning by Arora & Domkundwar, Dhanpat raj Sons

Reference Books:
1. Refrigeration And Air Conditioning by Stooker W.F.
2. Refrigeration And Air Conditioning by Ahmadaul Ameen, PHI publication

EXPERIMENTS TO BE PERFORMED (MINIMUM SEVEN NUMBERS)
1. To study Domestic Refrigerator.
2. To study the Hermetically Sealed Compressor.
3. To study Refrigeration Tutor and to determine the following:
   a. Theoretical coefficient of Performance
   b. Actual Coefficient of Performance
   c. Theoretical capacity of the plant
   d. Actual capacity of the plant.
4. To Study the Mechanical Heat Pump and to determine the following:
   a. Theoretical coefficient of Performance
   b. Actual Coefficient of Performance
   c. Theoretical capacity of the plant
   d. Actual capacity of the plant.
5. To study the Air and Water Heat Pump and to determine the following:
   a. Theoretical coefficient of Performance of the system as a refrigerator and as a heat pump.
   b. Actual Coefficient of Performance of the system as a refrigerator and as a heat pump.
   c. Capacity of the system in tons as a refrigerator.
   d. Capacity of the system in kW as a heat pump under the following conditions of operation:
      i. Water cooled condenser and water-cooled evaporator.
      ii. Water-cooled condenser and air-cooled evaporator.
      iii. Air-cooled condenser and air-cooled evaporator.
      iv. Air-cooled condenser and water-cooled evaporator.
6. To study the following processes on the Air Conditioning Test Rig.
   a. Sensible Heating
   b. Sensible Cooling
   c. Sensible Cooling/cooling dehumidification
   d. Humidification and cooling
7. To Find the Efficiency of Cooling Tower Test Rig.
8. To Study the Simple vapor Absorption System.
9. To study the AC Simulator and to determine the following:
   a. Sensible Heating
   b. Sensible Cooling
   c. COP of R-22
   d. Air Washer Efficiency
   e. Sensible heat load applied
   f. Latent heat load applied
   g. RSHF
   h. ESHF
   i. Creation of different climatic conditions in AC simulator
UNIT-I
Chassis & Frame: Layout of chassis & its main components, Types of frames, Conventional frames & unitized Chassis.
Springs: Purpose, Types namely leaf, Coiled, Rubber, Air, Torsion bar, Stabilizer, Telescopic damper.
Suspension system: Objects & principles of suspension, system, Types, Rigid axle & Independent suspension for front & rear ends, Simple & double arm parallel & perpendicular type of suspension system, Gas filled suspension system.

UNIT – II
Fluid flywheel: Characteristics, Construction, principles of working.

UNIT – III
Gear Box: Object of Gear Box, Air, Rolling & Gradient resistance, Necessity of Gear Box: Tractive effort variation with speed, Types of Gear Boxes: Sliding mesh, Constant mesh, Synchromesh, Automatic transmission, Overdrive, Lubrication of gear box. Torque converter: Principles of working, characteristics, Torque converter with direct drive, Testing of automobiles.

UNIT – IV
Universal Joint, Types, propeller shaft, slip joint.
Front Axle: Live & dead axle, Stub axle.
Back Axle: Hotch kiss drive, Torque tube drive.
Tyres: Types specification, Causes of tyre wear & rim.

UNIT – V
Steering system: Types of steering gears, Reversibility of steering, Center point steering, Steering geometry namely castor, Camber, King pin inclination, Toe in, Toe out, cornering power, Under & over steer; power steering, effect of shimmy, Condition of true rolling, Calculation of turning radius. Correct steering equation and related problems.
Text Books:
2. Automotive Mechanics – Heitner

Reference Books:
1. Automobile Engineering - Dr. N. K. Giri – Khanna Publishers

STUDIES TO BE CARRIED OUT (MINIMUM TEN EXPERIMENTS)
1. Study of Frame and Chassis.
2. Study of Clutches – Single Plate, Multi Plate and Centrifugal
5. Study of Brakes – Mechanical, Hydraulic, Air Brake and Disc Brake.
6. Study of Steering System used with Rigid Axle suspension and independent suspension system, Power Steering
7. Study of different types of springs used in Automobiles.
8. Study of Rigid Axle suspension system.
9. Study of Front Independent Suspension System.
10. Study of Read Independent Suspension System.
11. Study of Battery, Staring and Generating System and Battery Charging System.
13. Study of Educational Car Model.