

# **Faculty of Engineering & Technology**

Study and Evaluation Scheme

Of

**Bachelor of Technology**

**B.Tech. – Mechanical Engineering**

**III & IV Year**

(Applicable w.e.f Academic Session 2013-14)



**AKS UNIVERSITY, SATNA**

Study and Evaluation Scheme

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**Faculty of Engineering & Technology**  
**Department of Mechanical Engineering**  
**B.Tech. (Mechanical Engineering)**

**V Semester**

**TEACHING & EXAMINATION SCHEME**

Sr. No.	Paper Code	Semester- III	L	T	P	Credit	Total Credit
1.	01ME507	Machine Design-I	3	1		4	24
2.	01ME502	Mechanics of solid-II	3	1		4	
3.	01ME503	Dynamics of Machine	3	1		4	
4.	01ME504	Internal combustion engine	3	1		4	
5.	01ME505	Fluid machinery	3	1		4	
1.	01ME551	Dynamics of Machine Lab			2	1	
2.	01ME552	Fluid machinery Lab			2	1	
3.	01ME553	Internal combustion engine Lab			2	1	
4	01ME555	Machine Design-I Lab			2	1	

**Faculty of Engineering & Technology**  
**Department of Mechanical Engineering**  
**B.Tech- (Mechanical Engineering)**

**VI Semester**

**TEACHING & EXAMINATION SCHEME**

	Paper Code	Semester- VI	L	T	P	Credit	Total Credit
1.	01ME601	Operational Research	3	1		4	26
2.	01ME602	Manufacturing Process-II	3	1		4	
3.	01ME603	Turbo Machinery	3	1		4	
4.	01ME604	Production Management	3	1		4	
5.	01ME605	Heat and mass transfer	3	1		4	
1.	01ME651	Manufacturing Process-II Lab			3	2	
2.	01ME652	Heat and mass transfer Lab			3	2	
3.	01ME653	Modeling & Simulation Lab			3	2	

**Faculty of Engineering & Technology**  
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**VII Semester**

**TEACHING & EXAMINATION SCHEME**

Sr. No.	Paper Code	Semester- III	L	T	P	Credit	Total Credit
1.	01ME701	Vibration and noise control	3	1		4	28
2.	01ME702	Refrigeration & Air Conditioning	3	1		4	
3.	01ME703	Machine design-II	3	1		4	
4	01ME704	Automobile Engineering	3	1		4	
5	01ME705	Renewable Energy System	3	1		4	
1.	01ME751	Project-I			8	4	
2.	01ME752	Vibration and noise control Lab			2	1	
3.	01ME753	Refrigeration & Air Conditioning Lab			2	1	
4	01ME754	Automobile Engineering Lab			2	1	
5	01ME755	Industrial Training (Viva Voce)				1	

**Faculty of Engineering & Technology**  
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**VIII Semester**

**TEACHING & EXAMINATION SCHEME**

	Paper Code	Semester- VIII	L	T	P	Credit	Total Credit
1.	01ME801	Industrial Engineering	3	1		4	26
2.	01ME802	Computer aided design and manufacturing	3	1		4	
3.	01MT803	Turbology	3	1		4	
4.	<b>ELECTIVE</b>		3	1		4	
	01ME804	Power plant engineering					
	01CA805	Soft computing					
1.	01ME851	Major Project				8	
2	01ME852	Computer aided design and manufacturing lab			2	1	
3	01ME853/ 854	Elective- Lab			2	1	

## **B.Tech. (Mechanical Engg.)**

### **V Semester**

## **MACHINE DESIGN-I**

### **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:**

1. Machine Design by R.S. Khurmi and J.B. Gupta, S. Chand Publication, New Delhi
2. Design of Machine Elements by V.B. Bhandari, TaTa McGrahill, New Delhi
3. Machine Design by J.E. Shigley, McGrahill Publication
4. Machine Design by Kulkarni, TaTa McGrahill Publication

## **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**

1. Advanced Mechanics of Materials–A.P. Boresi and O.M. Sidebottom–John Wiley & Sons
2. Strength of Materials – G.H. Rider – Macmillan
3. Mechanics of Material – J.M. Gere and S.P. Timoshenko – CBS publisher
4. Strength of Materials – R.K. Rajput – S.Chand & Company

### **Reference Books:**

1. Mechanics of Material – F.P. Bear and E.E. Johnston – McGraw Hill
2. Strength of Material, Vol. I and II – S.P. Timo Shenko – EWP Press
3. Strength of Material – Dr. Sadhu Singh – Khanna Publishers

## **B.Tech. (Mechanical Engg.)**

### **V Semester**

## **DYNAMICS OF MACHINE**

### **UNIT- I**

**Cams:** Classification of cams and followers, Nomenclature of a radial cam, Description of follower movement, Displacement diagrams, Uniform and modified uniform motion, Simple harmonic motion, Uniform acceleration motion and its modifications, Cycloidal motion, Synthesis of cam profile by graphical approach, Considerations of pressure angle.

Cams with specified contours: Circular arc cam & tangent cam.

### **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**

**Balancing:** Balancing of rotating masses, Static and dynamic balancing, Determination of balancing masses in two plane balancing, Balancing of internal combustion engines, Balancing of in-line engines, Firing order, Balancing of V-twin and radial engines, Forward and reverse crank method, Balancing of rotors.

### **UNIT- IV**

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

### **UNIT- V**

**Mechanical Vibrations:** One dimensional longitudinal, Transverse, and torsional vibrations, Natural frequency, Effect of damping on vibrations, Different types of damping. Forced vibration, Forces and displacement, Transmissibility, Vibration Isolation, Vibration sensors: seismometer and Accelerometers, Whirling of shafts with single rotor.

### **Text Books:**

1. Theory of Machine- S.S.Rattan - Tata McGraw Hill
2. The Theory of Machines - Thomas Bevan, - CBS/ Cengage Publishers
3. Theory of Machines – J. E. Shigley – McGraw Hill

### **Reference Books:**

1. Theory of Mechanisms and Machines- A. Ghosh, A. K. Mallik – EWP Press .
2. Theory of Machine – P.L. Ballaney – Khanna Publishers .



## **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**

**Introduction :** Introduction of Internal and external combustion engine and their comparison, four stroke cycle S.I. and C.I. engine, Two stroke engine, Comparison of four stroke and two stroke engines, Comparison of S.I. and C.I. engine, Classification of I.C. engine, Valve timing diagram for S.I. and C.I. engines, Effect of valve timing and engine speed on volumetric efficiency, reasons for ignition and injection advance, Dual fuel, Multi-fuel and Wankel Rotary engine.

**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**

**Fuels:** Basic requirement of I.C. Engine fuels, Requirement of an ideal gasoline, Structure of petroleum, Effect of fuel structure on combustion, Volatility of liquid fuels, Effect of volatility on engine performance for starting, Vapour lock, Acceleration, Percolation, Carburetor icing, and Crank case dilution.

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

**Combustion:** Determination of stoichiometric air fuel ratio, Fuel-air and exhaust gas analysis for a given combustion process. Combustion in S.I. and C.I. engines, Detonation, Pre-ignition, Knocking, Antiknock rating of fuels Octane number, Critical compression ratio, HUCR, performance number, Cetane number, Dopes.

### **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.

**Governing of I C Engine:** Necessity of governing, Various methods of governing.

## **Unit-V**

**Testing and Performance:** Performance parameters, Measurements of brake power, Indicated power, Friction power, Fuel and air consumption, Exhaust gas calorimeter, Calculation of various performance parameter, Heat balance sheet. Performance current for S.I. and C.I. engine with load and speed.

**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:-**

1. A Course in Internal Combustion Engines – M.L. Mathur & R.P. Sharma – Dhanpat Rai & Sons
2. Internal Combustion Engine – V. Ganeshan – TMH

### **Reference Books:-**

1. A Course in Internal Combustion Engine – V.M. Domkundwar – Dhanpat Rai & Sons
2. Internal Combustion Engine – R. Yadav – Central Publishing House, Allahabad
3. Fundamental of Internal Combustion Engine – Paul W. Gill, James H. Smith, Eugene J. Ziurys Oxford and IBH Publishing Company
4. Internal Combustion Engines – R.K.Rajput – Laxmi Publications

## **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)
6. Study of Petrol Injection System.
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.
17. Analysis of engine exhaust gases using Orsat apparatus / gas analyzer.

## **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.

**Fluid system:** Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, Hydraulic crane, Hydraulic lift, Hydraulic Ram, Hydraulic coupling, Hydraulic torque converter, Air lift pump, Jet pump.

### **Text Books:**

1. Mechanics of Fluid – Massey B.S. – English Language Book Society (U.K.)
2. Hydraulic Machines - Jagdish Lal – S.K. Kataria & Sons
3. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som & G. Biswas - TMH

### **Reference Books:**

1. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd.
2. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar– Kataria & Sons
3. Hydraulics and Fluid Mechanics – Modi P.N, Seth S.M. – Standard Book House

**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.

## **B.TECH. (Mechanical Engineering)**

### **VI SEMESTER**

### **HEAT & MASS TRANSFER**

#### **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

**Thermal Radiation:** Introduction, absorption and reflection of radiant energy, Emission, Radiosity and irradiation, Black and non black bodies, Kirchoff's law, Intensity of radiation, Radiation exchange between black surface, Geometric Configuration factor. Grey body relation exchange between surface of unit configuration factors, Electrical analogy to simple problems. Non-luminous gas radiation. Errors in temperature measurement due to radiation.

**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:

1. Heat Transfer – S.P. Sukhatme – Tata McGraw Hill
2. Heat Transfer – J.P. Holman – Tata McGraw Hill
3. Heat transfer- C P Arora, Tata McGraw Hill

### Reference

#### Books:

1. Heat & Mass Transfer – K. Kannan – Anuradha Agencies
2. Heat Transfer – A Practical Approach–Yunus A. Cengel – McGraw Hill
3. Heat Transfer – Ghosh, Dastudhar – Oxford University Press
4. Heat & Mass Transfer – D.S. Kumar – S.K. Kataria & Sons.

### 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.
8. Determination of Heat Transfer Coefficient in Drop Wise & Film Wise condensation.
9. To Determine Critical Heat Flux in Saturated Pool Boiling.
10. To Study Performance of Simple Heat Pipes.
11. To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.
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.
18. Testing and performance of different heat insulators.

## **B.TECH. (Mechanical Engineering)**

### **VI SEMESTER**

### **OPERATION RESEARCH**

#### **UNIT I**

**Introduction:** Definition and Development of Operations Research, Necessity and scope of OR in Industry, Operations Research in Decision making, Models in OR, Fields of application, Difficulties and Limitation of OR.

**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.

**The Assignment Problems:** Mathematical formulation of assignment problems, Solution of assignment problems, Traveling salesman problems, Air crew Assignment problems.

#### **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:  $\infty$  /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
3. Operation Research– Hira & Gupta – S. Chand & Co.
4. Operation Research – H. Gillette – TMH, New Delhi
5. Operations Research – M. Taha – TMH, New Delhi
6. Fundamentals of Operation Research – Ackof Sasieni – Dhanpat Rai & Sons
7. Quantitative Approach to Management – Lovin and Krit Patrick – TMH
8. Operation Research– S.D. Sharma – S. Chand & Com. New Delhi.



**B.TECH. (Mechanical Engineering)**  
**VI SEMESTER**  
**MANUFACTURING PROCESS-II**

**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.

**Press Working:** Types of presses, selection of press, components of a simple press, press working operations – shear, bending, drawing etc., types of dies, die sets, considerations in die design.

**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.

**Gear Cutting:** Principle of gear generations, Gear manufacturing by casting processes, forming processes and Metal removal processes, gear cutting on milling machines (Forming and Generation). Gear finishing processes.

**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:**

1. Manufacturing Technology (Vol. - I & II) – P.N. Rao – Tata McGraw Hill Pub. Company, New Delhi
2. A Text Book of Production Technology (Manufacturing Processes & Technology) – P.C. Sharma – S. Chand and Company Ltd., New Delhi.

**Reference Books:**

1. Machine Tool Engineering – G.R. Nagpal – Khanna Publishers, New Delhi.
2. Production Technology – R.K. Jain – Khanna Publisher – New Delhi
3. Manufacturing Engineering and Technology – Serope Kalpakjian & Schmid – pearson Education, Delhi.
4. Machine Tool Practices – Kibbe Richard R – PHI, New Delhi.
5. Principle of Metal Cutting – G.C. Sen, A. Bhattacharya – New Central Book Agency (P) Ltd. Calcutta
6. Manufacturing Processes (Vol-I&II) – H.S. Bawa- Tata McGraw Hill pub. Company, New Delhi
7. Production Technology – HMT Bangalore, Tata McGraw Hill pub. Company, New Delhi.

**B.TECH. (Mechanical Engineering)**  
**VI SEMESTER**  
**PRODUCTION MANAGEMENT**

**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 drivers 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:**

1. Production and operation Management – By P. Ramamurty – New Age International Publication.
2. Industrial Engineering & Production Management – Martand Telsang – S. Chand & Co.,
3. Supply Chain Management – R.P. Mohanty & S G Deshmukh, SBiztantra Publications.

**Reference Book:**

1. Production and operation Management – By R. Mayer – Tata McGraw Hill publication.
2. Quality Planning and Analysis, Juran and Gryna
3. Production and operations Management by – Adam and Ebert – PHI –
4. Production planning and Control – By Samuel Eilon, Navneet Prakashan Ltd., Bombay.

## **B.TECH. (Mechanical Engineering)**

### **VI SEMESTER**

### **TURBO MACHINERY**

#### **UNIT – I**

**Impulse Turbine:** Steam turbine– Principal of operation of steam turbine, Types, Impulse turbine compounding of steam turbine- pressure compounded velocity compounded and pressure – velocity compounded impulse turbine, Velocity diagram for impulse turbine, Force on the blade and work done, Blade or diagram efficiency, Gross stage efficiency. Influence of ratio of blade to steam speed on blade efficiency in a single stage impulse turbine. Efficiency of multi-stage turbine, Impulse blade sections, Choice of blade angle. Blade height in velocity compounded impulse turbine.

#### **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**

**Turbo Compressors:** Introduction, Classifications of Centrifugal compressors – components, Working, Velocity diagrams, Calculations of power and efficiencies, Slip factor, Surging and choking power and efficiencies.

**Axial Flow Compressor:** Construction and working, Velocity diagram, Calculation of power and efficiencies, Degree of reaction, Work done factor, Stalling, Comparison of centrifugal and axial flow compressor.

#### **Text Books:**

1. Steam and Gas turbine – By R. Yadav - Central Publishing House, Allahabad.
2. Gas Dynamics with Application: S.K. Kulshrestha.

#### **Reference Books:**

1. Turbine compressors and Fans – S.M. Yahya – TMH
2. Gas Turbine – V. Ganeshan – TMH

**B.TECH. (Mechanical Engineering)**  
**VII SEMESTER**  
**AUTOMOBILE ENGINEERING**

**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**

**Clutches:** Characteristics, Functions, Principles of operation of clutch, *Friction clutch:* Single plate, Multi plate, Centrifugal clutch, Positive clutch, clutch lining materials. Torque transmitted and related problems.

**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.

**Differential:** Functions, Single & double reduction differential, Limited slip differential.

**Front Axle:** Live & dead axle, Stub axle.

**Back Axle:** Hotch kiss drive, Torque tube drive.

**Tyres:** Types specification, Causes of tyre wear & rim.

**Brakes & Braking system:** Purpose, Principles, Layout of braking system. Classification: mechanical, Hydraulic brakes, Master cylinder, Tandem master cylinder, wheel cylinder, Self energizing & self adjusting brakes, Disc brakes, Antiskid brakes. Power operated brakes.

**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.

**Electrical System:** Battery construction, Maintenance, Testing and charging, Cutout, Lighting circuit, Horn, Signals.

**Text Books:**

1. Automobile Engineering – Vol I and II - Kripal Singh – Standard Publications
2. Automotive Mechanics – Heitner
3. Automobile Engineering – G.B.S. Narang – Khanna Publishers
4. Motor Vehicle – Newton & Steeds – Life & Sons Limited.

**Reference Books:**

1. Automobile Engineering - Dr. N. K. Giri – Khanna Publishers
2. Automobile Engineering – K. R. Govindan – Anuradha Agencies

**STUDIES TO BE CARRIED OUT (MINIMUM TEN EXPERIMENTS)**

1. Study of Frame and Chassis.
2. Study of Clutches – Single Plate, Multi Plate and Centrifugal
3. Study of Gear Boxes – Sliding mesh, Constant mesh, Synchro mesh.
4. Study of Differential, Universal joints, Axles and Slip Joints.
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 Rear Independent Suspension System.
11. Study of Battery, Starting and Generating System and Battery Charging System.
12. Study of Automotive Electrical System.
13. Study of Educational Car Model.

**B.TECH. (Mechanical Engineering)**  
**VII SEMESTER**  
**MACHINE DESIGN-II**

**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.

**Plain or Journal Bearings:** Types of lubrication, Viscosity, Hydrodynamic theory of lubrication, Somerfield number, Heat balance, design procedure. Self-contained bearings, bearing materials.

**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 :-**

1. Machine Design by T.V. Sunderarajamoorthy and N. Shanmugam – Anuradha Agencies.
2. Mechanical Engineering Design by J.E. Shigley – Mc Graw Hill Publication.
3. Machine Design by P.C. Sharma and D.K. Agrawal – Kataria & Sons Publications.

**Reference Books :**

1. Machine Design An Integrated Approach, Robert L –Norton published by Addison Wesley Longman (Singapore)
2. Design of Machine elements by V.B. Bhandari, Tata McGraw Hill Publications.
3. Machine Design by Mobin – Mir Publishers.

**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.

**B.TECH. (Mechanical Engineering)**  
**VII SEMESTER**  
**VIBRATION & NOISE CONTROL**

**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
2. Theory & Practice of Mechanical Vibrations – J.S. Rao, Gupta - New Age International.

**REFERENCE BOOKS**

1. Mechanical Vibrations – G.K. Grover - S. Chand & CO.
2. Acoustics for Engineers - Turner & Pretlove - Macmillan
3. Acoustics and Noise Control - Smith, Peters & Owen - Addison-Wesley-Longman, 2nd Edition
4. Industrial Noise Control: Fundamentals and Applications - Bell and Bell, Marcel-Dekker



**B.TECH. (Mechanical Engineering)**  
**VII SEMESTER**  
**REFRIGERATION AND AIR CONDITIONING**

**UNIT-I**

Refrigeration and second law of thermodynamics, Reversed Carnot Cycle. Its practical limitations, Standard Vapor compression Refrigeration System and its performance analysis. Effect of evaporator and condensing temperatures. Modifications, its effects, Liquid-to-Suction heat exchanger, Effect of Superheat and criteria For optimum superheat, Actual vapor compression refrigeration systems, Limitations of single stage.

**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 valves, 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 stoker W.F.
2. Refrigeration And Air Conditioning by ahmadaul Ameen, PHI publication
3. Hand book of Air Conditioning and Refrigeration by Shan K.Wang, Tata McGraw-Hill

**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

**B.TECH. (Mechanical Engineering)**  
**VIII SEMESTER**  
**COMPUTER AIDED DESIGN AND MANUFACTURING**

**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**

**Representation of Surface:** Parametric Representation of surfaces, Equation of surface, Tangent vector, Normal vector, Twist vector, Parametric patches and surfaces, Analytical surfaces: Ruled surface, surface of revolution, Tabulated cylinder. Synthetic surface: Hermit bi-cubic surface, Bezier bi-cubic surface, B-spline bi- cubic surface, Coon's surface.  
**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**

**Numerical Control:** Introduction to numerical control, Basic component of an NC System, The NC Procedure, NC coordinate systems, NC motion control system, Application of NC, Introduction to Computer Control in NC, Problem with Conventional NC, Computer Numerical control, Direct Numerical control, Combined DNC/CNC System, Adaptive control system. NC Part Programming, Introduction to NC Part programming, Manual Part Programming, Computer assisted part programming APT language, G&M codes and examples, Introduction to Rapid Prototyping.

**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:**

1. CAD/CAM Theory and Practice-Ibrahim Zeid-Tata McGraw Hill Publications
2. CAD/CAM-Milkell 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
2. Kinematic Synthesis of linkages-Richard S Hartenberg, Jacques Denavit-McGraw Hill
3. CAM/CAD principle & Applications-P.N.Rao- Tata McGraw Hill Publications.

**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.
9. View port setting for 3D drawing and use of extrude command.
10. Generation of solid of revolution.
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

**B.TECH. (Mechanical Engineering)**  
**VIII SEMESTER**  
**INDUSTRIAL ENGINEERING**

**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.

**Method Study :** Introduction, definition, procedure, Recording techniques, Flow Process Charts, Critical examination by questioning technique, man-machine chart, Motion economy principles, Micro motion study – Therbligs.

**Work Measurement:** Definition, Objectives, Techniques of Work measurement, Selection & timing the job, Rating, Allowances, Normal and standard time determination, Work sampling.

**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.

**Business Process Re-Engineering:** Definition, Need & characteristics, Industrial Engineering & Re-engineering, Framework for Reengineering, Process of Reengineering, Information Technology leverage in Reengineering, advantages of Re-engineering.

**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
2. Comprehensive Industrial Engineering- N.J. Manek --- Laxmi Publication (P) Ltd.
3. Industrial Engineering and Management Systems – S. Dalela, Mansoor Ali: Standard Publishing Distributors.

## **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.
7. Performance of micro motion study of a job.
8. Problems in assignment of men & machines.
9. Training for a performance rating using walking exercises / audio visual aids.
10. Calculation of allowance for a job.
11. Standard time calculation problems.
12. Problems of wage incentive.
13. Case study of an industrial/service organization using a method study techniques.
14. Stop watch time study of a job.