Faculty of Engineering & Technology

Study and Evaluation Scheme

Of

Bachelor of Technology

B.Tech. – Mechanical Engineering

II, III & IV Year

(Applicable w.e.f Academic Session 2013-16, till revised)

AKS UNIVERSITY, SATNA

Study and Evaluation Scheme

AKS University, Satna

Sherganj, Panna Road, Satna (MP) 485001

Study & Evaluation Scheme
of
Bachelor of Technology (Mechanical Engineering)
SUMMARY

Programme : **B.Tech (ME)**

Duration : Four year full time (Eight Semesters)

Medium : English

Minimum Required Attendance : 75 %

Maximum Credits: 158+54 (First Year)= **212**

Evaluation Assessment :	**Internal**	**External**	**Total**
	50	100	150

Internal Evaluation (Theory/ Practical Papers)

	Sessional-I	**Sessional-II**	**Continuous Assessment & attendance**
	10	10	10+20= 30

Duration of Examination :	**External**	**Internal**
	3 hrs.	2 hrs

To qualify the course a student is required to secure a minimum of 36% marks in aggregate including the semester end examination, internal assessment evaluation (Both theory & Practical Papers)

A candidate who secures less than 36% or Grade **'D'** of marks in a Subject/Paper(s) shall be deemed to have failed in that Subject/Paper(s). In case a student has secured less than 36% or Grade **'R'** in Subject/Paper(s), he/she shall be deemed to re-appear (ATKT Examination) in Subject/Paper(s) to achieve the required percentage (Min. 36%) or grade (Min. D) in the Subject/Paper(s).

Question Paper Structure

1. *The question paper shall consist of 26 questions in three Sections. Out of which Section-A shall be of Objective type 10 questions and will be compulsory. (weightage 2 marks each).*
2. *Section-B shall contain 10 Short answer type questions and students shall have to answer any eight (weightage 5marks each).*
3. *Out of the remaining six question s are long answer type questions, student shall be required to attempt any four questions. The weightage of Questions shall be 10 marks each.*

Faculty of Engineering & Technology
Department of Mechanical Engineering
B.Tech. & B.Tech+M.Tech (Integrated)

(Mechanical Engineering)

III Semester

TEACHING & EXAMINATION SCHEME

Sr. No.	Paper Code	Semester- III	L	T	P	Credit	Total Credit
1.	01MS301	Engineering Mathematics-III	3	1		4	29
2.	01ME302	Mechanics of solid-I	3	1		4	
3.	01ME303	Applied Thermodynamics	3	1		4	
4.	01ME304	Mechanical measurement and control	3	1		4	
5.	01ME305	Material Science & Metallurgy	3	1		4	
6.	01CA306	Computer Graphics	3	1		4	
7.	01SD307	SSD			2	1	
1.	01ME351	Mechanics of solid-I Lab			2	1	
2.	01ME352	Applied Thermodynamics Lab			2	1	
3.	01ME353	Mechanical measurement and control Lab			2	1	
4	01CA354	Computer Graphics- LAB			2	1	

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IV Semester

TEACHING & EXAMINATION SCHEME

Sr. No.	Paper Code	Semester- III	L	T	P	Credit	Total Credit
1.	01ME401	Fluid mechanics	3	1		4	24
2.	01ME402	Kinematics of machine	3	1		4	
3.	01ME403	Machine design-I	3	1		4	
4.	01ME404	Manufacturing Process-I	3	1		4	
5.	01MT405	Principle of management	3	1		4	
6.	01SD406	SSD			2	1	
1.	01ME451	Mechanical drafting and design Lab			2	1	
2.	01ME452	Kinematics of machine Lab			2	1	
3.	01ME453	Fluid mechanics and hydraulics Lab			2	1	

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V Semester

TEACHING & EXAMINATION SCHEME

Sr. No.	Paper Code	Semester- III	L	T	P	Credit	Total Credit
1.	01ME501	Mechanical drafting and design	3	1		4	25
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	
6.	01SD506	SSD			2	1	
1.	01ME551	Dynamics of Machine Lab			2	1	
2.	01ME552	Fluid machinery Lab			2	1	
3.	01ME553	Internal combustion engine Lab			2	1	
4	01ME554	Mechanical drafting and design Lab			2	1	

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VI Semester

TEACHING & EXAMINATION SCHEME

Sr. No.	Paper Code	Semester- III	L	T	P	Credit	Total Credit
1.	01MS601	Industrial Engineering	3	1		4	28
2.	01ME602	Manufacturing Process-II	3	1		4	
3.	01ME603	Turbo Machinery	3	1		4	
4.	01MT604	Production Management	3	1		4	
5.	01ME605	Automobile Engineering	3	1		4	
6.	01ME651	Automobile Engineering Lab			3	2	
7.	01ME652	Turbo Machinery Lab			3	2	
8.	01ME653	Modeling Simulation Lab			3	2	
9	01ME654	Industrial Training				2	

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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	26
2.	01ME702	Heat and mass transfer	3	1		4	
3.	01ME703	Machine design-II	3	1		4	
4.		**ELECTIVE-I**	3	1		4	
	01ME704	Computer aided design and manufacturing					
	01CA705	Power plant engineering					
	01SD706	Finite element analysis					
1.	01ME751	Project-I			12	6	
2.	01ME752	Vibration and noise control Lab			3	2	
3.	01ME753	Heat and mass transfer Lab			3	2	
4	01CA754	Machine design-II Lab			3	2	

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VIII Semester

TEACHING & EXAMINATION SCHEME

Sr. No.	Paper Code	Semester- III	L	T	P	Credit	Total Credit
1.	01ME801	Operation Research	3	1		4	26
2.	01ME802	Refrigeration and air conditioning	3	1		4	
3.	01MT803	Industrial Management	3	1		4	
4.		**ELECTIVE-II**	3	1		4	
	01ME804	Non conventional sources of energy					
	01ME805	Advanced CFD					
	01ME806	Robotics					
	01EV807	Air pollution control					
	01CA808	Soft computing					
3.	01ME353	Major Project	0	0	0	8	
4	01CA354	Refrigeration and air conditioning Lab	0	0	3	2	

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

Numerical solution of algebraic and Transdantal equations: Bisection method, Secant method, Regular-falsi method, Newton-Raphson method and Graeffe's root squaring method.
- Numerical solution of ordinary differential equations: Taylor's series method, Euler's method, Euler's modified method, Picard's method, Runge- Kutta method.
- 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
2. H.K.Das, Basic Engineering Mathematics-III, S.Chand & company Ltd.
3. D. K. Jain., Engineering Mathematics-III
4. Sonendra Gupta, Engineering Mathematics-III, Dhanpat Rai Publishing Company(P) Ltd.

Reference Books:-
1. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
3. Chandrika Prasad, Advanced Mathematic for Engineers, Prasad Mudranalaya,1996.
4. B.V.Ramana,Higher Engineering mathematics,Tata Mcgraw-Hills Publishing Company Limited.

B.TECH. (Mechanical Engineering)
III SEMESTER
MACHANICS OF SOLID-I

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
2. Mechanics of Solids – Beer & Johnson, Tata McGraw Hill Publications.

Reference Books:

1. Strength of material – Rider–ELBS
2. Introduction to Solid Mechanics – I.H.Shames–PHI
3. Strength of Materials – R.K. Rajput – Dhanpat Rai & Sons
4. Strength of Materials – Dr. Sadhu Singh – Khanna publication.

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.
9. To study the Spring Testing Machine.
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

B.TECH. (Mechanical Engineering)
III SEMESTER
APPLIED THERMODYNAMICS

UNIT - I Second Law Analysis

Introduction to the second law of Thermodynamics, The Clausius inequality, Entropy, Principle of increase in entropy, T-ds relation. Availability – Second law analysis of Closed system, Second law analysis of steady–flow system, Irreversibility.

UNIT - II Thermodynamic Relationships

Helmholz and Gibbs functions, Coefficient of Volume expansion and isothermal compressibility, Differential relations of internal energy, Maxwell's Relation, C_p C_v 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

Classification of air compressors, Advantages, Disadvantages of reciprocating compressors, Working of reciprocating compressor, Equation of work (with & without clearance) volumetric efficiency, Multistage compressors, Efficiency of compressor, Effect of atmospheric condition on output of Compressors, Thermodynamic analysis of reciprocating compressor, Intercooler & External cooler.

Unit – V Thermodynamics of Compressible Fluids

Isentropic flow, Stagnation conditions, Stagnation enthalpy, Temperature, Pressure, Density, Flow through available area, Duct, Converging nozzle, Convergent divergent nozzle, Operation of convergent divergent nozzle for different back pressures. Flow with friction and heat transfer, Fanno flow, Rayleigh flow. Flow of steam through nozzle, Throat area for maximum discharge, Supersaturated Flow in nozzle.

Text Books:
   1. Engineering Thermodynamics – P.K. Nag – TMH Publishers
   2. Thermodynamics & Thermal Engineering – J. Selwin Rajadurai – New Age InternationalPublishers

Reference Books:
   1. Thermodynamics – C.P. Arora – TMH Pub.
   2. Thermal Science & Engineering – D.S. Kumar – S.K. Kataria & Sons
   3. Thermodynamics – S.C. Gupta – Pearson Education
   4. Thermodynamics- An Engineering Approach – Cengal & Boles – McGraw Hill
   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.
12. Determination of vacuum efficiency and condenser efficiency of a surface steam condenser.
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: Measurement of displacement and angular velocity.
Measurement of ressure: Gravitational direct acting, Elastic and indirect type pressure transducers. Measurement of very low pressure–Mcleod gauge and Pirani gauge. 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: T ype of strain gauges and their working, Strain gauge circuits, Mcleod guage, Pirani guage, Temperature compensation. Strain rosettes, Anal ysis of strains, Measurement of force and torque.

UNIT- III
Measurement of flow: Obstruction meters, Variable head meters, Hot wire and magnetic meters, Ultrasonic flow meters. Vibration and noise measurement: Seismic instruments, Vibration pick ups and decibel meters.
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:-
1. Measurement Systems, Application and Design – E.O. Doebelin - McGraw Hill
2. Mechanical Measurements and Control – D.S. Kumar – S.K. Kataria & Sons
3. Mechanical Measurements – G. Beckwith &Thomas G. – Pearson Education
4. Automatic Control Systems-Kuo

Reference Books:-

1. Engineering Metrology – K.J. Hume - MacDonald and Company
2. Engineering Metrology – I.C. Gupta - Dhanpat Rai & Sons
3. Mechanical & Industrial Measurements – R.K. Jain – Khanna Publishers.

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.
2. Measurement of various angles using Bevel Protractor, Sine Bar & Combination Set.
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.
6. Measurement of Gear Elements using Profile Projector and image analyzer.
7. Measurement of Tool Angles of a Single Point Cutting Tool by using Tool Makers Microscope.
8. Calibration of Vernier Caliper, Micrometer, Height Gauge, Depth Micrometer using Slip Gauges.

B.TECH. (Mechanical Engineering)
III SEMESTER
MATERIAL SCIENCE & METALLURGY

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, eutectiod, 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 C a s t 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:
1. Engineering Physical Metallurgy – Lakhtin – CBS Publishers & Distributors
2. Materials Science- Narang – CBS Publishers & Distributors

Reference Books:

1. Elements of Material Science & Engg. - Van Vlack. – Addison – Wesley longman, 6th Edn., New York 2. Physical Metallurgy - Clark & Varney, East West Edn., New Delhi
2. Engineering Materials - Woulf series.
3. Material Science & Engg. – A first course – V. Raghavan – PHI (P) Ltd., Delhi, 2003
4. A Text Book of Material Science & Metallurgy – O.P. Khanna – Dhanpat Rai & Sons – New Delhi
5. Physical Metallurgy Principles – Robert E Reed Hill – Affiliated East-West Press Pvt. Ltd., New

Delhi, 2004

B.TECH. (Mechanical Engineering)
III SEMESTER
Computer Graphics

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: C_0, C_1 & C_2 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:
1. Computer Graphics-Donald hearn and M.Pauline Baker-Prentice Hall of India Pvt Ltd.
2. Introduction to Computer Graphics – N. Krishnamurhy - TMH Publication.

Reference Books:
1. Computer Graphics –Harrington S. – TMH Publication.
2. CAD-CAM Theory and Practice-Ibrahim Zeid- TMH Publication.
3. Computer Graphics - Schaum's Outline –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

B.TECH. (Mechanical Engineering)
III SEMESTER
MACHINE DRAWING

UNIT - I

Conventional representation of surface finish, Roughness number symbol, Symbols of Machine elements and welded joints.

Limits, Fits and Tolerances: General aspects, Nominal size and basic dimensions, Definitions, Basis of fit or limit system, Systems of specifying tolerances, Designation of holes, Shafts and fits, Commonly used holes and shafts.

Fasteners: Drawings of various views of Screw threads, metric and BSW threads, Square thread and multi start threads. Nut bolts, Washers, Setscrew, Locknuts and foundation bolts.

Riveted joints: Forms and proportions of river heads, Different views of different types of riveted Lap and Butt joints.

UNIT - II

Drawings of various views of
Shaft joints: Cotter joint and Knuckle joint. **Keys & Shaft coupling:** Muff, Flanged, Flexible, Universal and Oldhams coupling. **Shaft bearing:** Solid and bush bearing, Plummer block, Footstep bearing. **Pipe joint:** Flanged joint, Socket and Spigot joint, Hydraulic joint, Union joint, Gland & Stuffing Box, Expansion joint. **Pulley:** Belt pulley, V belt pulley, Fast and loose pulley, Speed cone pulley, Built up pulley.

Gears: Spur gear in mesh with approximate construction of tooth profile, Rack and pinion.

UNIT – III

Assembly and detailed drawings of Engine Parts: Piston, Stuffing box, cross head, Vertical & Horizontal engine, Connecting rod, Crank, Eccentric.

Valves: Steam stop valves, Feed check valve, Safety valves, Blow off cock.

NOTE–Study of assembly production drawing/blue print are to be practiced in the tutorial/practical. Few drawings are to be practiced on AutoCAD. The parts are to be shown during practice.

Text Books:
1. Machine drawing- N.D.Bhatt., published by R.C. Patel Charotar Book Stall Tulshi Sadan, Station Road, Annad, India.
2. Machine drawing – P.S. Gill S.K. Kataria & Sons Delhi.
3. Machine drawing – T.Jones.

SSD- CSEP (Communication skills Enhancement Program)

3rd Semester

B.Tech (Engg.)/B.Tech (Ag.)/B.Tech (BT)/B.Sc.(Hons) Ag./B.Sc (BT)/B.Pharm/BBA/B.Com/B.com(Hons)/BCA(Hons)/B.Sc. (IT)/Diploma (Engg.)

CSEP PROGRAM: This programme is devised to give you all an exposure to the language used in various communication activities. The objective of the programme is to enhance our communication skills. Research says that the more you listen and speak a language the faster you learn. In these sessions, we are going to practice to speak sentences and words used in different situations. Once you have the command on the language, you can use it for any context; be it interviews, presentations, business, technology so on and so forth.

Learning through activities is more effective than learning through lectures and books. We are going to provide you with opportunities to make speeches, presentations, interact with various people etc.

Unit-1

Thematic structure: Money, Cricket, A trip to Gizmo world, Culture and Shopping

Assignment: Progress Test-1

Unit-2

Thematic structure: Festivals, Computers, Auto mania, Environment and studying abroad.

Assignment: Progress Test-2

Unit-3

Thematic structure: Internet, Fashion & Style, Globalization, all about jobs and Trends in Technology.

Assignment: Progress Test-3

Unit-4

Conversation Questions: College, Beauty and Physical attractiveness, Food and eating, Entertainment, Advertising, Films in your own language, Books & reading.

Activities: Reading newspaper and news analysis, Role plays, Extempore, JAM, Story creation, Picture description, Group Discussion and celebrity Interview.

Assignment: Post assessment Test

B.Tech. (Mechanical Engineering)
Semester-IV
FLUID MECHANICS

UNIT-I
Properties of fluid: Fluid, ideal and real fluid, Properties of fluid: Mass density, Weight density, Specific volume, Specific gravity, Viscosity, Surface tension, Capillarity, Vapour pressure, Compressibility and bulk modulus. Newtonian and non-Newtonian fluids.
Fluid statics : Pressure, Pascal's law, Hydrostatic law, Pressure measurement, Hydrostatic force on submerged plane and curved surface, Buoyancy and Flotation, Liquid in relative equilibrium.

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, A cceleration of a fluid particle, M otion 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, S hear stress and pressure gradient relationship, F low 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.
4. Fluid Machines With Engineering Applications by R.L. Draught lery & A.C. Jugersoll.
   (McGraw Hills)
5. Journal of experiments in Hydraulic Laboratory by V. N. Rao & Husan New Heights.
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).

3. A text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines. By Khurmi
(S. Chand & Co.)

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.
8. Flow measurement using Pitot tube.
9. To study the transition from laminar to turbulent flow and to determine the lower critical
   Reynold's number.
10. To determine the hydraulic coefficients (C_c, C_d and C_v) 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.

B.Tech. (Mechanical Engineering)
Semester-IV
KINEMATICS OF MACHINE

UNIT-I
Relative velocity: Elements, pairs, Mechanism, Four bar chain and its inversion, Velocity diagrams, Relative velocity method, Instantaneous centre method.

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
Governors: Characteristics of centrifugal governors, Gravity controlled governors, Porter and proell. Spring controlled centrifugal governor: Hartung, & hartnell governor. Performance parameter : Sensitivity, stability, Isochoronism, Governor effort and power.

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:
1. Theory of machine – S.S.Ratan-Tata McGraw Hill.
2. The Theory of machine – Thomas Beven – CBS Publishers.

Reference Books:
1. Theory of mechanism and machine – A. Ghosh, A.K. Mallik –EWP Press.
2. Theory of Machine – Shigley, JE
3. Theory of Machine Jagdish Lal
4. Theory of machine – J.E. Singh – McGraw Hill.

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 coriolli'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.

B.Tech. (Mechanical Engineering)
Semester-IV
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 Engineering)
Semester-IV
MANUFACTUTRING SCIENCE-I

UNIT – I
Introduction to Manufacturing Processes: Importance of manufacturing processes, classification, economic and technological definitions of manufacturing processes.
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, CO_2 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.
Resistance Welding: Principle, equipment and processes. Thermit Welding, brazing & soldering, Internal and external welding defects, Inspection & testing of weld.

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.
Milling Machine: Introduction, specification, types, mechanisms and attachments for milling, milling operations, Indexing-simple, compound and differential.

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

Reference Books :

1. Manufacturing Science – A. Ghosh & A.K. Mallik – East West Press Pvt. Ltd., New Delhi
2. Manufacturing Engineering and Technology – S. Kalpakjian & S.R. Schmid – Addision Wesley Longman, New Delhi
3. Production Technology – R.K. Jain – Khanna Publishers, New Delhi
4. A Text Book of Production Technology (Vol. I & II) – O.P. Khanna – Dhanpat Rai & Sons, New Delhi.
5. Shop Theory-James Anderson and Earl E Tatra, T Tata McGraw Hill, New Delhi.
6. Manufacturing Process (Vol-I&II)-H.S. Bawa-Tata McGraw Hill Pub. Company, New Delhi.

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
6. Study of Work holding devices.
7. Facing, straight turning, step turning & taper turning.
8. Thread cutting and knurling.
9. Boring
10. Preparation of Solid of revolution using wood working lathe.
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.

B.Tech. (Mechanical Engineering)
Semester-IV
PRINCIPLES OF MANAGEMENT

UNIT - 1 : HISTORICAL DEVELOPMENT
Definition of Management - Science or Art - Management and Administration - Development of Management Thought - Contribution of Taylor and Fayol - Functions of Management - Types of Business Organisation.

UNIT - 2 : PLANNING
Nature & Purpose - Steps involved in Planning - Objectives - Setting Objectives - Process of Managing by Objectives - Strategies, Policies & Planning Premises- Forecasting - Decision-making.

UNIT - 3 : ORGANISING
Nature and Purpose - Formal and informal organization - Organization Chart - Structure and Process - Departmentation by difference strategies - Line and Staff authority - Benefits and Limitations - De-Centralization and Delegation of Authority - Staffing - Selection Process - Techniques - HRD - Managerial Effectiveness.

UNIT - 4 : DIRECTING
Scope - Human Factors - Creativity and Innovation - Harmonizing Objectives - Leadership - Types of Leadership Motivation - Hierarchy of needs - Motivation theories - Motivational Techniques - Job Enrichment - Communication - Process of Communication - Barriers and Breakdown - Effective Communication - Electronic media in Communication.

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
1. Harold Kooritz & Heinz Weihrich "Essentials of Management", Tata McGraw-Hill,1998
2. Joseph L Massie "Essentials of Management", Prentice Hall of India, (Pearson) Fourth Edition, 2003.

REFERENCES
1. Tripathy PC And Reddy PN, " Principles of Management", Tata McGraw-Hill, 1999.
2. Decenzo David, Robbin Stephen A, "Personnel and Human Reasons Management", Prentice Hall of India, 1996
3. JAF Stomer, Freeman R. E and Daniel R Gilbert Management, Pearson Education, Sixth Edition, 2004.
4. Fraidoon Mazda, "Engineering Management", Addison Wesley,-2000.

SSD- (Soft Skills Development)

4th Semester

B.Tech (Engg.)/ B.Tech (Ag.)/ B.Tech (BT)/ B.Sc.-Ag(Hons)/ B.Sc (BT)/ B.Pharm/ BBA (Hons) / B.Com/B.com(Hons)/ BCA(Hons)/ B.Sc.(IT) Hons./ Diploma (Engg.)

What is soft Skills?
The bundle of Skills which helps a person to perform a task better in a more satisfying way for both the performer and spectator (In personal, Professional and social life).

Why it is required?
To make a person to perform a task with better understanding of who, where, when, what, how and with whom a job can be executed to deliver the best expected result in perfect timing.

Learning Outcome: On completion of the course (SSD), the student should be able:

- ➢ Understand the Importance of various skills involved in developing enriching Interpersonal relationship.
- ➢ Be more aware of his/her own self- Confidence and values.
- ➢ Learn how to go about being a good team player and form an effective team.
- ➢ Understand the skills tested and participate effectively in Group discussion.
- ➢ Learn the basics of how to make an effective Presentation and have numerous practice Presentation in small groups and larger audiences.

Unit-1

Conceptual Sessions: Soft skills – a general overview, Industry Expectations, SWOT & STAR, Self Discovery, Leap to success- 7 Orientations,

Activity: Castle Plan.
Assignment : Sentence fluency assignment

Unit-2

Conceptual Sessions: Attitude, Time Management, Goal setting, Team building and leadership,
Activity: Early Bird and second mouse and Lost at Sea.
Assignment : Goal setting Assignment (Pre and Post)
Unit-3
Conceptual Sessions: Telephone etiquettes- Preparing for business calls/Making business calls/Telephonic phrases, Dining etiquettes, Email etiquettes, Corporate grooming and dressing
Activity: Role play in different scenarios/ Socialization and networking.
Assignment : Progress test on general etiquettes.
Unit-4
Conceptual Sessions: Group discussion: Introduction and definition of a GD, Purpose of a GD, Types and strategies in a GD, Do's and Don'ts in GD, Speak to Impress (Presentation skill), Anchoring in formal setting, Reading Comprehension
Activity: GD Practise and Presentation on Company profile.
Assignment : Reading Comprehension assignment.

B.Tech. (Mechanical Engg.)

V Semester

MECHANICAL DRAFTING & DESIGN

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 Compute 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
3. Narayana and Reddy; Machine Drawing; New age, Delhi.
4. Agarwal and agrawal; Engineering Drawing; TMH
5. Shigley JE et al; Mechanical Engineering Design, TMH
6. John KC; Text Book Of Machine Drawing; PHI Learning
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

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 Involutes 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 stoichometric 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, S pray penetration and spray direction, Multiple point fuel injection system.

Cooling System: Cooling requirement, A ir 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.

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.

5th Semester

B.Tech (Engg.)/B.Tech (Ag.)/B.Tech (BT)/B.Sc.(Hons) Ag./B.Sc (BT)/B.Pharm/BBA/B.Com/B.com(Hons)/BCA(Hons)/Diploma (Engg.)

Introduction to CPP Program: 'Soft skills' are a framework of desirable qualities which gives a candidate an edge over his peers during the selection process of a company. We, at AKS University, have designed the Campus Placement Program (CPP) to help out our students who are sitting for their placement process in various Companies.

Objective of The Program:

- ❖ Develop effective communication and Presentation skills.
- ❖ Develop all-round personality with a mature outlook to function effectively in different circumstances.
- ❖ Take part effectively in various selection procedures adopted by the recruiters.
- ❖ Develop broad career plans, evaluate the employment market, identify the organizations to get good placement, match the job requirements and skill sets.

UNIT-1

Talking about Present, Past and Future, Describing Processes and operations, Expressing Opinion: Agreement & Disagreement, Pronunciation and neutral accent, Group Discussion: Concept and Practice, Resume Writing.

UNIT-2

Public Speaking: A presentation about the company will be made by the students throughout the Unit. Each and every student is required to go through at least 10 Companies Profile related to their domain expertise. Basically the presentation includes the information like selection procedure, company's milestones, organizational achievements, candidate scope of improvement within the organization if selected, salary, employment benefits. Usually this presentation will end up with question and answer session, students given chance to ask questions about company.

UNIT-3

Mastering Personal Interviews: Paper Interview, Personal Interview, FAQs, Interview Practice, Domain Specific Interview Preparation, Peer review- Pair interview, Interview model   (Vocabulary for an effective Interview).

UNIT-4

Communication Skills and Reading Comprehension Test Preparation: Interpersonal Communication Assignment, Sentence Fluency Assignment, A way with words Assignment, Vocabulary Assignment, Communication skills placement paper Test, Reading Comprehension Assignment, Communication Assignment: Presentation Skills and Group discussion.

B.TECH. (Mechanical Engineering)
VI 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 Read Independent Suspension System.
11. Study of Battery, Staring and Generating System and Battery Charging System.
12. Study of Automotive Electrical System.
13. Study of Educational Car Model.

B.TECH. (Mechanical Engineering)
VI 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, Competitative 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.

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.

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:
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, Regneration, 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
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 conductivit y 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, E xtended surfaces rectangular, T riangular, C ircumferential and pin fins, General conduction analysis, F ins 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; E mpirical 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, I ntensity of radiation, R adiation exchange between black surface, G eometric 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.

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 Desing An Inntegrarated Approach, Rodert L –Norton published by Addison Wesley Longman (Singapore)
2. Design of Machine elements by V.B. Bhandari, Tata McGraw Hill Publicatins.
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 (Elective)
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 sold 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 PartsClassification & 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 MANAGEMENT

UNIT – I
Basic Concepts and Functions of Management: Definition, Management, Science or art? System approach to Management, Social responsibility of Manager, Social responsibilit y and Social responsiveness, ethics and management, Functions of Management.

Management of Organizations: Nature and purpose of organizing, Formal and informal organization, Types of organization structure- Line and Staff concept, Functional design, Multi divisional form, Conglomerate form and Matrix form of organizations. Mechanistic and Organic structure, Flat and Tall Structure, Span of Control, Differentiation and Integration, Centralization and Decentralization. Fayol's guidelines for effective management: Division of Labour, Unity of Command, Unity of direction, Authority, Discipline, Initiative.

UNIT – II
Human Resource Management: Nature and Scope of Human Resource Planning, Training and Development, Recruitment and Selection, Career Growth, Grievances, Motivation and its types, Need for Motivation, Reward and Punishment, Need want satisfaction chain, Maslow's hierarchy of needs. Quality of working life, Job enrichment and Job enlargement.

Financial Management: Functions of Financial Management, Book keeping and accounting, Financial statement Analysis, Financial Ratios, Capital Budgeting, Break-Even Analysis.

UNIT – III
Strategic Management: Concept of Strategy and Strategic Planning, Corporate strategy, Objectives, Goal, policies, Mission and Vision, SWOT analysis, Framework for Strategy, Porter's Framework for Industry Analysis, BCG Matrix, McKinsey's7S Framework, Formulation, decision Making and Implementation of Strategy.

UNIT – IV
Management Information System: Role of information in decision making, Definition of MIS, computer based user machine system, integrated system, MIS v/s Data processing, subsystem of an MIS, MIS, DSS and Expert system. Evolution and effectiveness of Information system.

Enterprise Resource Planning: Introduction to ERP, Brief history of ERP, Importance and advantages of ERP to a company, Risks and benefits of ERP, ERP Implementation Strategies, Common ERP Packages.

UNIT – V
Flexible Systems Management: Definition of Flexibility, Connotation of flexibility, Systematic concept of flexibility, Foundation of flexible system management, Types of flexibility and its applications in management of modern organizations. Flexy tools, SAP-LAP Analysis.

Text Books:

1. Essential of Management: H. Koonz and h. Weihrich.
2. MIS conceptual foundation, structure and development, G B Davis & M H Olson.
3. Flexibility in Management, Sushil, Vikas publication, New Delhi.
4. Strategic Management– John a Pearce, Richard B Robinson: Tata McGraw-Hill Publishing Co. Ltd.
5. Organizational Behavior Concepts, Controversies Applications - Stephen, P. Robbins- Prentice Hall, Englewood Cliffs, New Jersey.
6. Financial Management – M.Y. Khan and P.K. Jain - Tata Mc-Graw Hill.
7. Competitive Advantage - Porter Michael - The Free Press.
8. Competitive Strategy - Porter Michael - The Free Press, 1985.
9. Fundamentals of Business Organizations and Management – Y.K. Bhusan – S. Chand and Sons.
10. Enterprise Resource Planning: Alexis Leon – Tata Mc-Graw Hill Publishing Co. Ltd.
Strategic Management – S C Bhattacharya: Wheeler Publishing, New.

B.TECH. (Mechanical Engineering)
VIII 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: ∞ /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)
VIII 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 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 mechanishm. 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
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