J. S. UNIVERSITY, SHIKOHABAD

B.TECH

2nd , 3rd & 4th year

(Mechanical Engineering)

SCHEME

&

SYLLABUS

[Effective from the session 2015-16]

STUDY AND EVALUATION SCHEME FOR

B.Tech (Mechanical Engineering).

SEMESTER - III

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTAS-31	Engg Mathematics-III	4	1	-	-	50	100	150	3
2	BTCE-31	Fluid Mechanics	4	1	-	-	50	100	150	3
3	BTME-31	Mechanics of Solids	4	1	-	-	50	100	150	3
4	BTME-32	Material Science	4	1	-	-	50	100	150	3
5	BTME-33	Thermodynamics	4	1	-	-	25	50	75	2
6	BTIP-31	Industrial Psychology	4	1	-	-	25	50	75	2
7	BTAC-31	Human Value & Professional Ethics*	2	-	-	-	25	50	75	2
PRACTICA/DRAWING SUBJECTS										
8	BTCE-31P	Fluid Mechanics Lab.	-	-	2	-	20	30	50	2
9	BTME-32P	Material Science & Testing Lab.	-	-	2	-	20	30	50	2
10	BTME-34P	Machine Drawing-I	-	-	-	3	20	30	50	2
11	BTME-33P	Thermodynamics Lab.	-	-	2	-	20	30	50	2
12	BTGD-30	Games//Social and Cultural Activities + Discipline (25 + 25)							50	
								Grand Total	1000	

*Human values & Professional Ethics will be offered as a compulsory audit course for which passing marksare 30% in End Semester Examination and 40% in aggregate.

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilised for revision etc.

STUDY AND EVALUATION SCHEME FOR

B.Tech (Mechanical Engineering).

SEMESTER - IV

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTOE-41-BTOE-49	Science Based Open Elective	4	1	-	-	50	100	150	3
2	BTEE-45	Electrical Machines & Controls	4	1	-	-	50	100	150	3
3	BTME-41	Applied Thermodynamics	4	1	-	-	50	100	150	3
4	BTME-42	Manufacturing Science & Technology-I	4	1	-	-	50	100	150	3
5	BTME-43	Measurement and Metrology	4	1	-	-	25	50	75	2
6	BTIS-41	Industrial Sociology	4	1	-	-	25	50	75	2
7	BTAC-41	Cyber Security*	2	-	-	-	25	50	75	2
PRACTICA/DRAWING SUBJECTS										
8	BTEE-45P	Electrical Machines & ControlsLab.	-	-	2	-	20	30	50	2
9	BTME-44P	Machine Drawing II	-	-	-	2	20	30	50	2
10	BTME-45P	Manufacturing Technology I Lab.	-	-	3	-	20	30	50	2
11	BTME-43P	Measurement and Metrology Lab.	-	-	2	-	20	30	50	2
12	BTGD-40	Games//Social and Cultural Activities + Discipline (25 + 25)							50	
								Grand Total	1000	

*Cyber Security will be offered as a compulsory audit course for which passing marks are 30% in End Semester Examination and 40% in aggregate.

List of Open Electives for B. Tech. Courses

SCIENCE BASED OPEN ELECTIVE

BTOE-041	Introduction to Soft Computing (Neural Networks, Fuzzy Logic and Genetic Algorithm)
BTOE-042	Nano Sciences
BTOE-043	Laser Systems and Applications
BTOE-044	Space Sciences
BTOE-045	Polymer Science & Technology
BTOE-046	Nuclear Science
BTOE-047	Material Science
BTOE-048	Discrete Mathematics
BTOE-049	Applied Linear Algebra

STUDY AND EVALUATION SCHEME FOR
B.TECH

MECHANICAL ENGG.

SEMESTER - **V**

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTME-51	Manufacturing Science & Technology-II	3	1	-	-	50	100	150	3
2	BTME-52	Heat & Mass Transfer	3	1	-	-	50	100	150	3
3	BTME-53	I.C.Engine & Compressor	3	1	-	-	50	100	150	3
4	BTME-54	Kinematics of Machines	3	1	-	-	50	100	150	3
5	BTME-55	Machine Design-I	2	1	-	-	25	50	75	2
6	BTMB-51	Engineering Economics	2	1	-	-	25	50	75	2
PRACTICA/DRAWING SUBJECTS										
7	BTME-51P	Manufacturing Science & Technology-II Lab	-	-	4	-	20	30	50	2
8	BTME-52P	Heat & Mass Transfer Lab	-	-	4	-	20	30	50	2
9	BTME-55P	Machine Design-I Lab			4		20	30	50	2
10	BTME-53P	Seminar	-	-	4	-	50	-	50	2
11	BTGD-50	Games//Social and Cultural Activities + Discipline (30 + 20)							50	
								Grand Total	1000	

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STUDY AND EVALUATION SCHEME FOR
B.TECH
MECHANICAL ENGG.

SEMESTER - **VI**

S.No.	Subject Code	Name of Subject	Periods Per Week	Evaluation Scheme

			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTME-61	Machine Design-II	2	1	-	-	50	100	150	3
2	BTME-62	Dynamics of Machines	3	1	-	-	50	100	150	3
3	BTME-63	Refrigeration & Air Conditioning	3	1	-	-	50	100	150	3
4	BTME-64	Fluid Machinery	3	1	-	-	50	100	150	3
5	BTME-65	Unconventional Manufacturing Processes	3	1			25	50	75	2
6	BTMB-61	Industrial Management	2	1	-	8	25	50	75	2
PRACTICA/DRAWING SUBJECTS										
7	BTME-61P	Machine Design-II Lab	-	-	4	-	20	30	50	2
8	BTME-62P	Theory of Machine Lab	-	-	4	-	20	30	50	2
9	BTME-63P	Refrigeration & Air Conditioning Lab					20	30	50	2
10	BTME-64P	Fluid Machinery Lab	-	-	4	-	20	30	50	2
11	BTGD-60	Games//Social and Cultural Activities + Discipline (30 + 20)							50	
								Grand Total	1000	

STUDY AND EVALUATION SCHEME FOR
B. TECH. MECHANICAL ENGINEERING

SEMESTER -VII

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
S.No.	Subject	Name of Subject	Periods Per Week				Evaluation Scheme			
1	BTOE-71	Quality Management	4	1	-	-	50	100	150	3
2	BTME-71	Computer Aided Design	4	1	-	-	50	100	150	3
3	BTME-72	Automobile engineering	4	1	-	-	50	100	150	3
4	BTME-73	Computer Aided Manufacturing	4	1	-	-	50	100	150	3
5	BTME-74	Mechanical System Design	4	1	-	-	50	100	150	3
PRACTICA/DRAWING SUBJECTS										
6	BTME-71P	CAD/CAM LAB	-	-	-	-	20	30	50	2
7	BTME-72P	I.C Engine & Automobile LAB	-	-	-	-	20	30	50	2
8	BTME-73P	Industrial Training	-	-	-	-	50	-	50	2
9	BTME-74P	PROJECT	-	-	-	-	50	-	50	2
10	BTGD-70	Games//Social and Cultural Activities + Discipline					50	-	50	-
								Grand Total	1000	

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilised for revision etc.

STUDY AND EVALUATION SCHEME FOR
B. TECH. MECHANICAL ENGINEERING

SEMESTER -VIII

	Code		L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	BTOE-81	Non Conventional Energy Resources	4	1	-	-	50	100	150	3
2	BTME-81	Power Plant Engineering	4	1	-	-	50	100	150	3
3	BTME-82	Advance Welding Technology	4	1	-	-	50	100	150	3
4	BTME-83	Non Destructive Testing	4	1	-	-	50	100	150	3
PRACTICA/DRAWING SUBJECTS										
6	BTME-86	SEMINAR	-	-	-	-	50	-	50	
7	BTME-87	PROJECT	-	-	-	-	100	200	300	
8	BTGD-80	Games//Social and Cultural Activities + Discipline					50		50	
								Grand Total	1000	

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilised for revision etc.

SEMESTER-III

[BTAS-31] Engg Mathematics-III

Unit – I: Function of Complex variable

Analytic function, C-R equations, Harmonic Functions, Cauchy's integral theorem, Cauchy'sintegral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities,Zeroes and Poles, Residue theorem, Evaluation of real integrals of the type

Unit – II: Integral Transforms

Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems,Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensionalheat transfer equations, wave equations and Laplace equationsZ- transform and its application to solve difference equations.

Unit – III: Statistical Techniques

Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of leastsquares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, non –linear and multiple regression analysis, Binomial, Poisson and Normal distributions, Tests ofsignifications: Chi-square test, t-test

Unit – IV: Numerical Techniques – I

Zeroes of transcendental and polynomial equations using Bisection method, Regula-falsi methodand Newton-Raphson method, Rate of convergence of above methods.

Interpolation: Finite differences, Newton's forward and backward interpolation, Lagrange's andNewton's divided difference formula for unequal intervals**.**

Unit – V: Numerical Techniques –II

Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss-Seidal method.Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's one third andthree-eight rules,Solution of ordinary differential equations (first order,second order and simultaneous) byEuler's, Picard's and fourth-order Runge- Kutta methods.

Test Books:-

1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.

2. Jain, Iyenger Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi

Reference Books:-

1. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House,.

2. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.

[BTCE-31] Fluid Mechanics

Unit - I

Fluid and continuum, Physical properties of fluids, Rheology of fluids.
Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

Unit - II

Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and nonuniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential.
Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance,

Unit - III

Potential Flow: source, sink, doublet and half-body.
Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturi meter and bend meter, Hot-wire anemometer and LDA, notches and weirs, momentum equation and its application to pipe bends.
Similarity Laws: geometric, kinematics and dynamic similarity, undistorted and distorted model studies.

Unit - IV

Equation of motion for laminar flow through pipes, Stokes' law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks.

Unit - V

Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, separation and its control, Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect.
Introduction to compressible flow

References :

1. Fox & Donald, "Introduction to Fluid Mechanics" John Wiley &Sons Pvt Ltd,
2. Cengel&Cimbala, "Fluid Mechanics" TMH, New Delhi.

[BTME-31] Mechanics of Solids

UNIT-I

Compound stress and strains: Introduction, normal stress and strain, shear stress and strain, stresses oninclines sections, strain energy, impact loads and stresses, state of plane stress, principal stress and strain,maximum shear stress, Mohr's stress circle, three dimensional state of stress & strain, equilibriumequations, generalized Hook's law, theories of failure.

UNIT –II

Stresses in Beams: Pure Bending**,** normal stresses in beams, shear stresses in beams due to transverseand axial loads, composite beams.

Deflection of Beams: Equation of elastic curve, cantilever and simply supported beams, Macaulay'smethod, area moment method, fixed and continuous beams

Torsion: Torsion, combined bending & torsion of solid & hollow shafts, torsion of thin walled tubes.

UNIT-III

Helical and Leaf Springs: Deflection of springs by energy method, helical springs under axial load andunder axial twist (respectively for circular and square cross sections) axial load and twisting momentacting simultaneously both for open and closed coiled springs, laminated springs.

Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress,middle third and middle quarter rules, struts with different end conditions, Euler's theory for pin endedcolumns, effect of end conditions on column buckling, Ranking Gordon formulae, examples of columnsin mechanical equipments and machines.

UNIT-IV

Thin cylinders & spheres: Introduction, difference between thin walled and thick walled pressurevessels, Thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain.

Thick cylinders:

Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures,compound cylinders, stresses in rotating shaft and cylinders, stresses due to interference fits.

UNIT-V

Curved Beams: Bending of beams with large initial curvature, position of neutral axis for rectangular,trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tensionor compression.

Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and deflection inunsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axisand about one axis) for I-section and channel section.

Books and References :

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of Materials by.Beer, Jhonston, DEwolf and Mazurek, TMH
3. Strength of Materials by Pytel and Singer, Harper Collins
4. Strength of Materials by Ryder, Macmillan.
5. Strength of Materials by Timoshenko and &Yσungs, East West Press.

[BTME-32] Material Science

Unit-I

Introduction : Importance of materials. historical perspective, Brief review of modern & atomic conceptsin Physics and Chemistry. Atomic models, Periodic table, Chemical bondings.

Crystallography and Imperfections : Concept of unit cell space lattice, Bravais lattices, common crystalstructures, Atomic packing factor and density. Miller indices.Xray crystallography techniques.Imperfections, Defects & Dislocations in solids.

Unit-II

Mechanical properties and Testing : Stress strain diagram, Ductile & brittle material, Stress vs strength.Toughness, Hardness, Fracture, Fatigue and Creep. Testing of material such as Strength tests, Hardnesstests, Impact tests, Fatigue tests, Creep tests, and Non-destructive testing (NDT).

Microstructural Exam : Microscope principle and methods. Preparation of samples and Microstructureexam and grain size determination. Comparative study of microstructure of various metals & alloys such as Mild steel, CI, Brass.

Phase Diagram and Equilibrium Diagram : Uniary and Binary diagrams, Phase rules. Types ofequilibrium diagrams: Solid solution type, eutectic type and combination type. Iron-carbon equilibriumdiagram.

Unit-III

Ferrous materials : Various types of carbon steels, alloy steels and cast irons, its properties and uses.

Heat Treatment : Various types of heat treatment such as Annealing, Normalizing, Quenching,Tempering (Austempering, Martempering), and various case hardening processes. Time Temperature Transformation (TTT) diagrams.

Diffusion: Diffusion of Solids, Ficks I and II law.

Non-Ferrous metals and alloys : Non-ferrrous metals such as Cu, Al, Zn, Cr, Ni etc. and itsapplications. Various type of Brass and Bronze, bearing materials, its properties and uses. Aluminumalloys such as Duralumin. Other advanced materials/alloys.

Unit-IV

Dielectric Materials: Dielectric Materials and their applications.

Magnetic properties : Concept of magnetism - Dia, para, ferro Hysteresis. Soft and hard magnetic materials, Magnetic storages.

Electric properties, Semi conductors and Super conductors: Energy band concept of conductor,insulator and semi-conductor. Intrinsic & extrinsic semi-conductors.P-n junction and transistors.Basicdevices and its application.Super conductivity and its applications.Messier effect. Type I& IIsuperconductors. High Tc superconductors.

Unit-V

Ceramics : Structure types and properties and applications of ceramics. Mechanical/Electrical behaviour and processing of Ceramics.

Plastics : Various types of polymers/plastics and its applications. Mechanical behaviour and processingof plastics.Future of plastics.

Other materials : Brief description of other material such as optical and thermal materials, CompositeMaterials and its uses. Introduction to Smart materials & Nano-materials and their potential applications

Performance of materials in service: Brief theoretical consideration of Fracture, Fatigue, and Corrosion and its control.

Books and References:

1. Callisters Materials Science and Engineering, by William D. Callister, Jr, (Adopted by R. Balasubramaniam), Wiley India Pvt. Ltd.
2. Elements of Material Science & Engineering by Van Vlack, Pearson
3. Materials Science and Engineering - A First Course by Raghavan, PHI

[BTME-33] Thermodynamics

Unit – I:

Fundamental Concepts and Definitions: Introduction- Basic Concepts: System, Control Volume,Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints,Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & InexactDifferentials, Cycle Reversibility Quasi – static Process, Irreversible Process, Causes of IrreversibilityEnergy and its forms, Work and heat (sign convention), Gas laws, Ideal gas, Real gas, Law ofcorresponding states, Dalton's law, Amagat's law, Property of mixture of gases.

Zeroth law of thermodynamics: Concept of Temperature and its' measurement, Temperature scales.

First law of thermodynamics: Thermodynamic definition of work, Displacement work and flow work, Displacement work for various non flow processes, Joules' experiment, First law analysis for closedsystem (non flow processes), Internal energy and enthalpy. Limitations of first law of thermodynamics, PMM-I.

Unit – II:

First law of thermodynamics applied to open systems, Steady flow systems and their analysis, Steadyflow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. Analysis of unsteadyprocesses such as filling and evacuation of vessels with and without heat transfer.

Second law of thermodynamics: Thermal reservoirs, Energy conversion, Heat engines, Efficiency,Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausiusstatement of second law of thermodynamics, Equivalence of the two statements. Reversible andirreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries,Thermodynamic Temperature Scale, PMM-II.

Unit – III

Entropy : Clausius inequality, Concept of Entropy, Entropy change of pure substance in differentthermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

Availability and Irreversibility: Available and unavailable energy, Availability and Irreversibility,Second law efficiency, Helmholtz & Gibb's function.

Unit – IV

Properties of steam and Rankine cycle: Pure substance, Property of Pure Substance (steam), Triplepoint, Critical point, Saturation states, Sub-cooled liquid state, Superheated vapour state, Phasetransformation process of water, Graphical representation of pressure, volume and temperature, P-T & PVdiagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables &Mollier chart, Drynessfactor and it's measurement, processes involving steam in closed and open systems. Simple Rankine cycle.

Introduction to IC engines: Compression Ignition engines, Spark Ignition engines, 2 stroke and 4 strokeengines, Performance parameters of IC engine, Heat balance sheet.

Books and References:

1. Engineering Thermodynamics by P.K.Nag, TMH
2. Thermodynamics by Shavit and Gutfinger, CRC Press.
3. Thermodynamics- An Engineering Approach by Cengel& Boles, TMH.

[BTCE-31P] Fluid Mechanics Lab

Note: Ensure to conduct at least 10 experiments from the list:

1. To verify the momentum equation using the experimental set-up on impact ofjet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also todetermine the coefficient of velocity and the coefficient of contraction of theorifice mouth piece.
3. To calibrate an orifice meter and study the variation of the co-efficient ofdischarge with the Reynolds number.
4. To calibrate a Venturimeter and study the variation of the co-efficient ofdischarge with the Reynolds number.
5. To calibrate a bend meter and study the variation of the co-efficient of dischargewith the Reynolds number.
6. To draw a flow-net using Electrical Analogy Method.
7. To study the transition from laminar to turbulent flow and to determine thelower critical Reynolds number.
8. To study the velocity distribution in a pipe and also to compute the discharge byintegrating the velocity profile.
9. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
10. To study the boundary layer velocity profile over a flat plate and to determinethe boundary layer thickness.
11. To determine Meta-centric height of a given ship model.
12. To determine the head loss for a sudden enlargement
13. To determine the head loss for a sudden Contraction.

[BTME-32P] Material Science & Testing Lab.

(A) Experiments on Material Science (at least 5 of the following):

1. Preparation of a plastic mould for small metallic specimen.
2. Preparation of specimen for micro structural examination-cutting, grinding, polishing, etching.
3. Determination of grain size for a given specimen.
4. Comparative study of microstructures of different specimens of different materials (mild steel, grayC.I., brass, copper etc.)
5. Experiments on heat treatment such as annealing, normalizing, quenching, case hardening andcomparison of hardness before and after heat treatment.
6. Material identification of, say, 50 common items kept in a box.
7. Experiment on Faraday's law of electrolysis.
8. Study of corrosion and its effects.
9. Study of microstructure of welded component and HAZ. Macro & micro examination of the weldedspecimen.
10. Study of Magnetic/ Electrical/Electronic materials.

(B). Experiments on Material Testing (at least 5 of the following):

1. Strength test of a given mild steel specimen on UTM with full details and stress versus strain plot onthe machine.
2. Other tests such as shear, bend tests on UTM.
3. Impact test on impact testing machine like Charpy, Izod or both.
4. Hardness test of given specimen using Rockwell and Vickers/Brinell testing machines.
5. Spring index test on spring testing machine.
6. Fatigue test on fatigue testing machine.
7. Creep test on creep testing machine.
8. Experiment on deflection of beam, comparison of actual measurement of deflection with dial gauge tothe calculated one, and or evaluation of young's modulus of beam.
9. Torsion test of a rod using torsion testing machine.
10. Study of NDT (non-destructive testing) methods like magnetic flaw detector, ultrasonic flaw detector,eddy current testing machine, dye penetrant tests.

[BTME-34P] Machine Drawing-I

Introduction (1 drawing sheets)

Introduction, classification of machine drawings, principles of drawing, conventional representation ofmachine components and materials, lines, types of lines, dimensioning types, lines and rules of dimensioning.

Orthographic Projections (3 drawing sheets)

Introduction to orthographic projection, concept of first angle and third angle projection, drawing ofsimple machine elements in first angle projection, missing line problems, principle of visualization ofobjects, sectional views, full and half sectional views, auxiliary views.

Fasteners (2 drawing sheets)

Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation,representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation boltsetc., keys, types of keys, cotter and knuckle joints.

Riveted joints (1 drawing sheet)

Introduction, rivets and riveting, types of rivets, types of riveted joints, drawing of boiler joints etc.

Assembly drawing (2 drawing sheets)

Introduction to assembly drawing, drawing assembly drawing of simple machine elements like rigid orflexible coupling, muff coupling, plummer block, footstep bearing, bracket etc.

Free hand sketching (1 drawing sheet**)**

Introduction, Need for free hand sketching, Free hand sketching of foundation bolts, studs, pulleys, couplings etc.

Computer aided drafting (1 drawing**)**

Introduction to computer aided drafting; advantages and applications of CAD, concepts of computeraided 2D drafting using any drafting software like AutoCAD, Solid Edge, Draft Sight etc., basic draw andmodify commands, making 2D drawings of simple machine parts.

Books and References:

1. Fundamentals of Machine Drawing by Sadhu Singh & Shah, PHI
2. Engineering Drawing by Bhat, & Panchal, Charotar Publishing House
3. Machine Drawing with AutoCAD by Pohit and Ghosh, Pearson
4. Machine Drawing-KL Narayana, P Kannaiah, KV Reddy, New Age
5. Machine Drawing, N. Siddeshswar, P Kannaiah, VVS Shastry, Tata McGraw Hill

[BTME-33P] Thermodynamics Lab.

Minimum 10 experiments out of following;
1. Study of Fire Tube boiler
2. Study of Water Tube boiler
3. Study and working of Two stroke petrol Engine
4. Study and working of Four stroke petrol Engine
5. Determination of Indicated H.P. of I.C. Engine by Morse Test
6. Prepare the heat balance sheet for Diesel Engine test rig
7. Prepare the heat balance sheet for Petrol Engine test rig
8. Study and working of two stroke Diesel Engine
9. Study and working of four stroke Diesel Engine.
10. Study of Velocity compounded steam turbine
11. Study of Pressure compounded steam turbine
12. Study of Impulse & Reaction turbine
13. Study of steam Engine model.
14. Study of Gas Turbine Model
15. Any other suitable experiment(s) on thermodynamics

[BTIP-31] Industrial Psychology

Unit-I

Introduction to Industrial Psychology – Definitions & Scope. Major influences on industrial Psychology- Scientific management and human relations schools Hawthorne Experiments

Unit-II

Individual in Workplace Motivation and Job satisfaction , stress management. Organizational culture, Leadership & group dynamics.

Unit-III

Work Environment & Engineering Psychology-fatigue. Boredom, accidents and safety.Job Analysis, Recruitment and Selection – Reliability & Validity of recruitment tests.

Unit –IV

Performance Management : Training & Development.

References :

1. Miner J.B. (1992) Industrial/Organizational Psychology. N Y : McGraw Hill.

2. Blum & Naylor (1982) Industrial Psychology. Its Theoretical & Social Foundations CBS Publication.

3. Aamodt, M.G. (2007) Industrial/Organizational Psychology : An Applied Approach (5th edition) Wadsworth/Thompson : Belmont, C.A

. 4. Aswathappa K. (2008). Human Resource Management (fifth edition) New Delhi : Tata McGraw Hill

[BTAC-31] Human Value & Professional Ethics

Module-1

Course introduction, Needs Basic guidelines

1 Understand the need , basic , guidelines content for process value education.
2. Self Exploration what is it? It content and process, Natural Acceptence and experiential Validation as the mechanism for self exploration.
3 Continues happiness and Prosperty- A look at continues human Aspiration.
4 Understanding Happiness and Prosperty correctly- A critical appraisal of the current senerio.
5 Method to fulfilled the human aspiration

Module -2

Understanding Harmony in human Being (Harmony in Myself)

1. Understanding Harmony as a co – existence of the sentient I and the Material Body.
2. Understanding the need of self (I) and body sukh and suvidha.
3. Understanding the body of an instrument of I (being Doar, seer and enjoyer.
4. Understanding the Charactersticks and activities of (I)

Module -3

Understanding harmony in the Family and Society

1. Understanding harmony in the Family and basic unit of Human interaction.
2. Understanding values in human – Human relationship meaning of nayaya and program for the fulfillment of ensure abhay and tripti.
3. Understanding the meaning of Vishvas difference between intension and competence.
4. Understanding the Harmony in the society (society being an Extension of family - samadhan , Samriddi , Abhay,sahastitva and comprehension of Human goals.

Module -4

Understanding the harmony in the Nature and existence – whole Existence as Co- existence.

1 Understanding the harmony in the Nature.
2 Interconnectedness and mutual fulfillment among the four order of Nature –recyclability ,andself regulation in nature.
3 Holistic prception of Harmony at all levels of existence.

Module – 5 Implication of the above Holistic understanding of Harmony on professional ethics.

1 Natural acceptance of human values.
2 Deffinativeness of ethical human conduct.
3 Basic for humanistic education. Humanstick constitution and human universal order.
4 Case studies of typical holistic technologies , Management model and Production system.
5 Strategy for transition from the presnt stage of universal order.

A - At the level of individual : as socialy and ecologically responsible engineers technologist and manager.
B- At the Level of Society as mutually enriching institution and organisations

SEMESTER-IV

BTEE-45 ELECTRICAL MACHINES & AUTOMATIC CONTROL

Unit-I
Single phase Transformer: Efficiency Voltage regulation, O.C.& S.C. Tests.
Three Phase Transformer: Three phase transformer connections, 3-phase to 2-phase or 6-phaseconnections and their applications.
Auto Transformer: Volt- Amp relations, efficiency, advantages & disadvantages, applications.
D.C. Motors: Concept of starting, speed control, losses and efficiency.

Unit-II
Three phase Induction Motor: Construction, equivalent circuit, torque equation and torque- slipcharacteristics, speed control.
Alternator: Construction, e.m.f. equation, Voltage regulation and its determination by synchronousimpedance method.
Synchronous Motor: Starting, effect of excitation on line current (V-curves), synchronouscondenser.
Servo Motor: Two phase A.A. servo motor & its application.

Unit-III
Modeling of Mechanical System: linear mechanical elements, force-voltage and force currentanalogy, electricalanalog of simple mechanical systems; concept of transfer function & itsdetermination for simple systems.
Control System: Open loop & closed loop controls, servo mechanisms; concept of various types ofsystem.
Signals: Unit step, unit ramp, unit impulse and periodic signals with their mathematical representationand characteristics**.**

Unit-IV
Time Response Analysis: Time response of a standard second order system and responsespecifications, steady state errors and error constants.
Stability: Concept and types of stability, Routh Hurwitz Criterion and its application fordetermination of stability, limitations; Polar plot, Nyquist stability Criterion and assessment ofstability.

Unit-V
Root Locus Techniques: Concept of root locus, construction of root loci.
Frequency Response Analysis: Correlation between time and frequency responses of a second ordersystem; Bode plot, gain margin and phase margin and their determination from Bode and Polar plots.
Process control: Introduction to P, PI and PID controllers their characteristics, representation andapplications.

Books and References:
1. J. Nagrath& D. P. Kothari, “Electrical machines” Tata McGraw Hill.
2. B.R. Gupta &VandanaSinghal, “Fundamentals of Electrical Machines”, New Age International.
3. K. Ogata, “Modern Control Engineering” Prentice Hall of India.
4. B.C. Kuo, “Automatic Control systems.” Wiley India Ltd.
5. Irvin L. Kosow, “Electric Machinery and Transformers” Prentice Hall of India.
6. D. Roy Choudhary, “Modern Control Engineering” Prentice Hall of India.
7. M. Gopal, Control Systems: Principles and Design” Tata McGraw Hill.
8. Ghosh, “Electrical Machines” Pearson Education.

BTME-41 APPLIED THERMODYNAMICS

Unit-I

Thermodynamic relations: Conditions for exact differentials. Maxwell relations, Clapeyron equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic and Isothermal compressibility.

Fuels and Combustion: Combustion analysis, heating values, air requirement, Air/Fuel ratio, standard heat of reaction and effect of temperature on standard heat of reaction, heat of formation, Adiabatic flame temperature.

Unit-II

Boilers: Classifications and working of boilers, boiler mountings and accessories, Draught and its calculations, air pre heater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance.

Condenser: Classification of condenser, air leakage, condenser performance parameters.

Unit-III

Vapour Power cycles: Carnot vapour power cycle, Rankine cycle, effect of pressure and temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, Combined cycles, Cogeneration.

Steam Engines: Modified Rankine cycles, working and classification of steam engines, Indicator diagram, Saturation curve, Missing quantity, Heat balance.

Unit-IV

Steam and Gas Nozzles: Flow through Convergent and convergent-divergent nozzles, variation of velocity, area and specific volume, Choked flow, throat area, Nozzle efficiency, Off design operation of nozzle, Effect of friction on nozzle, Super saturated flow.

Steam Turbines : Classification of steam turbine, Impulse and Reaction turbines, Staging, Stage and Overall efficiency, Reheat factor, Bleeding, Velocity diagram of simple and compound multistage impulse and reaction turbines and related calculations, work done, efficiencies of reaction, Impulse reaction turbines, state point locus, Losses in steam turbines, Governing of turbines, Comparison with steam engine.

Unit-V

Gas Turbine: Gas turbine classification, Brayton cycle, Principles of gas turbine, Gas turbine cycles with intercooling, reheat and regeneration and their combinations, Stage efficiency, Polytropic efficiency. Deviation of actual cycles from ideal cycles.

Jet Propulsion: Introduction to the principles of jet propulsion, Turbojet and turboprop engines and their processes, Principle of rocket propulsion, Introduction to Rocket Engine.

Books and References:

1. Basic and Applied Thermodynamics by P.K. Nag, TMH
2. Applied thermodynamics by Onkar Singh, New Age International
3. Applied Thermodynamics for Engineering Technologists by Eastop, Pearson Education
4. Applied Thermodynamics by VenkannaAnd Swati, PHI
5. Theory of Stream Turbine by W.J. Kearton
6. Gas turbine Theory & Practice, by Cohen & Rogers, Addison Weslay Long man
7. Gas Turbine, by V. Ganeshan, Tata Mc Graw Hill Publishers.
8. Steam & Gas Turbine by R.Yadav, CPH Allahabad

9. Thermodynamics and Energy Systems Analysis, Borel and Favrat, CRC Press
10. Mechanics and Thermodynamics of Propulsion, Hill and Peterson, Pearson
11. Thermal Engineering by Kulshrestha, Vikas Publishing.
12. Thermal Engg. By P.L. Ballaney, Khanna Publisher
13. Thermal Engg. By R.K. Rajput, Laxmi Publication

BTME-42 MANUFACTURING SCIENCE & TECHNOLOGY-I

Unit-I

Introduction :

Importance of manufacturing.Economic & technological considerations in manufacturing. Classification of manufacturing processes. Materials & manufacturing processes for common items.

Metal Forming Processes :

Elastic & plastic deformation, yield criteria(Mises' and Tresca's). Hot working versus cold working. Analysis (equilibrium equation method) of Forging process for load estimation with sliding friction, sticking friction and mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging.

Unit-II

Metal Forming Processes (continued):

Analysis of Wire/strip drawing and maximum-reduction, Tube drawing, Extrusion and its application. Condition for Rolling force and power in rolling.Rolling mills & rolled-sections. Design, lubrication and defects in metal forming processes.

Unit-III

Sheet Metal working :

Presses and their classification, Die & punch assembly and press work methods and processes. Cutting/Punching mechanism, Blanking vs. Piercing.Compound vs. Progressive die. Flat-face vs Inclined-face punch and Load(capacity) needed.Analysis of forming process like cup/deep drawing. Bending & spring-back.

Unit-IV

Casting (Foundry)

Basic principle & survey of casting processes.Types of patterns and allowances. Types and properties of moulding sand, sand testing. Elements of mould and design considerations, Gating, Riser, Runnes, Core. Solidification of casting,.Sand casting, defects & remedies and inspection.Cupola furnace. Die Casting, Centrifugal casting, Investment casting, Continuous casting, CO2casting and Stir casting etc.

Unit-V

Unconventional Metal forming processes :

Unconventional metal forming or High Energy Rate Forming (HERF) processes such as explosive forming, electromagnetic, electro-hydraulic forming.

Powder Metallurgy :

Introduction to Powder metallurgy manufacturing process.Application and, advantages.

Jigs &Fixtures :

Locating & Clamping devices & principles. Jigs and Fixtures and its applications.

Manufacturing of Plastic components :

Review of plastics, and its past, present & future uses. Injection moulding. Extrusion of plastic section. Welding of plastics.Future of plastic & its applications.Resins & Adhesives.

Books and References :

1. Manufacturing Science by Ghosh and Mallik
2. Production Engg. Science by P.C. Pandey
3. Manufacturing Engineering & Technology by Kalpakjian, Pearson
4. Manufacturing Technology by P.N. Rao., TMH
5. Manufacturing Processes by Shan, Pearson.

6. Manufacturing Processes foe Engineering materials by Kalpakjian, Pearson
7. Materials and Manufacturing by Paul Degarmo.
8. Manufacturing Processes by Kaushish , PHI
9. Principles of Foundry Technology, Jain, TMH
10. Production Technology by R.K. Jain

BTME-43 MEASUREMENT AND METROLOGY

Unit-I

MECHANICAL MEASUREMENTS

Introduction: Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, units of measurement, static performance characteristics and elementary idea of dynamic performance characteristics of measurement devices, calibration, concept of error (systematic and random), sources of error, statistical analysis of errors.

Sensors and Transducers:

Types of sensors, types of transducers and their characteristics.

Signal Transmission and Processing:

Signal transmission and processing devices and systems. Signal display & recording devices

Unit-II

Time Related Measurements:

Stroboscope, frequency measurement by direct comparison. Measurement of displacement

Measurement of Pressure:

Gravitational, directing acting, elastic and indirect type pressure transducers. Measurement of very low pressures (high vacuum).

Strain Measurement:

Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration.

Temperature Measurement:

Thermometers, bimetallic thermocouples, thermistors and pyrometers.

Measurements of Force, Torque, Acceleration, and Vibration:

Different types of load cells, elastic transducers, pneumatic & hydraulic systems. Seismic instruments, accelerometers vibration pick ups and decibel meters, vibrometers.

Unit-III:

Measurement of Fluid Velocity and Flow rate:

Measurement of fluid velocity, Hot Wire Anemometry, Laser Doppler Velocimetry. Flow measuring devices, Rotameter.

METROLOGY

Metrology and Inspection :

Standards of linear measurement, line and end standards. Limit fits and tolerances. Interchangeability andstandardisation.Linear and angular measurements devices and systems Comparators: Sigma, Johansson'sMicrokrator.Limit gauges classification, Taylor's Principle of Gauge Design.

Unit-IV

Measurement of geometric forms like straightness, flatness, roundness.Toolmakers microscope, profile project autocollimator.Interferometry: principle and use of interferometry, optical flat.

Measurement of screw threads and gears.Surface texture: quantitative evaluation of surface roughness and its measurement.

Books and References:

1. Experimental Methods for Engineers by Holman, TMH
2. Mechanical Measurements by Beckwith, Pearson
3. Principles of Measurement Systems by Bentley, Pearson
4. Metrology of Measurements by Bewoor and Kulkarni, TMH
5. Measurement Systems, Application Design by Doeblein, TMH
6. Hume K.J., "Engineering Metrology", MacDonald and Co
7. Jain, R.K., "Engineering Metrology" Khanna Publishers

8. Jain, R.K., “Mechanical Measurement” Khanna Publishers

BTME-44P MACHINE DRAWING -II LAB

Review of Orthographic Projections (2 drawing sheets)
Orthographic projection of solids in first angle of projection, missing lines views, interpretation of views
Part and Assembly Drawing(4 drawing sheets)
Introduction to assembly drawing, steps in making of assembly drawing, assembly drawing of footstep bearing, lathe tool post, lathe tool post, tail stock stuffing box, connecting rod, gate valve, screw jack, Ramsbottom’s safety valve etc.
Production drawing: (2 drawing sheet)
Limits, fits and tolerances, types of tolerances and fits, hole basis and shaft basis of fits, and geometric dimensioning and tolerance, surface texture, indication of surface roughness, methods of placing machining symbols on orthographic views
Computer Based Solid Modeling(4 computer based drawing assignments)
Introduction, input, output devices, introduction to any 3D modeling software like AutoCAD, Solidworks, Creo Parametric, Autodesk Inventor etc., basic commands and development of 3D drawings of simple machine parts and assemblies.
Books and References:
1. Textbook of Machine Drawing, K C John, PHI
2. Machine Drawing, N. Siddeshswar, P Kannaiah, VVS Shastry, Tata McGraw Hill
3. Fundamentals of Machine Drawing, Dr Sadhu Singh & P L Shah, Prantice Hall India
4. Machine Drawing-KL Narayana, P Kannaiah, KV Reddy-New Age
5. Autodesk Inventor by Examples, Sam Tikoo, Wiley

BTME-45P MANUFACTURING TECHNOLOGY-1 LAB

Minimum 8 experiments out of following (or such experiment) are to be performed:
1. Design of pattern for a desired casting (containing hole).
2. Pattern making with proper allowance.
3. Making a mould (with core) and casting.
4. Sand testing methods (at least one, such as grain fineness number determination)
5. Injection moulding with plastics
6. Forging - hand forging processes
7. Forging - power hammer study & operation
8. Tube bending with the use of sand and on tube bending m/c.
9. Press work experiment such as blanking/piercing, washer, making etc.
10. Wire drawing/extrusion on soft material.
11. Rolling-experiment.
12. Bending & spring back.
13. Powder metallurgy experiment.
14. Jigs & Fixture experiment.
15. Any other suitable experiment on manufacturing science / process / technique.

BTME-43P MEASUREMENT & METROLOGY LAB

Minimum 8 experiments out of following (or such experiment) are to be performed:

1. Study the working of simple measuring instruments- Vernier calipers, micrometer,tachometer.
2. Measurement of effective diameter of a screw thread using 3 wire method.
3. Measurement of angle using sinebar& slip gauges. Study of limit gauges.
4. Study & angular measurement using level protector.
5. Adjustment of spark plug gap using feeler gauges.
6. Study of dial indicator & its constructional details.
7. Use of dial indicator to check a shape run use.
8. Use of dial indicator and V Block to check the circularity and plot the polar Graph.
9. Study and understanding of limits, fits & tolerances.
10. Experiment on measurement of pressure.
11. Study of temperature measuring equipments.
12. Measurement using Strain gauge.
13. Measurement of speed using stroboscope.
14. Experiment on measurement of flow.
15. Measurement of vibration/power.
16. Experiment on dynamometers.
17. To study the displacement using LVDT.

MTEE-45P ELECTRICAL MACHINES & AUTOMATIC CONTROL LAB

Note: To perform at least 7 experiments of Electrical Machines and 3 experiments of Automatic Control System

A. Electrical Machines

1. To obtain speed-torque characteristics and efficiency of a dc shunt motor by direct loading.
2. To obtain efficiency of a dc shunt machine by no load test.
3. To obtain speed control of dc shunt motor using (a) armature voltage control (b) field control.
4. To determine polarity and voltage ratio of single phase and three phase transformers.
5. To obtain efficiency and voltage regulation by performing O.C. and S.C. tests on a single phase transformer at full load and 0.8 p.f. loading.
6. To obtain 3-phase to 2-phase conversion using Scott connection.
7. To perform load test on a 3-phase induction motor and determine (a) speed- torque characteristics (b) power factor v/s line current characteristics.
8. To study speed control of a 3-phase induction motor using (a) Voltage Control (b) Constant (Voltage/ frequency) control.
9. To perform open circuit and short circuit test on a 3-phase synchronous machine and determine voltage regulation at full load and unity, 0.8 lagging and 0.8 leading power factor using synchronous impedance method.
10. To determine V-curve of a 3-phase synchronous motor at no load, half load and full load.

B. Automatic Control System:

1. To determine transient response of a second order system for step input for various values of constant ‘K’ using linear simulator unit and compare theoretical and practical results.
2. To study P, PI and PID temperature controller for an oven and compare their performance.
3. To determine speed – torque characteristics of an a.c. 2-phase servo motor.
4. To study and calibrate temperature using Resistance Temperature Detector(RTD)

5. To study dc servo position control system within P and PI configurations.
6. To study synchro transmitter and receiver system and determine output V/s input characteristics.
7. To study open loop and closed loop control of a dc separately excited motor

[BTIS-41] Industrial Sociology

Unit-I Industrial Sociology: Nature,Scope and Importance of Industrial Sociology. Social Relations in Industry, Social Organization in Industry- Bureaucracy,Scientific Management and Human Relations**.**

Unit-II Rise and Development of Industry: Early Industrialism – Types of Productive Systems – The Manorial or Feudal system. The Guild system, The domestic or putting-out system,and the Factory system. Characteristics of the factory system.Causes and Consequences of industrialization.Obstacles to and Limitations of Industrialization**.**

Unit-III Industrialization in India: Industrial Policy Resolutions – 1956.Science.Technology andInnovation Policy of India 2013.

Unit-IV Contemporary Issues: Grievances and Grievance handling Procedure. Industrial Disputes:causes,Strikes and Lockouts.Preventive Machinery of Industrial Disputes:Schemes of Workers Participation in Management- Works Committee,Collective Bargaining, Bi-partite & Tri-partite Agreement,Code of Discipline,Standing Orders. Labour courts & Industrial Tribunals.

References : 1. GISBERT PASCAL, Fundamentals of Industrial sociology, Tata McGraw Hill Publishing Co., New Delhi, 1972.

2. SCHNEIDER ENGNO V., Industrial Sociology 2nd Edition, McGraw Hill Publishing Co., New Delhi, 1979.

3. MAMORIA C.B. And MAMORIA S., Dynamics of Industrial Relations in India.

[BTAC-41] Cyber Security

UNIT-1

Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.

UNIT-2

Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats - Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce-Electronic Payment System, eCash,Credit/Debit Cards. Digital Signature, public KeyCryptography.

UNIT-3

Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control,CCTV and intrusion Detection Systems, Backup Security Measures.

UNIT-4

Security Policies, Why Policies should be developed, WWW policies, Email Security policies, PolicyReview Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement ofthe Policies.Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; ITAct 2000 Provisions,Intellectual Property Law: Copy Right Law, Software License, Semiconductor Lawand Patent Law.

References :

1. Charles P. Pfleeger, Shari LawerancePfleeger, "Analysing Computer Security ", Pearson Education India.

2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.

3.Dr. Surya Prakash Tripathi, RitendraGoyal, Praveen kumar Shukla ,"Introduction to Information Security and

Cyber Law" Willey Dreamtech Press.

SCIENCE BASED OPEN ELECTIVES
[BTOE-41] INTRODUCTION TO SOFT COMPUTING
(Neural Networks, Fuzzy Logic and Genetic Algorithm)

Unit-I : Neural Networks-1(Introduction & Architecture)
Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions,Neural network architecture: single layer and multilayer feed forward networks, recurrent networks.Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.

Unit-II : Neural Networks-II (Back propogation networks)
Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back opogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.

Unit-III : Fuzzy Logic-I (Introduction)
Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

Unit-IV : Fuzzy Logic –II (Fuzzy Membership, Rules)
Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications&Defuzzificataions, Fuzzy Controller, Industrial applications.

Unit-V : Genetic Algorithm(GA)
Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

Text Books:
1. S. Rajsekaran& G.A. VijayalakshmiPai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India.
2. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.

Reference Books:
3. SimanHaykin,"Neural Netowrks"Prentice Hall of India
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

[BTOE-42] NANO SCIENCES

UNIT -1 :

Introduction:

Difinition of Nano-Science and Nano Technology, Applications of Nano-Technology.

Introduction to Physics of Solid State:

Structure: Size dependence of properties; crystal structures, face centered cubic nanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations.

Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces.

Localized Particles: Acceptors and deep taps; mobility; Excitons.

UNIT-2

Quantum Theory For Nano Science:

Time dependent and time independent Schrodinger wave equations. Particle in a box, Potential step: Refelection and tunneling(Quantum leak). Penetration of Barrier, Potential box(Trapped particle in 3D:Nanodot), Electron trapped in 2D plane(Nano sheet), Quantum confinerment effect in nano materials.

Quantum Wells, Wires and Dots

Preparation of Quantum Nanostructure; Size and Dimensionality effect, Fermigas; Potential wells; Partial confinement; Excitons; Single electron Tunneling, Infrared etectors; Quantum dot laser Superconductivity.

Properties of Individual Nano particles

Metal Nano clusters: Magic Numbers; Theoretical Modelling of Nanopraticles; geometric structure; electronic structure; Reactivity; Fluctuations Magnetic Clusters; Bulle to Nano structure.

Semi conducting Nanoparticles: Optical Properties; Photofragmentation; Coulmbic explosion.

Rare Gas & Molecular Clusters: Inert gas clusters; Superfluid clusters molecular clusters.

UNIT-3

Growth Techniques of Nanomaterials:

Lithograpahic and Nonlithograpahic techniques, Sputtering and film deposition in glow discharge, DC sputtering technique(p-$CuAlO_2$ deposition). Thermal evaporation technique, E-beam evaporation, Chemical Vapour deposition(CVD), Synthesis of carbon nano-fibres and multi-walled carbon nanotubes, Pulsed Laser Deposition, Molecular beam Epitoxy, Sol-Gel Techniuqe (No chemistry required), Synthesis of nanowires/rods, Electrodeposition, Chemical bath deposition, Ion beam deposition system, Vapor-Liquid–Solid (VLS) method of nanowires.

UNIT -4

Methods of Measuring Properties:

Structure: Crystallography, particle size determination, surface structure,

Microscopy: Scanning Prob Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Elecrtron Microscopy (TEM)

Spectroscopy: Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy, Luninscence.

UNIT-5

Buckey Ball:

Nano structuresofcarbon(fullerene):

Carbon nano-tubes: Fabrication , structure. electrical, mechanical, and vibrational properties and applications. Nano diamond, Boron Nitride Nano-tubes, single elecron transistors, Moelcular machine, Nano-Biometrics, Nano Robots.

Text/Reference Books:

1. C.P.Poole Jr F.J. Owens, “Introduction to Nanotechnology”.
2. “Introduction to S.S. Physics” - (7^{th} Edn.) Wiley 1996.

[BTOE-43] LASER SYSTEMS AND APPLICATIONS

UNIT-I & II

Introduction:

Review of elementary quantum physics, Schrodinger equation, concept of coherence, absorption, spontaneous emission and stimulated emission processes, relation between Einstein's A and B coefficients, population inversion, pumping, gain, optical cavities.

UNIT-III & IV

Lasers & Laser Systems:

Main components of Laser, principle of Laser action, introduction to general lasers and their types. Three & four level Lasers, CW & Pulsed Lasers, atomic, ionic, molecular, excimer, liquid and solid state Lasers and systems, short pulse generation and Measurement.

UNIT-V

Applications:

Laser applications in medicine and surgery, materials processing, optical communication, metrology and LIDAR and holography.

Text/ Reference Books:

1. K.R. Nambiar, "Laser Principles, Types and Application" New Age International.
2. S. A. Ahmad, "Laser concepts and Applications" New Age Internati

[BTOE-44] SPACE SCIENCES

1. Introduction:

Introduction to space science and applications, historical development

2. Solar System:

Nebular theory of formation of our Solar System.Solar wind and nuclear reaction as the source of energy.

Sun and Planets: Brief description about shape size, period of rotation about axis and period of revolution, distance of planets from sun, Bode's law, Kepler's Laws of planetary motion, Newton's deductions from Kepler's Laws, Newton's Law of gravitation, correction of Kepler's third law, determination of mass of earth, determination of mass of planets with respect to earth. Brief description of Asteroids, Satellites and Comets.

3. Stars:

Stellar spectra and structure, stellar evolution, nucleo-synthesis and formation of elements.

Classification of stars: Harvard classification system, Hertzsprung-Russel diagram,

Luminosity of star, variable stars; composite stars (white dwarfs, Neutron stars, black hole, star clusters, supernova and binary stars); Chandrasekhar limit.

4. Galaxies:

Galaxies and their evolution and origin, active galaxies and quasars.

5. Creation of Universe:

Early history of the universe, Big-Bang and Hubble expansion model of the universe,cosmic microwave background radiation, dark matter and dark energy.

Text Books / Reference Books:

1. K. S. Krishnaswami, "Astrophysics: A modern Perspective" New Age International.
2. K. S. Krishnaswami, "Understanding cosmic Panorama" New Age International.

[BTOE-45] POLYMER SCIENCE AND TECHNOLOGY

UNIT –I & II

POLYMERS:

Introduction, chemistry of polymer synthesis, polymer reaction kinetics, physical properties and characterization of polymers, effect of structure on properties of polymers, organic polymers.Introduction to high performance polymers and composites and their processing.

UNIT –III & IV

POLYMERIZATION:

Introduction, step-growth polymerization, free radical chain growth polymerization, emulsion polymerization, ionic and cationic polymerization, chain statistics and rubber elasticity.

UNIT – UNIT –V & VI

PREPARATION AND APPLICATIONS:

Preparation, properties and technical applications of thermo-plastics (PVC, PVA), thermostats (PF, UF) and elastomers (SBR, GR-N), silicones.Application of polymers in space, ocean, electronics, medical, agriculture, automobile, sports and building construction.

[BTOE-46] NUCLEAR SCIENCE

UNIT-I

Nucleus and Its Basic Features:

Nuclear structure; nuclear forces and their properties, nuclear stability, nuclear radius and its meassurement, nuclear spin, nuclear magnetic and electrical moments.

UNIT-II

Nuclear Models:

Single particle model, liquid drop model and semi-emperical mass formula, nuclear potential and shell model, collective model.

UNIT-III

Nuclear Reaction:

Nuclear reaction and laws of conservation, types of nuclear reaction, mechanism of nuclear reaction, nuclear fission & binuclear fusion and their explanation by liquid drop model.

UNIT-IV

Nuclear Decay:

Decay constant, half life period and mean life, alpha decay, beta decay, gamma decay, interaction of nuclear radiation with matter.

Nuclear Instruments-I

Mass spectrograph,: General principle, Aston's Mass Spectrograph.

UNIT-V

Nuclear Instruments-II

Accelerators: Van de Graph Generator, Cyclotron, Synchrotron.

Detectors: G M Counter, Scintillation counter, cloud chamber, Bubble Chamber, production and detection of neutrons and Gamma-photon.

Application of Nuclear Techniques: Nuclear magnetic resonance, positron emission topography, radiotracer techniques and applications in material science and agriculture.

Text Books:

1. Tayal, "Nuclear Physics" Himalaya Publishing House.
2. S.N. Ghosal, "Nuclear Physics" S. Chand & Co.

Reference Books:

6. Roy & Nigam, "Nuclear Physics" John Wiley & sons.
7. W.E. Burcham, "Nuclear Physics" Longmans Publications.

[BTOE-47] MATERIAL SCIENCE

UNIT-I

Introduction: Historical perspective, importance of materials, Brief review of modern & atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bonding.

Crystallography and imperfections:

Concept of unit cell, space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices.X-ray crystallography techniques, imperfections, Defects & Dislocations in solids. .

UNIT-II

Mechanical Properties and Testing: Stress strain diagram, Ductile and brittle materials, stress Vs strength, toughness, hardness, fracture, fatigue and creep. Testing, such as Strength testing, Hardness testing, Impact testing, Fatigue testing Creep testing, Non-destructive testing (NDT)

Micro Structural Exam: Microscope principle and methods, Preparation of samples and microstructure exam and grain size determination, comparative study of microstructure of various metals and alloys, such as Mild steel, CI, Brass.

Phase Diagram and Equilibrium Diagram: Uniary and Binary diagrams, Phase rules, Types of equilibrium diagrams: solid solution type, eutectic type and combination type, Iron-carbon equilibrium diagram.

UNIT-III

Ferrous materials: Iron and steel manufacture, furnaces, various types of carbon steels, alloy steels and cast irons, its properties and uses.
Heat Treatment: various types of heat treatment, such as Annealing, Normalizing, Quenching, Tempering and Case hardening. Time Temperature Transformation (TTT) diagrams.
Non-Ferrous metals and alloys: Non-ferrous metals, such as Cu, Al, Zn, Cr, Ni etc. and its applications. Various types of Brass, Bronze bearing materials their properties and uses. Aluminum alloys, such as Duralumin, Other advanced materials/alloys.
UNIT-IV
Magnetic properties: Concept of magnetism- Dia, para, ferro magnetic materials, Hysteresis, Soft and hard magnetic materials, Magnetic Storages.
Electric Properties: Energy band, concept of conductor, insulator and semi conductor. Intrinsic and extrinsic semi-conductors, P-n junction and transistors, Basic devices and their applications.diffusion of Solid
Super conductivity and its applications, Messier effect. Type I& II superconductors. High Temp. superconductors.
UNIT-V
Ceramics: Structure, types, properties and applications of ceramics. Mechanical/Electrical behaviour and processing of ceramics.
Plastics: Various types of polymers/plastics and their applications. Mechanical behaviour and processing of plastics, Future of plastics.
Other Materials: Brief description of other materials, such as optical and thermal materials, concrete, composite materials and their uses.
Other Materials: Brief description of other materials, such as optical and thermal materials, concrete, composite materials and their uses.
Performance of materials in service: Brief theoretical consideration of fracture, fatigue, and corrosion and its control.
Text / Reference Books:
1. W.D. Callisster Jr. "Material Science & Engineering Addition" - Wesly Publishing Co.
2. Van Vlash, "Elements of Material Science & Engineering", John Wiley & Sons

[BTOE-48] DISCRETE MATHEMATICS

UNIT-I
Set Theory: Definition of Sets, Venn Diagrams, complements, cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets), proofs of some general identitites on sets, pigeonhole principle.
Relation: Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial ordering relation.
Function: Definition and types of function, composition of functions, recursively defined functions.
UNIT-II
Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction , normal forms(conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification.
Notion of proof: proof by implication, converse, inverse, contrapositive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example.
UNIT-III
Combinatories: Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations (n_{th} order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function (closed form expression, properties of G.F., solution of recurrence relation using G.F, solution of combinatorial problem using G.F.)
Unit-IV
Algebraic Structure: Binary composition and its properties definition of algebraic structure; Groyas Semi group, Monoid Groups, Abelian Group, properties of groups, Permutation Groups, Sub Group, Cyclic Group, Rings and Fields (definition and standard results).
UNIT-V
Graphs:

Graph terminology, types of graph connected graphs, components of graph, Euler graph, Hamiltonian path and circuits, Graph coloring, Chromatic number.

Tree: Definition, types of tree(rooted, binary), properties of trees, binary search tree, tree traversing (preorder, inorder, postorder).

Finite Automata: Basic concepts of Automation theory, Deterministic finite Automation(DFA), transition function, transition table, Non Deterministic Finite Automata (NDFA), Mealy and Moore Machine, Minimization of finite Automation.

Text/Reference Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Mc.Graw Hill, 2002.
2. V. Krishnamurthy, "Combinatories:Theory and Applications", East-West Press.

[BTOE-49] APPLIED LINEAR ALGEBRA

UNIT-1

Fields, Vector-spaces, sub-spaces, linear-combination, linear-dependence and independence.Basis, dimensions and coordinates (each and every fact to be illustrated by suitable examples).

UNIT-2

Linear-transformation, definition and examples, matrix representation, similarity, range and kernel, rank-nullity theorem and its consequences.

UNIT-3

Singular and non singular linear transformations, sum and product of linear transformations, vector space of linear transformations, nilpotent linear transformations.

UNIT-4

Inner product spaces, definition and examples, orthogonality, Cauchy-Schwartz Inquality, Minkowski Inequality, polarization Identity, complete ortho normal set, Bessel's Inequality, Gram-Schmidt's orthogonalization process.

UNIT-5

Linear functional, definition and examples, vector space of linear functional, dual vector spaces, adjoint, self adjoint, unitary and normal operators, examples and properties, eigen values and eigen vectors, diagonalisation of linear operators, quadratic forms, principle axis theorem(without proof), some applications to engineering problems.

TEXT/REFERENCE BOOKS

1. Dym, H. Linear Algebra in action, University Press.2012
2. Halmos, P.R.: Finite Dimensional Vector Spaces (1990) Narosa.

SEMESTER-V

BTME-51 MANUFACTURING SCIENCE& TECHNOLOGY-II

Unit I

Metal Cutting-

Mechanics of metal cutting. Geometry of tool and nomenclature .ASA system Orthogonal vs. oblique cutting. Mechanics of chip formation, types of chips. Shear angle relationship. Merchant's force circle diagram. Cutting forces, power required. Heat generation and cutting tool temperature, Cutting fluids/lubricants. Tool materials. Tool wear and tool life. Machinability.Dynamometer, Brief introduction to machine tool vibration and surface finish. Economics of metal cutting.

Unit-II

Machine Tools

(i) Lathe: Principle, construction, types, operations, Turret/capstan, semi/Automatic, Tool layout

(ii) Shaper, slotter, planer: Construction, operations & drives.

(iii) Milling: Construction, Milling cutters, up & down milling. Dividing head & indexing. Max chip thickness & power required.
(iv) Drilling and boring: Drilling, boring, reaming tools. Geometry of twist drills.

Unit-III

Grinding &Super finishing

(i) Grinding: Grinding wheels, abrasive & bonds, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria.Surface and cylindrical grinding.Centerless grinding
(ii) Super finishing: Honing, lapping and polishing.

Limits, Fits & Tolerance and Surface roughness:

Introduction to Limits, Fits, Tolerances and IS standards, Limit-gauges, and surface-roughness.

Unit-IV

B. Metal Joining (Welding)

Survey of welding and allied processes.Gas welding and cutting, process and equipment. Arc welding: Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding - spot, seam projection etc.Other welding processes such as atomic hydrogen, submerged arc, electroslag,friction welding. Soldering & Brazing. Adhesive bonding. Thermodynamic and Metallurgical aspects in welding and weld, Weldability, Shrinkage/residual stress in welds. Distortions & Defects in welds and remedies. Weld decay in HAZ.

Unit-V

C. Introduction to Unconventional Machining and Welding

Need & benefits, application and working principle of EDM, ECM, LBM, EBM, USM. AJM, WJM.Similarly, non-conventional welding applications such as LBW, USW, EBW, Plasma-arc welding,Diffusion welding, Explosive welding/cladding. Introduction to Hybrid machining processes

Books and References:

1. Manufacturing Science – A. Ghosh and A.K. Mallik,Affiliated East-West Press
2. Fundamentals of Metal Machining and Machine Tools – Geoffrey Boothroyd, CRC Press
3. Production Technology - R.K. Jain Khanna Publishers.
4. Introduction to Manufacturing Processes – John A. Schey ,McGraw-Hill
5. Production Engineering Science - P.C. Pandey,Standard Publishers Distributors,

BTME-52 HEAT & MASS TRANSFER

UNIT-1

Introduction to Heat Transfer:

Thermodynamics and Heat Transfer. Modes of Heat Transfer: Conduction, convection and radiation. Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism.

Conduction :

General differential heat conduction equation in the rectangular, cylindrical and spherical coordinate systems. Initial and boundary conditions.

Steady State one-dimensional Heat conduction :

Simple and Composite Systems in rectangular, cylindrical and spherical coordinates with and without energy generation; Concept of thermal resistance. Analogy between heat and electricity flow; Thermal contact resistance and over all heat transfer coefficient; Critical radius of insulation.

UNIT-2

Fins: Heat transfer from extended surfaces, Fins of uniform cross-sectional area; Errors of measurement of temperature in thermometer wells.

Transient Conduction:
Transient heat conduction; Lumped capacitance method; Time constant; Unsteady state heat conduction in one dimension only, Heisler charts.

UNIT-3

Forced Convection:
Basic concepts; Hydrodynamic boundary layer; Thermal boundary layer; Approximate integral boundary layer analysis; Analogy between momentum and heat transfer in turbulent flow over a flat surface; Mixed boundary layer; Flow over a flat plate; Flow across a single cylinder and a sphere; Flow inside ducts;Thermal entrance region, Empirical heat transfer relations; Relation between fluid friction and heat
transfer; Liquid metal heat transfer.

Natural Convection :
Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere, Combined free and forced convection.

UNIT-4

Thermal Radiation :
Basic radiation concepts; Radiation properties of surfaces; Black body radiation Planck's law, Wien's displacement law, Stefan Boltzmann law, Kirchoff's law; ; Gray body; Shape factor; Black-body radiation;Radiation exchange between diffuse non black bodies in an enclosure; Radiation shields; Radiation combined with conduction and convection; Absorption and emission in gaseous medium; Solar radiation;Green house effect.

UNIT-5

Heat Exchanger :
Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperature difference (LMTD) method; Effectiveness-NTU method; Compact heat exchangers.

Condensation and Boiling:
Introduction to condensation phenomena; Heat transfer relations for laminar film condensation on vertical surfaces and on outside & inside of a horizontal tube; Effect of non-condensable gases; Dropwise condensation; Heat pipes; Boiling modes, pool boiling; Hysteresis in boiling curve; Forced convection boiling.

Introduction to Mass Transfer:
Introduction; Fick's law of diffusion; Steady state equimolar counter diffusion; Steady state diffusion though a stagnant gas film.

Books:
1. Fundamentals of Heat and Mass Transfer, by Incroperra& DeWitt, John Wiley and Sons
2. Heat and Mass Transfer by Cengel, McGraw-Hill
3. Heat Transfer by J.P. Holman, McGraw-Hill
4. Heat and Mass Transfer by Rudramoorthy and Mayilsamy, Pearson Education
5. Heat Transfer by Ghoshdastidar, Oxford University Press

BTME-53 I C ENGINES & COMPRESSORS

Unit-1
Introduction to I.C Engines: Engine classification and basic terminology, Two and four stroke engines, SI and CI engines, Valve timing diagram. Thermodynamic analysis of Air standard cycles, Otto cycle, Diesel cycle, Dual cycle, Stirling cycle,Ericsson cycles, Comparison of Otto, Diesel and Dual cycles Fuel air cycle, factors affecting the fuel air cycle, Actual cycle.

Unit–II
SI Engines: Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, combustion chamber design for SI engines. Carburetion, Mixture requirements, Carburettors and fuel injection system in SI ngine Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition, Scavenging in 2 Stroke engines, Supercharging and its effect

Unit–III
CI Engine: Combustion in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI engines.Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings Exhaust emissions from SI engine and CI engine and it's control

Unit-IV
Engine Cooling and Lubrication: Different cooling systems, Radiators and cooling fans, Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation. Fuels: Fuels for SI and CI engine , Important

qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines.Testing and Performance: Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines

Unit V

Compressors: Classification, Reciprocating compressors, Single and Multi stage compressors,Intercooling, Volumetric efficiency.Rotary compressors, Classification, Centrifugal compressor , Axial compressors, Surging and stalling, Roots blower, Vaned compressor.

BOOKS:

1. Fundamentals of Internal Combustion Engine by Gill, Smith,Ziurs, Oxford & IBH Publishing CO.
2. Fundamentals of Internal Combustion Engines by H.N. Gupta, Prentice Hall of India
3. A Course in International Combustion Engines, by Mathur& Sharma, DhanpatRai& Sons.
4. I.C Engine Analysis & Practice by E.F Obert.
5. I.C Engine, by Ganeshan, Tata McGraw Hill Publishers.
6. I.C Engine, by R. Yadav, Central Publishing House, Allahabad

BTME-54 KINEMATICS OF MACHINES

Unit I

Introduction, mechanisms and machines, kinematics and kinetics, types of links, kinematic pairs and their classification, types of constraint, degrees of freedom of planar mechanism, Grubler's equation, mechanisms, inversion of four bar chain, slider crank chain and double slider crank chain.

Velocity analysis:

Introduction, velocity of point in mechanism, relative velocity method, velocities in four bar mechanism, slider crank mechanism and quick return motion mechanism, rubbing velocity at a pin joint, instantaneous center method, types and locations of instantaneous center, Kennedy's theorem, velocities in four bar mechanism and slider crank mechanism.

Unit II

Acceleration analysis:

Introduction, acceleration of a point on a link, acceleration diagram, Corioli's component of cceleration, crank and slotted lever mechanism, Klein's construction for slider crank mechanism and four bar mechanism, analytical method for slider crank mechanism.

Kinematic synthesis of mechanism:

Introduction, dimensional synthesis of mechanisms, motion, path and function generation, Chebyshev spacing, three position synthesis, graphical approach for four link mechanisms, straight line mechanisms, special mechanisms – indicator diagram mechanisms, steering mechanisms, Hook's Joint

Unit III

Cams

Introduction, classification of cams and followers, cam profiles for knife edge, roller and flat faced followers for uniform velocity, uniform acceleration, simple harmonic and cycloidal motions of follower. Analytical methods for cam profile.

Unit IV

Gears and gear trains

Introduction, classification of gears, law of gearing, tooth forms and their comparisons, systems of gear teeth, length of path of contact, contact ratio, interference and undercutting in involute gear teeth,minimum number of teeth on gear and pinion to avoid interference, simple, compound, reverted and planetary gear trains, sun and planet gear train.

Unit V

Friction drives

Introduction, belt and rope drives, open and crossed belt drives, velocity ratio, slip, power transmission,effect of mass of belt on power transmission, maximum power transmission, initial tension and maximum tension, pivots and collars, uniform pressure and uniform wear, clutches.

Books:

1. Theory of Mechanisms and Machines: A Ghose and A K Malik, East West Press Pvt Ltd.
2. Theory of Mechanisms and Machines: J JUicker, G R Pennock and J E Shigley, Oxford University Press.

BTME-55 Machine Design-I

UNIT I

Introduction

Definition, Design requirements of machine elements, Design procedure, Standards in design, Selection of preferred sizes, Indian Standards designation of carbon & alloy steels, Selection of materials for static and fatigue loads.

Design for Static Load

Modes of failure, Factor of safety, Principal stresses, Stresses due to bending and torsion, Theory of failure.

UNIT II

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

Riveted Joints

Riveting methods, materials, Types of rivet heads, Types of riveted joints, Caulking and Fullering, Failure of riveted joint, Efficiency of riveted joint, Design of boiler joints, Eccentric loaded riveted joint.

UNIT III

Shafts

Cause of failure in shafts, Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads,Design for rigidity.

Keys and Couplings

Types of keys, splines, Selection of square & flat keys, Strength of sunk key, Couplings, Design of rigid and flexible couplings.

UNIT IV

Mechanical Springs

Types, Material for helical springs, End connections for compression and tension helical springs, Stresses and deflection of helical springs of circular wire, Design of helical springs subjected to static and fatigue loading.

Power Screws

Forms of threads, multiple threads, Efficiency of square threads, Trapezoidal threads, Stresses in screws,Design of screw jack

Note: Design data book is allowed in the examination

Books and References:

1. Design of Machine Elements,V.B. Bhandari, Tata McGraw Hill Co.
2. Machine Design-Sharma and Agrawal, S.K. Kataria& Sons.
3. Machine Design, U C Jindal, Pearson Eductaion.
4. Design of Machine Elements, Sharma and Purohit, PHI.

[BTMB-51] Engineering Economics

Unit-1 Introduction to Engineering Economics and Managerial Economics Concept of Efficiency, Theory of Demand , Elasticity of Demand, Supply and Law of Supply indifference Curves, Budget Line, Welfare Analysis, Scope of Managerial Economics, Techniques and Applications of Managerial Economics.

Unit-2 Market Structure Perfect Competitions Imperfect- Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.

Unit-3 Demand Forecasting and cost Estimation Characteristics of Forecasts, Forecasting Horizons, Steps to Forecasting, Forecasting Methods, Seasonal Adjustments, Forecasting Performance Measures, Cost Estimation, Elements of cost, Computation of Material Variances Break-Even Analysis.

Unit-4 Management Aspects Functions of Management, Project Management, Value Engineering, Project Evaluation, Decision Making.

BTME-51P MANUFACTURING TECHNOLOGY -II – LAB

Minimum eight experiments out of the following along-with study of the machines / processes

1. Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
2. Bolt (thread) making on Lathe machine
3. Tool grinding (to provide tool angles) on tool-grinder machine.
4. Gear cutting on Milling machine.
5. Machining a block on shaper machine.
6. Finishing of a surface on surface-grinding machine.
7. Drilling holes on drilling machine and study of twist-drill.
8. Study of different types of tools and its angles & materials.
9. Experiment on tool wear and tool life.
10. Experiment on jigs/Fixtures and its uses
11. Gas welding experiment
12. Arc welding experiment
13. Resistance welding experiment.
14. Soldering & Brazing experiment
15. Experiment on unconventional machining.
16. Experiment on unconventional welding.
17. Experiment on TIG/MIG Welding.
18. Macro and Microstructure of welding joints.

BTME-52P HEAT & MASS TRANSFER – LAB

Minimum eight experiment of the following

1. Conduction – Experiment on Composite plane wall
2. Conduction – Experiment on Composite cylinder wall
3 Conduction - Experiment on critical insulation thickness
4. Conduction – Experiment on Thermal Contact Resistance
5. Convection - Pool Boiling experiment
6. Convection - Experiment on heat transfer from tube-(natural convection).
7. Convection - Heat Pipe experiment.
8. Convection - Heat transfer through fin-(natural convection) .
9. Convection - Heat transfer through tube/fin-(forced convection).
10 Convection - Determination of thermal conductivity of fluid
11 Experiment on Stefan's Law, on radiation determination of emissivity, etc.
12 Experiment on solar collector, etc.
13. Heat exchanger - Parallel flow experiment
14. Heat exchanger - Counter flow experiment.

BTME-55P MACHINE DESIGN-I Lab

Minimum eight experiments out of the following are to be performed.
Students are advised to use design data book for the design. Drawing shall be made wherever necessary on small drawing sheets

1. Design & drawing of Cotter joint.
2. Design & drawing of Knuckle joint

3. Design of machine components subjected to combined steady and variable loads
4. Design of eccentrically loaded riveted joint
5. Design of boiler riveted joint
6. Design of shaft for combined constant twisting and bending loads
7. Design of shaft subjected to fluctuating loads
8. Design and drawing of flanged type rigid coupling
9. Design and drawing of flexible coupling
10. Design and drawing of helical spring
11. Design and drawing of screw jack

SEMESTER-VI

BTME-61 MACHINE DESIGN-II

UNIT I

Principle of transmission and conjugate action

Spur Gears

Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations,Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth,Design of spur gears, AGMA and Indian standards.

Helical Gears

Terminology, Proportions for helical gears, Forces components on a tooth of helical gear, Virtual number of teeth, Beam strength& wear strength of helical gears, Dynamic load on helical gears, Design of helical gears.

UNIT II

Bevel gears

Terminology of bevel gears, Force analysis, Virtual number of teeth, Beam strength and wear strength of bevel gears, Effective load of gear tooth, Design of a bevel gear system.

Worm Gears

Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing system.

UNIT III

Sliding Contact Bearing

Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication, Properties and materials, Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing,

UNIT IV

Rolling Contact Bearing

Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing,Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting of bearing

UNIT V

IC ENGINE parts,

Selection of type of IC engine, General design considerations, Design of cylinder and cylinder head; Design of piston and its parts like piston ring and gudgeon pin etc.; Design of connecting rod; Design of crankshaft

Note: Design data book is allowed in the examination

Books and References:

1. Design of Machine Elements-V.B. Bhandari, Tata McGraw Hill Co.
2. Machine Design-Sharma and Agrawal, S.K. Kataria& Sons.
3. Machine Design, U C Jindal, Pearson Eductaion.
4. Design of Machine Elements, Sharma and Purohit, PHI.
5. Design of Machine Eesign-M.F. Spott, Pearson Eductaion
6. Machine Design-Maleev and Hartman, CBS Publishers.
7. Mechanical Engineering Design, 9e – Joseph E. Shigely, McGraw Hill Education.
9. Elements of Machine Component Design, Juvinal&Marshek, John Wiley &

BTME-62 DYNAMICS OF MACHINES

Unit I

Force analysis:

Static force analysis of mechanisms, D'Alembert's Principle, dynamics of rigid link in plane motion, dynamic force analysis of planar mechanisms, piston force and crank effort. Turning moment on crankshaft due to force on piston, Turning moment diagrams for single cylinder double acting steam engine, four stroke IC engine and multi-cylinder engines, Fluctuation of speed, Flywheel.

Unit II

Gyroscope: Space motion of rigid bodies, angular momentum, gyroscopic couples, gyroscopic stabilization, ship stabilization, stability of four wheel and two wheel vehicles moving on curved paths.

Mech. Vibrations: Types of Vibration, Degrees of freedom. Longitudinal Vibration: Single degree free and damped vibration. Forced vibration of single degree under harmonic excitation. Vibration isolation. Whirling of shaft and critical speed.

Unit III

Balancing: Introduction,static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of reciprocating masses, balancing of single cylinder engine, balancing of multi cylinder inline engines.

Unit IV

Governors: Introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors. Effort and Power of governor, Controlling force diagrams for Porter governor and spring controlled governors.

Unit V

Brakes and dynamometers: Introduction, Law of friction and types of lubrication, types of brakes, effect of braking on rear and front wheels of a four wheeler, dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer

Text/Reference Books:

1. Kinematics and dynamics of machinery: Wilson and Sadler, Third edition, Pearson.
2. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumarMallik, Third Edition Affiliated East-West Press.
3. Theory of Machines and Mechanisms: Joseph Edward Shirley and John Joseph Quicker, Jr. Oxford University Press

BTME-63 REFRIGERATION & AIR CONDITIONING

Unit-1

Refrigeration: Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P.

Air Refrigeration cycle:

Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART).

Unit-2

Vapour Compression System:

Single stage system, Analysis of vapour compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multistage vapour compression system requirement, Removal of flash gas, Intercooling, Different configuration of multistage system, Cascade system.

Unit-3

Vapour Absorption system;

Working Principal of vapour absorption refrigeration system, Comparison between absorption &compression systems, Elementary idea of refrigerant absorbent mixtures, Temperature – concentration diagram & Enthalpy – concentration diagram , Adiabatic mixing of two streams, Ammonia – Water vapour absorption system, Lithium- Bromide water vapour absorption system, Comparison. Three fluid system.

Refrigerants:

Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants. Ozone layer depletion and global warming considerations of refrigerants

Unit-4

Air Conditioning:

Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat transfer through walls & roofs, Infiltration & ventilation, Internal heat gain, Sensible heat factor (SHF),By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP). Air Washers, Cooling towers & humidifying efficiency.

Unit-5

Refrigeration Equipment & Application:

Elementary knowledge of refrigeration & air conditioning equipmentse.g compressors, condensers, evaporators & expansion devices, Food preservation, Cold storage, Refrigerates Freezers, Ice plant, Water coolers, Elementary knowledge of transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning.

Books:

1. Refrigeration and Air conditioning by C.P Arora, McGraw-Hill
2. Refrigeration and Air conditioning, by Manohar Prasad, New Age International (P) Ltd.Pub.
3. Refrigeration and Air conditioning by R. C. Arora, PHI

BTME-64 FLUID MACHINERY

UNIT-I

Introduction: Impulse of Jet and Impulse Turbines:

Classification of Fluid Machines & Devices, Application of momentum and moment of momentum equation to flow through hydraulic machinery, Euler's fundamental equation. Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat &curve),Classification of turbines, Impulse turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Governing of Pelton wheel

UNIT-II

Reaction Turbines: Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Degree of reaction, Draft tube, Cavitations in turbines, Principles of similarity, Unit and specific speed, Performance characteristics, Selection of water turbines.

UNIT-III

Centrifugal Pumps:

Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficiencies of centrifugal pumps, Specific speed, Cavitations & separation, Performance characteristics.

UNIT-IV

Positive Displacement and other Pumps:

Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels, Comparison of centrifugal and reciprocating pumps, Performance characteristics. Hydraulic ram, Jet pumps, Air lift pumps.

BOOKS:

1. Hydraulic Machines by JagdishLal, Metropolitan book co. pvt ltd.
2. Hydraulic Machines by K Subramanian, Tata McGraw Hill
3. Fluid Mechanics and Machinery by C.S.P.Ojha, R. Berndtsson, P.N. Chandramouli,Oxford University Press

BTME-65 UNCONVENTIONAL MANUFACTURING PROCESSES

UNIT-I

Introduction, Limitations of conventional manufacturing processes, Need for unconventional manufacturing processes, its classification and future possibilities, Hybrid processes Unconventional Machining Process based on material removal by abrasion, Principle and working and applications Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet machining and Ultrasonic Machining.

UNIT-II

Thermoelectric unconventional methods, Principle, working and applications of Plasma Arc Machining, Laser Beam Machining, Electron Beam Machining etc Working principle and applications of Electric Discharge Machining, EDM machines, EDM process characteristics, Wire electric discharge machining

UNIT-III

Electro-chemical machining processes, ECM, its working principle, advantages and applications, Electro-chemical grinding, Electro-chemical debarring, Chemical machining. Unconventional welding processes: Explosive welding, Cladding etc., Under water welding, Metalizing, Plasma are welding/cutting etc.

UNIT-IV

Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-discharge forming, water hammer forming, explosive compaction etc.Electronic-device Manufacturing, Diffusion and Photo- Lithography process for electronic-device manufacturing.

Books and references:

1. Modern Machining Processes – P.C. Pandey

2. Advanced Machining Processes, V.K. Jain, Allied Publishers.
3. Handbook of Manufacturing Processes, James G Bralla, Industrial Press.

BTMB-61 : INDUSTRIAL MANAGEMENT

Unit-I Introduction: Concept, Development, application and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

Unit-II Management Function: Principle of Management – Time and motion study, work simplification – process charts and flow diagrams, Production Planning.

Unit-III Inventory Control: Inventory, Cost, Deterministic Models, Introduction to supply chain management.

Unit-IV Quality Control: Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM.

BTME-61P MACHINE DESIGN-II Lab

A. Computer and Language :students are required to learn the basics of computer language such as C and C++ so that they should be able to write the computer programme (*3practical turns*)

B. Writing Computer programme for conventional design: Students are required to write computer program and validate it for the design of machine components done in theory subject (*5practical turns*)

C. Mini Project: Each **s**tudent will be given a real life problem for the complete design of a subsystem/system using either manual calculation with the help of design handbook or through computer programme, if needed. This will be done as home assignment to be submitted at the end of the semester.

BTME-62P THEORY OF MACHINES LAB

Minimum eight experiments out of the following:
1. Study of simple linkage models/mechanisms
2. Study of inversions of four bar linkage
3. Study of inversions of single/double slider crank mechanisms
4. Experiment on Gears tooth profile, interference etc.
5. Experiment on Gear trains
6. Experiment on longitudinal vibration
7. Experiment on transverse vibration
8. Experiments on dead weight type governor
9. Experiment on spring controlled governor
10. Experiment on critical speed of shaft
11. Experiment on gyroscope
12. Experiment on static/dynamic balancing
13. Experiment on Brake
14. Experiment on clutch

BTME-63P REFRIGERATION & AIR CONDITIONING Lab

Minimum eight experiments out of the following:

1. Experiment on refrigeration test rig and calculation of various performance parameters.
2. Study of different types of expansion devices used in refrigeration system.
3. Study of different types of evaporators used in refrigeration systems.
4. To study basic components of air-conditioning system.
5. Experiment on air-conditioning test rig & calculation of various performance parameters.
6. Experiment on air washers
7. Study of window air conditioner.
8. Study & determination of volumetric efficiency of compressor.
9. Visit of a central air conditioning plant and its detailed study.
10. Visit of cold-storage and its detailed study.
11. Experiment on Ice-plant.
12. Experiment on two stage Reciprocating compressor for determination of volumetric efficiency , PV diagram and effect of intercooling.
13. Study of Hermetically sealed compressor.
14. Experiment on Desert coolers.

BTME-64P FLUID MACHINERY Lab

Minimum ten experiments out of the following along with study of the machines and processes

1. Impact of Jet experiment.
2. Experiment on Pelton wheel.
3. Experiment on Francis turbine.
4. Experiment on Kaplan turbine.
5. Experiment on Reciprocating pump.
6. Experiment on centrifugal pump.
7. Experiment on Hydraulic Jack/Press
8. Experiment on Hydraulic Brake
9. Experiment on Hydraulic Ram
10. Study through visit of any water pumping station/plant
11. Any other suitable experiment/test rig such as comparison & performance of different types of pumps and turbines.
12. Experiment on Compressor
13. Experiment for measurement of drag and lift on aerofoil in wind tunnel

SEMESTER-VII

[BTOE-71] QUALITY MANAGEMENT

UNIT-I Quality Concepts:

Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type. Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality Methods and techniques for

manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.

UNIT-II Quality Management :
Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program. 3 Human Factor in quality (11) Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.

UNIT-III Control Charts:
Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. 5 Attributes of Control Chart Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.

UNIT –IV
Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

UNIT –V
ISO-9000 and its concept of Quality Management
ISO 9000 series, Taguchi method, JIT in some details.

Text / Reference Books:
1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

COMPUTER AIDED DESIGN (CAD)

UNIT-I

Introduction: Introduction to CAD/CAED/CAE, Elements of CAD, Essential requirements of CAD, Concepts of integrated CAD/CAM, Necessity & its importance, Engineering Applications Computer Graphics-I CAD/CAM systems, Computer Graphics-I Graphics Input devices-cursor control Devices, Digitizers, Keyboard terminals, Image scanner, Speech control devices and Touch, panels, Graphics display devicesCathode Ray Tube, Random & Raster scan display, Color CRT monitors, Direct View Storage Tubes, Flat Panel display, Hard copy printers and plotters

UNIT-II

Computer Graphics-II Graphics standards, Graphics Software, Software Configuration, Graphics Functions, Output primitives-Bresenham's line drawing algorithm and Bresenham's circle generating algorithm Geometric Transformations: World/device Coordinate Representation, Windowing and clipping, 2 D Geometric transformations-Translation, Scaling, Shearing, Rotation & Reflection Matrix representation, Composite transformation, 3 D transformations, multiple transformation . 8 UNIT-III Curves: Curves representation, Properties of curve design and representation, Interpolation vs approximation, Parametric representation of analytic curves, Parametric continuity conditions, Parametric representation of synthetic curves-Hermite cubic splines-Blending function formulation and its properties, Bezier curves-Blending function formulation and its properties, Composite Bezier curves, B-spline curves and its properties, Periodic and non-periodic B-spline curves

UNIT-IV

3D Graphics: Polygon surfaces-Polygon mesh representations, Quadric and Superquadric surfaces and blobby objects; Solid modeling-Solid entities, Fundamentals of Solid modeling-Set theory, regularized set operations; Half spaces, Boundary representation, Constructive solid geometry, Sweep representation, Color models. Basic application commands for 2d drafting software like AutoCAD/Draftsight (any one)&3d solid modeling software Solidworks/Autodesk Inventor/PTC Creo /Catia (Any one)etc.

UNIT-V

Finite Element Analysis: Basic concept of the finite element method, comparison of FEM with direct analytical solutions; Steps in finite element analysis of physical systems, Finite Element analysis of 1-D problems like spring, bar, truss and beam elements formulation by direct approach; development of elemental stiffness equations and their assembly, solution and its post processing.

Books and References:

1. Computer Graphics, by Hearn & Baker, Prentice Hall of India

2. CAD/CAM, by Groover and Zimmers, Prentice Hall India Ltd.

3. CAD/CAM :Theory and Practice, by Zeid, McGraw Hill

4. CAD/CAM: Computer Aided Design and Manufacturing, by Groover, Pearson India

5. Mathematical Elements for Computer Graphics, buy Rogers and Adams, McGraw

AUTOMOBILE ENGINEERING

UNIT-I

Introduction: Basic concepts of Automobile Engineering and general configuration of an automobile, Power and Torque characteristics. Rolling, air and gradient resistance. Tractive effort. Gear Box. Gear ratio determination. 6 UNIT-II

Transmission System: Requirements. Clutches. Torque converters. Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle, wheel camber & Toe-in, Toe-out etc.. Steering geometry. Ackerman mechanism, Understeer and Oversteer.

UNIT-III

Braking System: General requirements, Road, tyre adhesion, weight transfer, Braking ratio. Mechanical brakes, Hydraulic brakes. Vacuum and air brakes. Thermal aspects. 5 Chasis and Suspension System: Loads on the frame, Strength and stiffness, Independent front & rear suspension, Perpendicular arm type, Parallel arm type, Dead axle suspension system, Live axis suspension system, Air suspension & shock absorbers.

UNIT-IV

Electrical System : Types of starting motors, generator & regulators, lighting system, Ignition system, Horn, Battery etc. 5 Fuel Supply System: Diesel & Petrol vehicle system such as Fuel Injection Pump, Injector & Fuel Pump, Carburetor etc. MPFI.

UNIT-V

Emission standards and pollution control : Indian standards for automotive vehicles-Bharat I and II, Euro-I and Euro-II norms, fuel quality standards, environmental management systems for automotive vehicles, catalytic converters, fuel additives and modern

trends in automotive engine efficiency and emission control. 5 Maintenance system: Preventive maintenance, break down maintenance and over hauling.

2 Books and References:

1. Automotive Engineering- Hietner

2. Automobile Engineering - Kripal Singh.

3. Automobile Engineering - Narang.

4. Automobile Engineering –TTTI, Pearson India

5. Automotive Mechanics-

COMPUTER AIDED MANUFACTURING (CAM)

UNIT-I

Introduction to Automation: Automated Manufacturing system; Need of automation, Basic elements of automation, Levels of automation, Automation Strategies, Advantages & disadvantages of automation, Historical development and future trends.

UNIT-II

Fundamental of Numerical Control, elements of NC machine tools, classification of NC machine tools, Advantages, suitability and limitations of NC machine tools, Application of NC system. Definition and designation of control axes, Constructional details of Numerical Control Machine Tools, MCU structure and functions, Methods of improving accuracy and productivity using NC.

UNIT –III

Computer Numerical Control (CNC) : Features of CNC, Elements of CNC machines, the machine control unit for CNC , Direct Numerical Control(DNC) and Adaptive Controls. System Devices: Drives, Feedback devices, Counting devices, DAC and ADCs, Interpolator systems, Control loop circuit elements in PTP system, Contouring system, Incremental and absolute systems.

UNIT –IV

NC Part Programming- (a) Manual (word address format) programming Examples Drilling, Turning and Milling; canned cycles, Subroutine, and Macro. (b) Computer Assisted Part programming (APT) Geometry, Motion and Additional statements, Macro-statement.

8 UNIT-V

Computer Integrated manufacturing system , Group Technology, Flexible Manufacturing System, Computer aided process planning-Retrieval and Generative System. Types and generations of Robots, Structure and operation of Robot, Robot applications.

Books and References :

1. Automation, Production System and Computer Integrated Manufacturing, by Mikell P. Grover, Prentice Hall of India Pvt Ltd.

2. CAD/CAM – Theory and Practice, by Ibrahim Zeid, McGraw Hill

3. Computer Aided Manufacturing, by Cheng, Pearson India

4. CAD/CAM: Principles and Oerations, by P. N. Rao, McGraw Hill

5. CAD/CAM: Computer Aided Design and Manufacturing, by M. Groover, Pearson India.

MECHANICAL SYSTEM DESIGN

UNIT-I

Engineering process and System Approach Basic concepts of systems, Attributes characterizing a system, types of system, Application of system concepts, Advantages of system approach, Problems concerning systems, Concurrent engineering, A case study-Viscous lubrication system in wire drawing. 4 Problem Formulation :Nature of engineering problems, Need statement, hierarchical nature of systems, hierarchical nature of problem environment, problem scope and constraint, A case study: heating duct insulation system, high speed belt drive system.

UNIT-II

System Theories: Introduction, System Analysis, Black box approach, state theory approach, component integration approach, Decision process approach, A case study- automobile instrumentation panel system. 4 System modeling Introduction, Model types and purpose, linear systems, mathematical modeling, concepts, A case study compound bar system.

UNIT-III

Graph Modeling and Analysis Graph Modeling and analysis process, path problem, Network flow problem, A case study: Material handling system. 4 Optimization Concepts Optimization processes, Selection of goals and objectives-criteria, methods of optimization, analytical, combinational, subjective. A case study: aluminium extrusion system.

UNIT-IV

System Evaluation Feasibility assessment, planning horizon, time value of money, Financial analysis, A case study: Manufacture of maize starch system. 4 Calculus Method for Optimization Model with single decision variable, model with two decision variables, model with equality constraints, model with inequality constraints, A case study: Optimization of an insulation system.

UNIT-V

Decision Analysis Elements of a decision problem, decision making, under certainty, uncertainty risk and conflict probability, density function, Expected monetary value, Utility value, Baye's theorem, A case study: Installation of machinery. 4 System Simulation Simulation concepts, simulation models, computer application in simulation, spread sheet simulation, Simulation process, problem definition, input model construction and solution, limitation of simulation approach, A case study: Inventory control in production plant.

Books and References:

1. Design and Planning of Engineering systems-DD Reredith, KV Wong, RW Woodhead, and RR Worthman, Prentice Hall Inc., Eaglewood Cliffs, New Jerse

2. Engineering Design, by Dieter, McGraw Hill

3. Design Engineering-JR Dixon, TMH, New Delhi

4. An Introduction to Engineering Design Method-V Gupta and PN Murthy, TMH, New Delhi

5. Engineering Design-Robert Matousck, Blackie and son ltd. Glasgow

CAD/ CAM LAB

Total TEN Experiments are to carried out. FIVE Experiments each from CAD and CAM.

A. CAD Experiments

1. Line Drawing or Circle Drawing experiment: Writing and validation of computer program.
2.Geometric Transformation algorithm experiment for translation/rotation/scaling: Writing and validation of computer program.
3.Design of machine component or other system experiment: Writing and validation of computer program.
4. Understanding and use of any 3-D Modeling Software commands.
5. Pro/E/Idea etc. Experiment: Solid modeling of a machine component
6. Writing a small program for FEM for 2 spring system and validation of program or using a FEM Package
7. Root findings or curve fitting experiment: Writing and validation of computer program.
8. Numerical differentiation or numerical integration experiment: Writing and validation of computer program.

B. CAM Experiments

1. To study the characteristic features of CNC machine
2. Part Programming (in word address format) experiment for turning operation (including operations such as grooving and threading) and running on CNC machine
3. Part Programming (in word address format or ATP) experiment for drilling operation (point to point) and running on CNC machine
4. Part Programming (in word address format or ATP) experiment for milling operation (contouring) and running on CNC machine
5. Experiment on Robot and programs
6. Experiment on Transfer line/Material handling
7. Experiment on difference between ordinary and NC machine, study or retrofitting
8. Experiment on study of system devices such as motors and feedback devices

9. Experiment on Mecatronics and controls

I.C. ENGINES AND AUTOMOBILE LAB

Experiments : Say minimum 10 experiments out of following in depth and details.
1. Performance Analysis of Four stroke S.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.
2. Determination of Indicated H.P. of I.C. Engine by Morse Test.
3. Performance Analysis of Four stroke C.I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.
4. Study & experiment on Valve mechanism.
5. Study & experiment on Gear Box.
6. Study & experiment on Differential Gear Mechanism of Rear Axle.
7. Study & experiment on Steering Mechanism.
8. Study & experiment on Automobile Braking System.
9. Study & experiment on Chassis and Suspension System.
10. Study & experiment on Ignition system of I.C. Engine.
11. Study & experiment on Fuel Supply System of S.I. Engines- Carburetor, Fuel Injection Pump and MPFI.
12. Study & experiment on Fuel Supply System of C.I. Engines- Injector & Fuel Pump.
13. Study & experiment on Air Conditioning System of an Automobile.
14. Comparative study of technical specifications of common small cars (such as Maruti Swift, Hyundai i20, Cheverlet Aveo, Tata Indica, Ford Fusion etc.
15. Comparative study & technical features of common scooters & motorcycles available in India.
16. Visit of an Automobile factory.
17. Visit to a Modern Automobile Workshop.
18. Experiment on Engine Tuning.
19. Experiment on Exhaust Gas Analysis of an I.C. Engine.

SEMESTER-VIII

ADVANCED WELDING TECHNOLOGY

UNIT-I
Introduction: Welding as compared with other fabrication processes, Importance and Application of welding, classification of welding processes, Health & safety measures in Welding.
Welding Power Sources: Physics of welding Arc**,** Basic characteristics of power sources for various arc welding processes, Transformer, rectifier and generators.
Physics of Welding Arc: Welding arc, arc initiation, voltage distribution along the arc, arc

characteristics, arc efficiency, heat generation at cathode and anode, Effect of shielding gas on arc, isotherms of arcs and arc blow.

Metal Transfer: Mechanism and types of metal transfer in various arc welding processed

UNIT-II

Welding Processes: Manual Metal Arc Welding (MMAW), TIG, MIG, Plasma Arc, Submerged Arc Welding, Electrogas and Electroslag, Flux Cored Arc Welding, Resistance welding, Friction welding, Brazing, Soldering and Braze welding processes, Laser beam welding, Electron beam welding, Ultrasonic welding, Explosive welding, Friction Stir Welding, Underwater welding & Microwave welding.

UNIT-III

Heat Flow Welding: Calculation of peak temperature; Width of Heat Affected Zone (HAZ); cooling rate and solidification rates; weld thermal cycles; residual stresses and their measurement; weld distortion and its prevention.

UNIT-IV

Repair & Maintenance Welding: Hardfacing, Cladding, Surfacing, Metallizing processes and Reclamation welding.

Weldability: Effects of alloying elements on weld ability, welding of plain carbon steel, Cast Iron and aluminum. Micro & Macro structures in welding.

UNIT-V

Weld Design : Types of welds & joints, Joint Design, Welding Symbols, weld defects, Inspection/testing of welds, Introduction to Welding Procedure Specification & Procedure Qualification Record.

Books and References:

1. Welding and Welding Technology, by- Richard L. Little, McGraw Hill Education.
2. Welding Principals and Practices, by- Edwars R. Bohnart, McGraw Hill Education.
3. Welding Engineering and Technology, by- R. S. Parmar, Khanna Publishsers.
4. Welding Handbooks (Vol. I & II).

POWER PLANT ENGINEERING

UNIT-I

Introduction

Power and energy, sources of energy, review of thermodynamic cycles related to power plants,

fuels and combustion calculations.
Load estimation, load curves, various terms and factors involved in power plant calculations. Effect of variable load on power plant operation, Selection of power plant units.
Power plant economics and selection
Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor.s profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.

UNIT-II

Steam power plant

General layout of steam power plant, Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories, Different systems such as coal handling system, pulverizers and coal burners, combustion system, draft, ash handling system, Dust collection system, Feed water treatment and condenser and cooling towers and cooling ponds, Turbine auxiliary systems such as governing, feed heating, reheating , flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency, Site selection of a steam power plant.

UNIT-III

Diesel power plant

General layout, Components of Diesel power plant, Performance of diesel power plant, fuel system, ubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance, Site selection of diesel power plant, Comparative study of diesel power plant with steam power plant.

Gas turbine power plant

Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants, Site selection of gas turbine power plant

UNIT-IV

Nuclear power plant

Principles of nuclear energy, Lay out of nuclear power plant, Basic components of nuclear reactions, nuclear power station, Nuclear waste disposal, Site selection of nuclear power plants. Hydro electric station Hydrology, Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems.

Non Conventional Power Plants

Introduction to non-conventional power plants (Solar, wind, geothermal, tidal)etc.

UNIT-V

Electrical system

Generators and generator cooling, transformers and their cooling, bus bar, etc.

Instrumentation

Purpose, classification, selection and application, recorders and their use, listing of various control rooms.

Pollution

Pollution due to power generation

2

Books and References:

1. Power Plant Engineering, by F.T. Morse, Affiliated East-West Press Pvt. Ltd
2. Power Plant Engineering by Hedge, Pearson India
3. Power Plant Technology, by Wakil, McGraw Hill.
4. Power Plant Engineering by P.K. Nag, Tata McGraw Hill.
5. Steam & Gas Turbines & Power Plant Engineering by R.Yadav, Central Pub.House.
6. Power Plant Engineering by Gupta, PHI India
7. Power Plant Engineering. Mahesh Verma, Metropolitan Book Company Pvt. Ltd.

NON-DESTRUCTIVE TESTING

Unit-I

Introduction Scope and advantages of NDT, Comparison of NDT with Destructive Testing, Some common NDT methods used since ages, Terminology, Flaws and Defects, Visual inspection, Equipment used for visual inspection. Ringing test, chalk test (oil whitening test). Uses of visual inspection tests in detecting surface defects and their interpretation, advantages & limitations of visual inspection.

Unit-II

Die penetrate test (liquid penetrate inspection), Principle, scope. Equipment & techniques, Tests stations, Advantages, types of penetrants and developers, Zyglo test, Illustrative examples and interpretation of defects. 5 Magnetic particle Inspection – scope and working principle, Ferro Magnetic and Nonferromagnetic materials, equipment & testing. Advantages, limitations Interpretation of results, DC & AC magnetization, Skin Effect, use of dye & wet powders for magna glow testing, different methods to generate magnetic fields, Applications. 5 Unit-III

Radiographic methods Introduction to electromagnetic waves and radioactivity, various decays, Attenuation of electromagnetic radiations, Photo electric effect, Rayleigh's scattering (coherent scattering), Compton's scattering (Incoherent scattering), Pair production, Beam geometry and Scattering factor. X-ray radiography: principle, equipment & methodology, applications, types of radiations and limitations. γ-ray radiography – principle, equipment., source of radioactive materials & technique, advantages of γ-ray radiography over X-ray radiography Precautions against radiation hazards. Case Study - casting and forging.

Unit-IV

Ultrasonic testing methods Introduction, Principle of operation, Piezoelectricity. Ultrasonic probes, CRO techniques, advantages, Limitation & typical applications. Applications in inspection of castings, forgings, Extruded steel parts, bars, pipes, rails and dimensions measurements. Case Study – Ultrasonography of human body.

Unit-V

Special NDT Techniques Eddy Current Inspection: Principle, Methods, Equipment for ECT, Techniques, Sensitivity, advanced ECT methods. Application, scope and limitations, types of Probes and Case Studies. Introduction to Holography, Thermography and Acoustic emission Testing.

Books and References:

1. Non-Destructive Testing and Evaluation of Materials, by- Prasad, McGraw Hill Education.

2. Basics of Non-Destructive Testing, by Lari & Kumar, KATSON Books.

3. Practical Non-destructive Testing, by- Baldev Raj, T. Jayakumar, M. Thavasimuthu, Woodhead Publishing.

4. Non-Destructive Testing Techniques, by- Ravi Prakash, New Age International.

5. Nondestructive Testing Handbook,by Robert C. McMaster, American Society for Nondestructive. 6.

[BTOE-81]NON-CONVENTIONAL ENERGY RESOURCES

UNIT-I Introduction various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.
Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

UNIT-II Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

UNIT-III Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations.
Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations.
Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-IV Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations.
Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics, Performance and limitations of energy conversion systems.

UNIT-V Bio-mass: Availability of bio-mass and its conversion theory.
Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations.
Wave and Tidal Wave: Principle of working, performance and limitations, Waste Recycling Plants.

Text/References Books:
1. Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.
2. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.
3. M.V.R. Koteswara Rao, “ Energy Resources: Conventional & Non-Conventional “ BSP Publications,2006.
4. D.S. Chauhan,”Non-conventional Energy Resources” New Age International.
5. C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.