

MECHANICAL

SEMESTER: THIRD

3ME01 MATHEMATICS-III

Section-A

UNIT-I : Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (10 Hrs)

UNIT-II Laplace transforms : Definition, standard forms, properties of Laplace transform, inverse Laplace transform, initial and final value theorem, convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function. Solution of Linear differential equations. (10 Hrs.)

UNIT-IIIa) Partial differential equation of first order of following form- (i) $f(p,q)=0$; (ii) $f(p,q,z)=0$; (iii) $f(x,p)=g(y,q)$; (iv) $Pp+Qq=R$ (Lagrange's form); (v) $z=px+qy+f(p,q)$ (Clairaut form)

b) Statistics : Curve fitting by method of least squares (Straight and parabola only), Correlation, Regression.

c) Probability Distribution:- Binomial distribution, Poisson and normal Distribution. (10 Hrs.)

Section-B

UNIT-IV Complex Analysis :- Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method, conformal mappings (translation, rotation, magnification, inversion, bilinear transformation), singular points, expansion of function in Taylor's and Laurent's series. Cauchy's integral theorem and formula, Residue theorem. (12 Hrs.)

UNIT-V Numerical Analysis : Solution of algebraic and transcendental equations by Newton-Raphson method & method of false position. Solution of system of linear equations by Gauss-Seidel method, Relaxation method. Solution of first order ordinary differential equations by Picard's, modified Euler's, Runge-Kutta and Taylor's method. (10 Hrs.)

UNIT-VI Vector Calculus :- Scalar and vector point functions, Differentiation of vectors, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, line, surface, volume integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem (without proof). (10 Hrs.)

3ME02/ 3PE02 MECHANICS OF MATERIALS / STRENGTH OF MATERIALS SECTION-A

Unit-I 1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, and other metals, factor of safety,

2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit-II 1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.

2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section, leaf springs.

Unit-III 1. Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load.

2. Shear stress distribution on beam rectangular and circular cross sections.

SECTION – B

Unit-IV Thin and thick cylinders and thin spherical shells subjected to internal pressures.

Unit –V 1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.

2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.

Unit-VI Deflection of beams Deflection in statically determinate (simply supported) beams subjected to point loads, uniformly distributed loads, moments by Macauley's method.

3ME03 FLUID POWER-I

Section - A

UNIT-I : - 1) Introduction to the study of fluid motion. Mechanical properties of fluids and their influence on flow characteristics.

2) Fluid Statics:- Fluid pressure, pressure variation in fluids, manometers, forces on plane and curved surface buoyancy. (12 Hrs)

UNIT-II:- Buoyancy, stability of floating bodies. Kinematics and dynamics of fluid flow:- Types of flows, Stream lines, potential lines, flow net, continuity equation. One and two dimensional motion, one dimensional method of flow analysis. Bernoulli's equation. Venturimeter, Momentum equation for steady flow. Vortex motion. (8 Hrs)

UNIT-III:- Dimensional analysis: Dimensional homogeneity and dimension less ratios. Dimensionless parameters. Similitude and model studies. (6 Hrs)

Section - B

UNIT-IV:- Motion of viscous fluids:-Introduction to laminar and Turbulent flows. Boundary layer concept. Separation. Drag lift on immersed bodies. Reynolds number and its significance. (7 Hrs)

UNIT V:- Darcy weisbach equation i.e. Equation of pipe flow, friction charts and its use, Minor losses in pipes and fittings, losses due to sudden enlargement and contraction, Hydraulic and energy gradient lines, pipes in series and parallel. Elementary concept of water hammer. (8 Hrs)

UNIT VI:- 1. Principles of fluid machinery: Dynamic action of fluid force exerted by fluid jet on plane, curved, stationary and moving vanes. Velocity diagrams, Work done by impact, pressure due to deviated flow.

2. General Theory of Hydrodynamic Machines:- Eulers equation, Degree of reaction, classification of machines according to degree of reaction. Efficiencies: Volumetric efficiency, Hydraulic efficiency, mechanical efficiency and overall efficiency. (7)

3ME04 ENGINEERING THERMODYNAMICS

Section-A

Unit-I Introduction to basic concepts of thermodynamics, Macroscopic and microscopic approaches, properties of system, state and equilibrium, processes and cycle. Temperatures and Zeroth law of thermodynamics, Quasistatic process, Forms of energy and its conversion. Gas Laws and Ideal gas equation of states, difference between gases and vapours, equation of state, gas constant and universal gas constant. (08 hrs)

Unit-II Work and Heat: Definition of work, thermodynamic work, displacement work and other forms of work, Definition of Heat, Work and heat transfer as path function, comparison of work and heat, work done during various processes, P-V diagrams. First law of thermodynamics: Energy of a system, classification of energy, law of conservation of energy law applied to closed system under going a cycle, Joules experiment. Energy a property of system, internal energy-a function of temperature, Enthalpy, specific heat at constant volume and constant pressure. Change in internal energy and Heat transfer during various non-flow processes. (10 hrs)

Unit-III First Law applied to flow processes: Steady state, steady flow process, mass balance and energy balance in steady flow process, steady flow energy equation and its application to nozzles and diffusers, turbine and compressor pumps, heat exchangers, Throttle valve etc. work done and Heat transfer during steady flow processes. (9Hrs)

SECTION - B

Unit-IV Second Law of thermodynamics: Limitations of Ist law, Thermal energy reservoir, heat engines refrigerator and heat pumps. Kelvin-Planck and Clausius statements, their equivalence, reversible and irreversible processes, Carnot cycle, two propositions regarding the efficiency of Carnot cycles. The thermodynamic temperature scale. Reverse carnot cycle. COP of heat pump and refrigeration. Inequality of Clausius. (7 Hrs)

Unit-V Entropy: Entropy-a property of system, entropy change for ideal gases, entropy change of a system during irreversible process, lost work. Principle of increase of entropy. Availability and irreversibility:- Available energy referred to cycle, decrease in available energy with heat transfer through a finite temperature differences. The Helmholtz and Gibbs functions, Availability, Irreversibility and effectiveness. (8 Hrs)

UnitVI a) Air Standard Cycles: Otto, diesel, semidiesel, sterling and joule cycles etc., their efficiencies and mean effective pressure.

b) Vapour Cycles:- Rankine and Modified Rankine Cycle. Comparison of Rankine and Carnot cycle, representation on P-V, T-S and H-S diagram. (No numerical on this unit) (8 Hrs)

3ME05 MANUFACTURING PROCESSES-I

Section - A

Unit-I :- Introduction to manufacturing processes & classification; Introduction to pattern making- Pattern materials, pattern making tools, allowances, Types of patterns, functions of patterns, General properties of moulding sands, Mold hardness. Preparation of sand moulds of different types, Moulding processes, core making, core prints, core boxes. Sand casting Processes - Basic principle and Terminology of sand casting, gating system, types of gate, risers, etc. (9Hrs)

Unit-II:- Technology of melting and casting - Melting furnaces, crucibles, pit, open hearth, gas fired cupola, cupola operation and electric hearth furnaces, Electric furnaces - Direct Arc, Indirect arc and electric induction furnace. Defects in castings and its types, Causes and remedies of casting defects. Origin and classification of defects, shaping faults, Inclusion and sand defects, Gas defects, shrinkage defects, contraction defects, dimensional errors. Inspection and testing of castings:- Radiography, ultrasonic, Eddy current testing, fluorescent penetrant test. (7 Hrs)

Unit III:- Casting processes and their principle of operation and applications permanent mold casting, slush casting, shell centrifugal casting, continuous casting, Die casting equipment and processes for Gravity, pressure and vacuum casting methods, cleaning of castings, Modernisation & Mechanisation of Foundries. (8 Hrs)

Section - B

Unit IV :- Mechanical working of metals: Principle of hot and cold working process and its types, Extrusion, piercing, pipe and tube production, manufacture of seamless pipe and tubing. Shearing operations, tube drawing, wire drawing, spinning, embossing and coining, squeezing and bending operations, rotary swaging, Rolling, types of rolling mills, forging operations, upset forging. (8 Hrs)

Unit V:- Joining processes:- Mechanical joining processes, Mechanical fastening, riveting, soldering, brazing Welding, Types of welding processes-Arc welding: principle and working, Gas welding- principle and working Types and purpose of Electrodes, Electrode coatings(flux). TIG & MIG processes – Working principles and its applications, shielding gases, MIG-Spray transfer and dip transfer processes. (6 Hrs.)

Unit VI:- Submerged arc welding & resistance welding :- Heat generation in resistance welding, operational characteristics of resistance welding processes such as spot welding, projection welding, butt welding. Principle of operation of friction welding, forge welding, plasma arc, thermit welding. Welding defects, Testing and Inspection of welds, Ultrasonic, Electroslog, Electron Beam, laser welding, weldability. Surface Treatment-Electroplating, electroforming, and iodising, metal spraying, shot peening, polishing, mechanical cleaning. (9 Hrs)

3ME06 / 3PE06 MECHANICS OF MATERIAL-LAB. / STRENGTH OF MATERIALS-LAB.

Practicals:

Minimum Six to Eight out of following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

3ME07 FLUID POWER-I-LAB.

Practical Term Work:-

At least six practical's (study/Trials) based on above syllabus, as given below shall be performed and a report there of submitted by the students.

1. Study of Manometers.
2. Measurement of fluid pressure by manometer.
3. Determination of metacentric height.
4. Verification of Bernoulli's equation.
5. Flow measurement by venturimeter.
6. Study of venturimeter.
7. Determination of Reynolds number.
8. Velocity distribution in Boundary layer & thickness of B.L.
9. Determination of co-efficient of friction for pipes.
10. Determination of head loss due to sudden enlargement.

11. Determination of head loss due to sudden contraction.
12. Determination of losses in bends.
13. Determination of losses in elbows.
14. Study of flow through pipes in series & parallel.
15. Verification of momentum equation.

Note :- Practical examination shall consist of oral or Experimentation based on above term work.

3ME08 MANUFACTURING PROCESSES-I –LAB.

Practice:-

1. Study of safety precautions in workshop practices.
2. Foundary:- Any two of the following jobs Sand preparation and practice in moulding of various types of patterns:- Pattern making 1 job, Moulding 1 job Casting 1 job.
3. Joining Processes:- 2 composite jobs involving electric welding, gas welding and resistance welding process.

A journal should be prepared and submitted on above term work. The practical examination shall consist of a job preparation and college assessment should be based upon the jobs, term work and viva examination.

ALL THE BEST