

Applied Mathematics – III
S.E. Sem. III [MECH/AUTO/MARINE]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	–
Term Work	–	25

SYLLABUS

1. Complex Variables

Functions of complex variable. Continuity (only statement) and derivability. Analytic function. Necessary conditions for the function to be analytic (statement of sufficient condition). Cauchy Riemann equations in polar coordinates. Harmonic function and orthogonal trajectories. Milne-Thomson method to find analytic function $f(z) = u + iv$ for given $u, v, u + v, u - v$.

2. Mapping

Conformal mapping. Standard transformations and Bilinear transformation. Fixed points and cross ratio.

3. Complex Integration

Regions and paths in the Z-plane. Line integral of a function of complex variable. Cauchy's integral theorem. Cauchy's integral formula and deduction (without proof). Taylor's and Laurent's development (without proof). Singularities, poles, residue at isolated singularity and its evaluation.

4. Laplace's Transforms

Function of bounded variation (statement only). Laplace's transforms of $1, t^n, e^{at}, \sin(at), \cos(at), \sinh(at), \cosh(at)$. Linearity property, expressions (without proof) for $L[e^{at} f(t)], L[f(at)], L[t^n f(t)],$

$$L[f(t)/t], L\left\{\int_0^t f(u) du\right\}, L\left\{\frac{d^n}{dt^n}(f(t))\right\}$$

Periodic functions, Heaviside unit step function. Dirac-delta Function and their Laplace transforms (statement only)

5. Inverse Laplace Transforms

Linearity property evaluation of inverse Laplace Transforms using theorems and by partial fraction method. Convolution Theorem (without proof) and Heaviside development. Application to solve initial and boundary value problems involving ordinary differential equations with one dependent variable.

6. Matrices

Types of Matrices. Adjoint of matrix Inverse of a matrix, orthogonal and Unitary matrices. Elementary transformations, rank of a matrix. Reduction to a normal form. System of homogeneous and non-homogeneous equations, their consistency and solution. Brief revision of vectors over real field, Inner product, Norm, Linear dependence and independence, orthogonality of matrix. Characteristic polynomial, values and vectors of square matrix. Characteristic polynomial, Cayley Hamilton theorem (without proof) Functions of square matrix.

Reference :

1. Matrices (*Vasistha*).
2. A Text Book of Applied Mathematics (*P.N. & J.N. Wartikar*).
3. Higher Engineering Mathematics (*B.S. Grewal*).
4. Advance Engineering Mathematics (*E. Kreyszig*).
5. Complex Variables (*R.V. Churchill*).
6. Laplace Transforms (*Schaum Series*).



Strength of Materials
S.E. Sem. III [MECH/AUTO]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	2 Hrs.	25
Oral Exam	–	25
Term Work	–	25

SYLLABUS

1. Stress and Strain

Definition, Stress strain, tensile and compressive stresses, shear, stress-Elastic limit, Hooke's law, Poisson's ratio, modulus of elasticity, modulus of rigidity, bulk modulus, yield stress, ultimate stress, factor of safety, state of simple shear, relation between elastic constants, volumetric strain, volumetric strain for tri-axial loading, deformation of tapering members, deformation due to self weight, bars of varying sections, composite sections, Temperature stresses.

2. Shear force and bending moment in Beams

Axial force, shear force and bending moment diagrams for statically determinate beams including beams with internal hinges for different types of loading, relationship between rate of loading, shear force and bending moment.

3. Stresses in Beams

Theory of pure bending. Assumptions, Flexural formula for straight beams, moment of resistance, bending stress distribution. Section moduli for different sections, beams of uniform strength, Fatched beams, principle axes, principle moment of inertia.

Direct and bending stresses. Core of section, chimneys subjected to wind pressure.

Shear stresses in Beams : Distribution of shear stress across plane sections used commonly for structural purposes, shear connectors.

4. Torsion

Torsion of circular shafts – solid and hollow, stresses in shaft when transmitting power, Shafts in series and parallel.

Strain Energy : Resilience, proof Resilience, strain energy stored in the member due to gradually applied load, suddenly applied load, impact load, strain energy stored due to shear, strain energy due to bending, strain energy due to Torsion.

5. Deflection of Beams

Deflection of cantilevers, simply supported and over hanging beams using double integration and Macaulay's methods for different types of loadings.

Thin Cylindrical and Spherical Shells : Stress and strain in thin Cylinders and spheres due to internal pressure, Cylindrical shell with hemispherical ends.

6. Principle Stresses

General equations for transformation of stress. Principal planes and principal stresses, maximum shear stress, determination using Mohr's circle, maximum principal & maximum shear stress theory of failure. Combined Bending and Torsion, Equivalent Bending moment and equivalent torque.

Columns and struts : Backling load, Types of end conditions for column, Euler's column theory and its Limitations, Rankin Gordon Formula.

Reference :

1. Mechanics of Structure (Vol. 1) (*SB Junnakar & Shah*) Charotar Publisher.
2. Strength of Materials (*S. Ramamarutham*).
3. Engineering Mechanics (*Timoshenko & Young*) Tata McGraw Hill.
4. Mechanics of Materials (*EP Popov*) Prentice Hall of India.
5. Strength of Materials (*W.A. Nash*) Schaum's Outline Series, Tata McGraw Hill.
6. Mechanics of Materials (*James Gere*) Thompson Learning.
7. Mechanics of Materials (*Ferdinand P. Beer, E. Russell Johnson, Jr. John Dewolf*) McGraw Hill Int.
8. Theory of Elastic Stability (*Timoshenko & Gere*) Tata McGraw Hill.
9. Strength of Materials (*G.H. Ryder*) MacMillan.
10. Strength of Materials (*R. Subramaniam*) Oxford.
11. Strength of Materials A Practical Approach (Vol. 1) (*D.S. Prakash Rao*) University Press.



Machine Drawing
S.E. Sem. III [MECH/AUTO]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	4 Hrs.	100
Practical Exam	3 Hrs.	50
Oral Exam	–	–
Term Work	–	25

SYLLABUS

1. **Solid Geometry** : Intersection of surfaces and interpretation of solids. Intersection of prism or cylinder with prism cylinder or cone both solids in simple position only. Primary auxiliary views and auxiliary projections of simple machine parts.

Machine Elements : Free hand sketches of machine elements such as bolts, nuts, washers, studs, tapped holes. Conventional representation of assembly Threaded parts in external and sectional. Views.

2. **Details and Assembly Drawing** : Introduction to unit assembly drawing steps involved in preparing assembly drawing from details and vice versa.

Preparation of details & assembly drawings of Clapper block, single tool post, Lathe and milling tail stock, Cotter, knuckle joint, Keys and coupling : keys-sunk, parallel, woodruff, saddle, feather, etc.

Coupling - simple, muff, Flanged, protected flange coupling. Oldham's coupling universal coupling.

3. **Preparation of Details and Assembly Drawings of Bearings** - simple, solid, bushes, pedestal, footstep, I.S. conventional representation of ball and bearings.

4. **Preparation of Details and Assembly Drawings of Pulleys**-flat belt, V-belt, rope belts fast and loose pulleys, pipe joints, flanged joints - spigot and gland and stuffing box, expansion joint.

5. **Preparation of details & assembly drawings of Valves** - Air cock, Blow off cock, steam stop valve, gates valve, globe valve, non-return valve. I.C. Engine parts piston, connecting rod, cross head and crankshaft.

6. **Preparation of details & assembly drawings of jigs and fixtures.**

Limits fits and tolerances dimensioning with tolerances indicating various types of fit in details and assembly drawings.

AutoCAD :

Computer aided drawing and designing of Assembly, Joints, Gears, Spring, Shaft, Pipe fittings, Bearings Jigs and fixtures, I.C. engine parts, Pulleys and Belts, Limits, fits and tolerances, Rivets, Preparation of 2-D drawings for machine components (bolts, nuts, flange coupling, connecting rod), 3-D modeling – solid, surface, wire frame using standard CAD packages, creation of 2-D drawings from 3-D models using CAD packages, different views, sections, isometric view and dimensioning them. Parametric modeling, creating standard machine parts, connecting rod, flange coupling

Reference :

1. Machine Drawing (*N.D. Bhatt*).
2. A text book of Machine drawing (*Lakshminarayan & M.L. Mathur*) Jain Brother, Delhi.
3. Machine Drawing (*Kamat & Rao*).
4. Machine Drawing (*M.B. Shah*).
5. A Text book of Machine Drawing (*R.B. Gupta*) Satya Prakashan Tech Publication.
6. Machine Drawing (*K.I. Narayana, P. Kannaiah, K. Venkata Reddy*).
7. Machine Drawing with AutoCAD (*Gautam Pohit and Gautam Ghosh*) Pearson Educaiton.
8. Machine Drawing (*Ajeet Singh*) Tata McGraw Hill.



Production Process – I

S.E. Sem. III [MECH/AUTO]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	–
Term Work	–	25

SYLLABUS

- 1. Classification of Manufacturing Process, Ferrous and non-ferrous metals and their alloys used in engineering, their properties and uses.**
Manufacturing of pig iron, cast iron, wrought iron and steels.
Remelting furnaces : Such as cupola, pit-furnace oil fired, gas and electric furnaces, their size, capacity, suitability, construction and working.
Pattern making and Foundry : Materials used for pattern making, types of pattern, Pattern allowances, core box, core prints and cores.
Moulding Methods : Hand and Machine moulding techniques.
Principle of gating, principle of risering, solidification of casting. Defects of casting and inspection of casting.
- 2. Lathes :** Type of lathes, their construction and working operation of lathes. Screw cutting on C lathe, attachments and accessories used on lathe, type of tools, cutting speed, feed, depth of cut and machining time, Capstan and turret lathes, tooling for simple jobs.
Elementary treatment of modern lathe such as single spindle and multi-spindle Automats. NC and CNC machines, machining centers.
- 3. Milling Machines :** Types of machines, horizontal, universal, vertical, cutters and their applications, Operation on milling machines, Use of dividing head and circular table. Direct, simple, compound, differential and angular indexing and helical milling operation. Table feed in milling, work holding devices.
- 4. Drilling Machines :** Types of machines, Types of drillings, operations such as drilling, boring reaming, spot facing, counter boring, counter sinking and tapping. Drill speeds and feeds.
Planing machines, shaping machines and slotting machine. Various types, construction and working, operations and tools, field of application, quick return mechanism and feed mechanisms of these machines.
Grinding : Grinding machines such as pedestal, cylindrical surface, centre less and tool and cutter grinder. Operations on the above mentioned machines. Grinding wheel, selection and specifications. Dressing and truing of grinding wheels. Finishing operations such as lapping and honing.
- 5. Welding and Joining Processes :** Riveting, soldering and brazing. Fusion welding, gas and arc welding, submerged arc welding – inert gas welding – Electric slag welding – CO₂ welding – thermit welding. Welding Equipments pressure welding – solid phase welding – resistance welding, friction welding. Process capability and applications. Weld joints- types edge preparations welding fixtures. Weldability - designs, process and metallurgical considerations – testing and improvement of weldability - microstructure of weld welding defects.
- 6. Powder Metallurgy :**
Principle, process, applications, advantages and disadvantages of powder metallurgy, processes of powder making and mechanisms of sintering.

Non-Destructive Techniques : Dye Penetrant, Magnetic, Electrical, Ultrasonic and Radiographic non-destructive testing methods.

Non conventional machining processes : (Only basic principles, machines and application), Electrical discharge machining (EDM), Electrochemical machining (ECM), Ultrasonic machining (USM), Laser beam machining (LBM), Electron beam machining (EBM), Plasma arc machining (PAM).

Reference :

1. Workshop Technology (*W.A.J Chapman*) Part 1, 2, 3.
2. A Textbook of Foundry Technology (*M. Lal*).
3. Production Technology (*R.C. Patel and C.G. Gupta*) Vol. 1, 2.
4. Manufacturing Processes & Materials for Engineers (*Doyle*).
5. Production Technology (*HMT*).
6. Production Technology (*Raghuvanshi*).
7. Production Technology (*Jain & Gupta*).
8. Elements of Workshop Technology (*Hazra Chaudhary*) (Vol. 1, 2).
9. Manufacturing Process (*Roy A. Lindberg*).



Thermodynamics
S.E. Sem. III [MECH/AUTO]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Oral Exam	–	25
Term Work	–	25

SYLLABUS

- 1. Thermodynamic concepts :** System, surrounding, state, path, property, Reversible and irreversible process, thermodynamic work, heat, temperature, thermal equilibrium. Zeroth law of thermodynamics.
First of Thermodynamics : Statement, First law applied to non-cyclic process, Internal energy, Application non-flow processes viz. Constant volume, constant pressure and constant temperature, adiabatic and polytropic processes. Heat and work calculation. Application of First law to open systems, flow work, Steady flow energy equation, Work done in steady flow processes in terms of pressure and volume. Throttling process, Joule's porous plug experiment. Joule-Thompson coefficient, SFEE applied to boiler, nozzle, condenser, etc.
- 2. Second law of thermodynamics :** Limitations of first law of Thermodynamics. Heat engine, thermal efficiency, reversed heat engine, coefficient of performance, Kelvin-Planck and Clausius statements and their equivalence Carnot cycle, Carnot's theorem, Thermodynamic temperature scale.
- 3. Entropy-Clausius inequality,** Entropy changes for an ideal gas during reversible process, Entropy of isolated system in real processes. Principle of increase of entropy.
Introduction to Availability : Available and unavailable energy. AE when heat is withdrawn from a finite reservoir and when heat is withdrawn from an infinite reservoir. Irreversibility.
- 4. Properties of steam :** Dryness fraction, enthalpy, internal energy and entropy. Steam table and Mollier chart, First law applied to steam processes.
- 5. Power Cycles :** Vapour power-Rankine cycle Modified Rankine cycle for improved performance (Reheat, regenerative)
Gas power Thermodynamics of Otto, Diesel, semi-Diesel and Brayton cycle. Comparison and representation on P-V, T-S diagram.
- 6. Thermodynamics of Fluid flow (one dimensional) :** Propagation of sound waves through compressible fluids. Sonic velocity and Mach number. Application of continuity, momentum and energy equations for steady state conditions. Steady flow energy equation applied to nozzle. Isentropic flow through ducts of varying cross-sectional area. Effect of varying backpressure on nozzle performance. Area ratio, Critical pressure ratio, Normal shock, basic equations of normal shock, change of properties across normal shocks. Rayleigh and Fanno lines. Adiabatic flow through constant area duct with friction.

Reference :

1. Thermodynamics (*W.C. Raynold, McGraw Hill and NY*).
2. Engineering Thermodynamics (*Mayhew, Y.R. Rogers GFC*) Orient Longman.
3. Engineering Thermodynamics (*M. Achutan*) PHI.
4. Engineering Thermodynamics (*J.B. Jones and Dugan*) PHI.
5. Thermal Engineering (*Ballaney*).
6. Thermodynamics and Engg. Approach (*Yunus and Cengel*) McGraw Hill Inc.
7. Engineering Thermodynamics (*Lyndd Russell, George A. Adebiyi*) Oxford Press.

