Applied Mathematics

S.E. Sem. III [PROD]

EVALUATION SYSTEM

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

SYLLABUS

1. **Laplace Transform**
   Definition and formulae (without proof) for the L. T. of standard functions; Properties (without proof). Problems using the above formulae and properties.

2. **Inverse Laplace Transform**
   Formulae and properties and simple problems using direct applications of the above, NO PROOF
   More Problems using Inverse L.T., Partial Fractions Method, Convolution Theorem (without proof) applications to find inverse LT. (NO THEORY TO BE ASKED IN EXAM) Solutions of ordinary differential equations (using boundary and initial conditions) (No unit step function, No periodic function).

3. **Matrices**
   Types of Matrices : Orthogonal, Symmetric, Skew symmetric, Unitary, Hermition, Skew Hermition. Definitions. Results and Theorems, (problems based on the above).

   Adjoint of Matrix
   Formula for inverse in terms of adjoint inversion Method to solve a system of non homogeneous equations. (Explanation of the methods and problems). Properties of adjoint (only statement) and problems based on the properties (No theory to be asked) Elementary Operations and applications. Reducing a matrix to Normal form. Echelon form and hence find the rank of the given matrix. Solutions of Homogeneous and Non–Homogeneous equations (stating the conditions in terms of rank and problems) (No partition of matrices)

4. **Eigen values and Eigen Vectors**
   Definitions, properties (only statement). Problems to find Eigen values. Eigen vectors. Cayley Hamilton Theorem (statement and application). To find the inverse of a matrix and to reduce a given polynomial and find its value.

5. **Definitions and results**
   Complex–valued function, Analytic function, singular points, Regular function, Necessary and sufficient condition for analytic functions (only statement), Cauchy Riemann equations in Cartesian and Polar form (ONLY STATEMENT AND PROBLEM)

   Problems: To find the analytic function, given (i) u (ii) v (iii) u.v (iv) u–v (using Milne Thompson Method) and other problems.

   Definitions and Problems of the following: Harmonic function, Orthogonal Trajectories (ONLY PROBLEMS AND THEOREMS WITHOUT PROOF)

   Bilinear Transformation: Definition of bilinear transformation critical points, fixed points, cross ratio and problems (ONLY STATEMENT OF THERMOS ON CROSS RATIO AND FIXED POINTS)

GIVEN the following transformations to find the of given curve or its pre−image.

Complex Integration: Only Line Integrals (direct evaluation) Independent only statement of path condition) No CAUCHY'S OR RESIDUES THEROMS AND INTEG. Formulae)

6. Introduction of Fourier series

Fourier series of periodic functions with period 2 pi and 21 even and odd functions, half range Sine and Cosine series. And Parseval's identity (only statement and problems) no derivations (Complex form of Fourier series and Fourier transform not to be included).

References :

1. Elements of Applied Mathematics (*P.N. Wartikar*) – Vol. III and IV
2. Engineering Mathematics (*Kumbhojkar*) – Vol. III
3. Matrices (*Vasistha*)
4. Complex Variable (*M.L.Khanna*)
5. Matrices (*Shanti Narayan*)
6. Theory of Function of Complex Variable (*Shanti Narayan*)
7. Complex Variables (*Schaum's Series*)
8. Laplace Transforms (*Schaum's Outline Series*)
9. Engineering Mathematics (*Bali, Saxena, Iyengar*)

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Strength of Materials

S.E. Sem. III [PROD]

EVALUATION SYSTEM

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

SYLLABUS

1. **Simple Stress and Strains**
   Direct stress and direct strain: stress–strain curves: deformation of uniform/tapering rectangular and circular and circular cross–section bars; deformation of members made of composite materials; factor of safety; shear stress and shear strain; Poisson's ratio; volumetric strain; bulk modulus; relationship between Young's modulus, bulk modulus and modulus of elasticity; temperature stresses in simple and compound bars.

2. **Shear Force and Bending Moment**
   Axial force, shear force and bending moment diagrams for statically determinate beams excluding beams with internal hinges for different types of loading.

3. **Simple Theory of Bending**
   Flexure formula for straight beams; principal axes of inertia; moments of inertia about principal axes; transfer theorem. Simple problems involving application of flexure formula, section modulus and moment of resistance of a section.

4. **Shear Stress in Beams**
   Distribution of shear stress across plane sections used commonly for structural purposes; shear connectors.

5. **Simple Theory of Torsion**
   Torsion of circular shafts–solid and hollow, stresses in shafts transmitting power, shafts in series and parallel; keys and couplings.

6. **Bending Moment Combined with Axial Loads**
   Application to members subjected to eccentrics loads, core of section.

7. **Principal Stresses**
   General equations for transformation of stress; principal planes and principal stresses, determination using mohr's circle maximum shear stress, principal stresses in beams; principal stresses in shafts subjected to torsion, bending and axial thrust; concept of equivalent torsional and bending moments

8. **Deflection of Beams**
   Deflection of cantilevers sample supported and overhanging beams using double integration and Macaulay's method for different types of loadings.

9. **Struts**
   Struts subjected to axial loads, concept of buckling. Euler's formula for struts with different support conditions. Euler's and Rankin's design formulae.

10. **Strain Energy**
    Strain energy due to axial loads gradually applied transverse loads and under impact load.

References :

1. Mechanics of materials by (*E.P. Popov*) – Prentice Hall of India Pvt. Ltd.
2. Machines of structures (*S.B.Junnarkar*) – Charotar publishers
3. Strength of materials (*T.S.Venkatesh*)
4. Strength of materials (*M.D. Dayal*)
5. Strength of material (*R.K.Rajput*) – S.Chand Publications

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Manufacturing Engineering – I

S.E. Sem. III [PROD]

EVALUATION SYSTEM

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

SYLLABUS

1. **Definition** need and classification of machine tools: Brief history and development, typical features, associated with cutting, tools and Performance measures of machine tools.

2. **Turning Mact Lines and Processes**
   Lathe as general purpose turning machine, principle of generating surfaces, lathe specifications, description and functions of lathe, principle parts, back 'gear–all gear drive, feed mechanism, lathe accessories, and attachments–chucks, collets, mandrel, face plate. Lathe operations, taper turning methods thread cutting, cutting tools and tool geometry, Capstan and turret lathes : principal parts of capstan and turret lathes, difference between capstan and turret lathe, work holding devices, tool holding devices, tool dies, chasers, taps, etc., tool layout for simple components like bolt, nut, pin, shaft, single 'point cutting tools; Types, geometry, materials.

3. **Drilling Machines and Processes**
   Types–sensitive, upright, radial, gang, multiple spindle, automatic drilling machines, work and tool holding devices, drilling machine operation, types and materials of drills, twist drill nomenclature. Counter–boring–types of counter bores. Spot facing–Types of spot facers. Countersinking Types of countersinks. Reaming–Types of reamers. Tapping–Hand tap and machine tap. Machining time in drilling.
   Deep hole drilling (only fundamentals to be covered): Gun drills, deep hole drilling machines Boring Machine.

4. **Reciprocating Machine Tools**
   Shaping machines: types of shapers, working of shaping machine, quick return mechanisms, shaper operations machining time planning machines: types of planning machines, planer mechanisms, feed mechanisms, work holding devices, shaper vs. planer. Slotting machines types of slotting machines, quick return mechanisms.

5. **Milling Machines**
   Types of milling machines–column and knee type, fixed bed type, planer type and special type milling processes conventional and climb milling, milling cutters, peripheral, face and shell milling cutters, geometry and materials of milling cutters attachments and special accessories for milling, universal dividing head indexing methods, direct, plain, compound and differential indexing mechanisms, arbors, adaptors and collets, chucks, calculations of machining time, copy milling machines.

6. **Broaching Machines**
   Broaching process, elements of typical internal broach, types of broaches, broaching machines-vertical, horizontal, surface and continuous broaching vs. other processes (design of broaches omitted).

7. Cutting Off Machines

Power hack–saws, band saw and circular saw, friction saw and abrasive cutting off machines, field of applications and limitations, tools and accessories.

8. Finishing Processes

Honing–process, machine, honing stone, and tools, abrasive, grit size… Lapping–process, hand and machine lapping, flat internal and external cylindrical lapping, lap materials, medium, vehicles. Super finishing process–equipments, stones, fluids. Roller burnishing-process, tools, applications.

References :

1. Production Technology – HMT T.M.H. Publishing Co.
2. Elements of workshop technology (*Hajra Chowdhary and Bose*) – Vol. II
3. Material and manufacturing processes (*De Garmo*)
4. Manufacturing process (*Begman*)
5. Production Technology (*Raghuvanshi*)
6. Production Technology (*Chapman*) – Vol. 1 and 2 and 3
7. Production Technology (*R.K.Jain*)

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Engineering Graphics and Machine Drawing

S.E. Sem. III [PROD]

EVALUATION SYSTEM

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

SYLLABUS

1. **Interpenetration of Solids**
   Cylinder to cylinder, cone to cylinder, prism to prism, prism to cylinder, pyramid to prism, pyramid to cylinder of only regular solids with axis of solids perpendicular to/or parallel to the reference planes (neglecting the axis of so/ids inclined to any reference plane)

2. Auxiliary projections of solids using front view, top view and side views.

3. **Machine Elements**
   Screwed fasteners : Thread nomenclature, forms of screw threads, V threads, Square thread, ACME. Buttress, and whitworth. Representation of threads, Hexagonal headed bolts and nuts, square headed bolts and nuts, locking devices for nuts.
   Keys, cotters and pin joints : Keys–saddle keys, sunk keys, round keys Cotter joints: socket and Spigot joint, Gib and cotter joint, cotter and Sleeve joint, Pin joint–Knuckle joint.
   Couplings : Rigid couplings, Split, Muff, Flanged protected type, Flexible bush pin type.

4. **Assembly and Detail Drawings**
   Machine tools parts : Machine swivel vice, pipe vice, screw jack, tailstock tool head of shaper, Simple drill jig and milling fixture.
   Bearings : Plummer block, foot bearing, bracket with pedestal bearing footstep bearing with radial and trust ball bearings.
   IC Engine parts : I.C. Engine connecting rods, stuffing box and eccentric
   Valves: Feed checks valve, Non Return valve, stop valve, Relief valve, lever safety valve.

5. **Gears**
   Profile of involutes gear teeth, methods or drawing gear loot 11 profiles. I.S. conventional representation of spur gears, bevel gears. Pulleys with flat belt v–belt and rope.

6. **Limits, Fits and Tolerances**
   Selection of tolerances, methods of placing limit dimensions fits.

References :

1. Machine Drawing (*N. D. Bhat*)
2. Machine Drawing (*Sidheshwar*)
3. Machine Drawing (*P.S. Gill*)
4. Machine Drawing (*Narayana and Reddy*)
5. General Principles of Presentation on Technical Drawing.
6. Guide for the selection of Fits – IS.

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Theory of Machines

S.E. Sem. III [PROD]

EVALUATION SYSTEM

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

SYLLABUS

1. **Basic Concepts**
   Links, kinematics pairs, kinematics pairs giving one, two and three degrees of freedom, kinematics chains, degree of freedom and movability criterion. Constrained kinematics chains as mechanism. Inversions of single and double slider crank chains and their applications.
   Introduction to simple mechanisms– pantograph, straight line motion mechanism, Engine indicators, vis., Simplex) Cross by, Thomson and Dobbie Mckines indicators, automobile steering gears.

2. **Motion Characteristics of Mechanisms**
   Velocity and acceleration analysis of mechanisms with single degree of freedom system using graphical method. Instantaneous centre, Kennedy's theorem; analysis of velocities of mechanism using instantaneous centre method. Analytical technique applied to only slider crank mechanism. Bennett's construction and Rotterdam's construction.

3. **CAMS**
   Introduction types of cams, types of followers. Follower motions. viz. simple harmonic motions constant velocity, uniform and constant acceleration and retardation and cycloidal motion, layout of cam profile for specified displacement characteristics. Cams with oscillating follower system.

4. **Clutches Brakes and Dynamometers**
   Study and analysis of single plate clutch, multiple plate clutches and cone clutches. Introduction types of brakes. Viz. block and shoe brakes, band brake, band and block brakes, braking of vehicles. Types of dynamomemeters viz. Prony brake, Rope brake belt transmission dynamometets.

5. **GEARS**
   Introduction: Types of gears and applications, Gear terminology, Condition for constant velocity ratio–conjugate profiles, profiles used in gears. Interference of involute teeth, methods of preventing interferences under cutting length of path of contact and contact ratio. Gear trains Simple compound planetary and epicyclie gear trains.

6. **Turning Moment Diagram and Flywheel**
   Piston effort, crank effort turning moment, coefficient of fluctuation of speed and energy, calculation of flywheel dimensions.

7. **Balancing**
   Introduction rotary masses-several masses in same plane, several masses in different planes, balancing of reciprocating masses, primary balance and secondary balance. Balancing of locomotives–Hammer Blow and variation of tractive efforts, static dynamic balancing machines.

8. **Vibrations**
   Introduction–free vibrations; longitudinal, transverse and torsional vibrations. Dunkerl's empirical equations, critical or whirling speed of shaft. Torsional vibrations of two rotor system-torsionally equivalent shaft–free torsional vibrations of a geared system.
   (Damped and forced vibrations are excluded)

9. Gyroscope

Introduction–Gyroscopic couple and precision stabilization of ships and Air crafts only.

References :

1. Theory of Machines (*Thomas Bevan*)
2. Theory of Machines (*Green*)
3. Theory of Machines (*Ballaney*)
4. Theory of Machines (*S.S.Ratan*)
5. Theory of Machines (*Jagdishlal*)
6. Mechanisms of Machines (*J. Hannah & RC Stephen*)

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