

MECHANICS OF SOLIDS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

PART - A

(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- Define resilience and proof resilience.
 - Define volumetric strain.
 - Differentiate between a cantilever and a simply supported beam.
 - What are the sign conventions for shear force and bending moment in general?
 - What do you understand by neutral axis and moment of resistance?
 - What is section modulus?
 - What are the assumptions made in Torsion of circular shafts?
 - What is moment – area method? Where is it conveniently used?
 - Define thin cylinders.
 - Differentiate between a thin cylinder and a thick cylinder.

PART - B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

- 2 A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter to which it is rigidly joined at each end. If at a temperature of 10°C there is no longitudinal stress, calculate the stresses in the rod and tube when the temperature is raised to 200°C. Take E for the steel and copper as 2.1×10^5 N/mm² and 1×10^5 N/mm² respectively. The value of coefficient of linear expansion of steel and copper is given as 11×10^{-6} per °C and 18×10^{-6} per °C respectively.

(OR)

- 3 Derive an expression for young's modulus in terms of bulk modulus and Poisson's ratio.

UNIT - II

- 4 A simply supported beam of length 10 m carries the uniformly distributed load 10 kN/m and two point loads 50 kN and 40 kN at 4m apart from a distance of 4 m from the right end. Draw the S.F and B.M diagrams for the beam. Also calculate the maximum bending moment.

(OR)

- 5 A horizontal beam 10 m long is carrying a uniformly distributed load of 1 kN/m. The beam is supported on two supports 6 m apart. Find the position of the supports, so that B.M on the beam is as small as possible. Also draw the S.F and B. M diagrams.

UNIT - III

- 6 Prove the relation, $M/I = f/y = E/R$.

(OR)

- 7 An I – section beam 350 mm x 150 mm has a web thickness of 10 mm and flange thickness of 20 mm. If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I –section. Sketch the shear stress distribution across the section.

UNIT - IV

- 8 Derive an expression for the shear stress produced in a circular shaft which is subjected to torsion. What are the assumptions made in Torsion?

(OR)

- 9 A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support. Find (i) Deflection under each load (ii) Max deflection and (iii) The point at which max deflection occurs. Take $E = 2 \times 10^5$ N/mm² and $I = 85 \times 10^6$ mm⁴.

UNIT - V

- 10 A spherical vessel 2.5 m diameter is subjected to an internal pressure of 42 N/mm². Find the thickness of the plate required if max stress is not to exceed 250 N/mm² and joint efficiency is 75%.

- 11 What do you mean by Lami's equation? How will you derive these equations?
