UNIT 1- STRESS AND STRAIN

PART – A (2 Marks)

1. Define longitudinal strain and lateral strain.
2. State Hooke's law.
3. Define modular ratio, Poisson's ratio
4. What is modulus of elasticity?
5. What do you meant by stiffness?
6. Explain lateral strain with a neat sketch
7. What are principal planes?
8. Give the expression for major principal stress in a two dimensional system
9. What are the types of stresses developed in thin cylinders subjected to internal pressure?
10. Write the relationship between bulk modulus, rigidity modulus and Poisson's ratio.
11. Draw stress – strain diagram for mild steel, brittle material and a ductile material and indicate salient points.
12. What is principle of super-position?
13. Differentiate thin cylinder & thick cylinder
14. What is the procedure for finding the thermal stresses in a composite bar?
15. Define the term 'obliquity' and how it is determined.
16. Define Factor of safety.
17. What do you meant by thermal stresses?
18. Define working stress & allowable stress

PART – B (16 Marks)

1. A tensile test was conducted on a mild steel bar. The following data was obtained from the test:

   (i) Diameter of the steel bar = 3 cm

   (ii) Gauge length of the bar = 20cm

   (iii) Load at elastic limit = 250 kN

   (iv) Extension at a load of 150 kN = 0.21 mm

   (v) Maximum load = 380 kN

   (vi) Total extension = 60 mm

   (vii) Diameter of rod at failure = 2.25 cm

   Determine:

   (1) The Young's modulus

   (2) The stress at elastic limit

   (3) The percentage of elongation

   (4) The percentage decrease in area.

2. Three bars made of copper; zinc and aluminium are of equal length and have cross section 500, 700, and 1000 sq.mm respectively. They are rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 250 kN, estimate the proportional of the load carried on each rod and the induced stresses. Take the value of E for copper = 1.3×10^{5} N/mm^2, for zinc = 1×10^{5} N/mm^2 and for aluminium = 0.8×10^{5} N/mm^2.
3. A bar 0.3m long is 50mm square in section for 120mm of its length, 25mm diameter for 80mm and of 40mm diameter for its remaining length. If the tensile force of 100kN is applied to the bar calculate the maximum and minimum stresses produced in it, and the total elongation. Take E = 2×10^{5} N/mm^2 and assume uniform distribution of stress over the cross section.
4. A bar of 25mm diameter is subjected to a pull of 40kN. The measured extension on gauge length of 200mm is 0.085mm and the change in diameter is 0.003mm.Calculate the value of Poisson's ratio and the three moduli.

A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made up of steel plate 3 mm thick. The length and internal diameter of the vessel are 50 cm and 25 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell due to an internal fluid pressure of 3 N/mm^2. Also calculate the increase in length, diameter and volume of vessel. Take E = 2×10^5 N/mm^2 and μ =0.3.

5. A hollow cylinder 2 m long has an outside diameter of 50 mm and inside diameter of 30 mm. If the cylinder is carrying a load of 25 kN, find the stress in the cylinder. Also find the deformation of the cylinder, if the value of modulus of elasticity for the cylinder material is 100 GPa.
6. A short metallic column of 500mm^2 cross sectional area carries a axial compressive load of 100kN.For a plane inclined at 60^o with the direction of the load calculate i) Normal stress ii) Resultant stress iii) Tangential stress iv) Maximum shear stress v) Obliquity of resultant stress.
7. (i) Derive a relation for change in length of a bar hanging freely under its own weight. (6)
   (ii) Draw stress - strain curve for a mild steel rod subjected to tension and explain about the salient points on it. (10)
8. (i) Derive the relationship between bulk modulus and young's modulus. (6)
   (ii) Derive relations for normal and shear stresses acting on an inclined plane at a point in a stained material subjected to two mutually perpendicular direct stresses. (10)
9. Two vertical rods one of steel and other of copper are rigidly fixed at the top and 80cm apart. Diameter and length of each rod are 3cm and 3.5m respectively. A cross bar fixed to the rods at lower ends carries a load of 6kN such that the cross bar remains horizontal even after loading. Find the stress in each rod and position of load on the bar. Take E for steel as 2×10^5 N/mm^2 and for copper as 1×10^5 N/mm^2