SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Course & Branch: B.Tech. – CIVIL
Title of the paper: Mechanics of Solids - I
Semester: III Max. Marks: 80
Sub.Code: 20302(2003/2004/2005) Time: 3 Hours
Date: 16-04-2007 Session: AN

PART – A (10 x 2 = 20)

Answer ALL the Questions

1. Define Hook's Law.
2. Write down the relation between
   (i) The Young's Modulus shear modulus
   (ii) The three elastic constants
3. Describe the term points of contraflexture. Also state whether the terms point of contraflexture and point of inflexture refers to the same point or different points.
4. What is the value of bending moment for a cantilever of span 'L' subjected to a moment 'M' at the free end?
5. Sketch the shear stress distribution diagram indicating the salient points for a rectangular section.
6. Sketch the shear stress distribution diagram for an 'I' Section indicating the salient points.
7. State one practical application where the following are used.
   (a) Leaf Springs (b) Helical Springs
8. Express the relation between the torque, angle of twist and shear stress with respect to a circular cross section.
9. Explain the term "Proof Resilience".
10. What is the strain energy stored per unit volume for a member of length 'L' subjected to an axial load 'P' applied gradually?

PART – B (5 x 12 = 60)

Answer All the Questions

11. A reinforced concrete column 300mm diameter has four steel bars of 20mm diameter each, embedded in it and carries a load of 400 kN. Find the stresses in steel and concrete. Take E for steel=2 x 10^5 N/Sq.mm and E for concrete = 0.136 N/Sq.mm.

(or)

12. A cast iron flat 300mm long and 50mm x 30mm uniform cross section is subjected to the forces of 25 kN tensile along the length, 350 kN compressive along the 50mm side and 200 kN tensile along the 30mm side. Calculate the change in volume of the flat. Take E for steel = 140 x 10^9 /Sq.m and poisson's ratio as 0.25.

13. A simply supported beam ABC with simple supports A and B, at 6m apart and with an overhang BC of 2m length carries an uniformly distributed load of 10 kN/m over the entire length. Sketch the Shear Force Diagram and Bending Moment Diagram indicating the various ordinates including the ordinates for (a) Maximum positive BM (b) Maximum negative BM, and the position of the point of inflexture.

(or)

14. Sketch the Bending Moment Diagram and Shear Force Diagram for the simply supported beam loaded as shown in Fig.1, indicating the various ordinates

Draw Diagram

15. (a) What are the assumptions made in the theory of simple bending? (3)

(b) Derive the equation of theory of simple bending

$M/I = f/y = E/R$ (9)

(or)

16. (a) Write down the formula used for calculation of shear stress distribution across a cross section of a member (2)

(b) Obtain the section modulus for the flanged beam shown in Figure. (10)

Draw Diagram

17. A hollow shaft having an inside diameter 60% of its outside diameter is to replace a solid shaft transmitting the same power at the same speed. Calculate the percentage savings in the material with reference to the solid shaft, if same material is used for the solid as well as hollow shafts.

(or)

18. A closely coiled helical spring is to carry a load of 500 N. Its mean coil diameter is to be 10 times that of the wire diameter. Calculate these diameters, if the maximum shear stress in the material of the spring is to be 80×10^6 N/Sq.m.

19. A bar 1000 mm in length as shown in Fig.3 is subjected to an axial pull, such that the maximum stress is equal to 150 x 10^6 N/Sq.m. Its area of cross section for the middle 50mm length is 100 Sq.mm and for the rest of the length is 200 Sq.mm. If E = 200 x 10^9 N/Sq.m, calculate the strain energy stored in the bar.

Draw Diagram

(or)

20. A weight of 1.2 kN is dropped on a collar attached at the lower end of a vertical bar 4m long and 30mm in diameter. Calculate the height of drop, if the maximum instantaneous stress is not to exceed 120 N/ Sq.mm. Also calculate the instantaneous elongation, if E = 2.0 x 10^5 N/Sq.mm.