SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY
DEEMED UNIVERSITY

Course: B.E./B.Tech. Semester: III
Title of the paper: Mechanics of Solids – I Max. Mark: 80
Sub. Code: 20302 (2004) Time: 3 Hours

PART – A (10 x 2 = 20)
Answer ALL the Questions

1. State Hooke's law.
2. Define Poisson's ratio.
3. Draw the S.F and B.M diagrams for a cantilever beam of length L carrying a point load W at the free end.
4. How do you locate the point of maximum bending moment?
5. What is a Section Modulus?
6. Show that the neutral axis passes through the centroid of a section in the elastic analysis of beams under pure bending.
7. Sketch the shear stress variation across a hollow and solid circular shaft subjected to torque.
8. Define strength of a shaft and stiffness of shaft.
9. Define resilience and modulus of resilience.
10. Give the expression for calculating strain energy.

PART – B (5 x 12 = 60)
Answer ALL the Questions

11. The modulus of rigidity of the material is $0.51 \times 10^5 N/mm^2$. A 10mm diameter rod of the material was subjected to an axial pull of 10kN and the change in diameter was observed to be 0.003mm. Calculate Poisson's ratio, Young's modulus and Bulk modulus of the material.

(or)

12. A reinforced concrete column 300mm x 300mm is reinforced with 8 steel rods with a total area of 1820mm^2. The column carries an axial load of 400kN. If the modulus of elasticity of steel is 18 times that of concrete; find the stresses in concrete and steel. Take E = 2 x 10^5 N/mm^2.

13. A simply supported beam of span 6m is loaded with a ud*l* of 3 kN/m over a length of 2m starting from a distance of 1m from left end. Draw S.F and B.M diagrams for the beam and find the magnitude and position of maximum B.M.

(or)

14. A cantilever beam 5m long carries point loads of 3kN, 4kN and 6kN at distances of 1.5m, 3m and 4.5m from the fixed end. In addition to this the beam carries a ud*l* of 2kN/m over the entire length of the beam. Draw S.F and B.M. diagrams.

15. A simply supported beam of rectangular cross-section 50 x 25 mm and 3m long is carrying a u.d.*l*. of 1.5kN/m. Determine the maximum bending stress induced in the beam?

(or)

16. A beam of triangular cross-section having base width 100mm and height 150 mm is subjected to a shear force of 13.5 kN. Find the value of τmax and sketch the shear stress distribution along depth of beam?

17. What power could be transmitted at 300 rpm by a hollow steel shaft of 7.5 cm external diameter and 5cm internal diameter when the permissible shear stress for the steel is 50N/ mm^2 and the maximum torque is 1.3 times the mean? Compare the strength of hollow shaft with that of a solid shaft of same materials, weight and length

(or)

18. A closed coil helical spring of 10cm mean diameter is made up of 1cm diameter rod and has 20 turns. The spring carries an axial load of 300N. Determine the maximum shearing stress taking the value of modulus of rigidity as $0.80 \times 10^5 N/mm^2$. Determine deflection when carrying this load. Also calculate the stiffness of the spring.

19. A steel bar 15mm in diameter is pulled axially by a force of 12KN. If the bar is 320mm long calculate the strain energy stored by the bar. Take $E = 2 \times 10^5 N/mm^2$.

(or)

20. Two elastic bars of same material and length one of circular section of diameter 150mm and other of square section of side 100mm absorb the same amount of Strain energy delivered by the axial forces. Compare the stresses in the two bars.