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 (2002/2003) Time: 3 Hours

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

1. What are the two basic principles of analyzing a composite bar subjected to axial loads?
2. Define factor of safety.
3. What are determinate and indeterminate structures?
4. What are the advantages of method of sections?
5. What are the different types of loads acting on a beam?
6. Draw the S.F and B.M diagrams of a cantilever beam of length '*l*' carrying a point of load 'w' at the free end.
7. Define torsional rigidity.
8. The polar modulus of a circular section of radius R is ----------.
9. Define resilience and modulus of resilience.
10. The maximum stress intensity due to suddenly applied load is ----------.

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

11. An aluminium tube of 40 mm external diameter and 20 mm internal diameter is fitted on a solid steel rod of 20 mm diameter. The composite bar is loaded in compression by an axial load P. Find the stress in steel when the load is such that the stress in aluminium is $70 N/mm^2$. What is the value of P? Take Es = 2.1×10^5 N/mm^2 and Eal = 0.7×10^5 N/mm^2.

(or)

12. A bar of steel is 0.7m long. For the first 0.2m it is 25mm diameter, for the next 0.3m it is 20mm in diameter and for the remaining 0.2m it is 15mm in diameter. Find the change in length if it is subjected to a tensile load of 100 kN. Take E = $2x10^5$ N/mm^2.

13. Analyse the truss shown in Fig.1 by the method of joints.

diagram

(or)

14. Find the forces in the members 1, 2 and 3 of a truss shown in Fig. 2 by the method of sections.

diagram

15. A simply supported beam is carrying a udl of 5kN/m over a length of 2m from right end. The length of the beam is 5m. Draw the S.F and B.M diagrams for the beam and also calculate the maximum B.M on the section.

(or)

16. A cantilever beam of length 6m carries a udl of 3kN/m over its entire span. In addition to this it carries concentrated loads of 3kN, 4kN and 6 kN at a distance of 2m, 3m and 5m respectively from the free end. Draw the S.F and B.M diagrams.

17. A solid circular shaft transmits 75 kW at 200 rpm. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1° in 2m length of shaft and shear stress is limited to 50N/mm^2 and maximum torque is 10% more than the mean torque. Take C = 0.8x10^5 N/mm^2.

(or)

18. A closed coiled helical spring is made of 8mm diameter wire. The mean diameter of the coil is 100 mm and the number of turns is 16. The modulus of rigidity of the shaft is 0.8x10^5 N/mm^2. If the maximum shear stress should not exceed 100 N/mm^2, calculate maximum safe load that can be applied to the spring under this load. Calculate the strain energy stored by the spring.

19. Determine the maximum strain energy stored in a solid shaft of diameter 10 cm and of length 1.25m, if the maximum allowable shear stress is 50 N/mm^2. Take C = 0.8x10^5 N/mm^2

(or)

20. A steel rod is 2m long and 50mm in diameter. An axial pull of 100kN is suddenly applied to the rod. Calculate the instantaneous stress induced and also the instantaneous elongation in the rod. Take E=2x10^5 N/mm^2. Also calculate the strain energy stored in the rod.