(Pages : 3) **E – 2286**

Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, May 2018

(2013 Scheme)

13.304 : MECHANICS OF SOLIDS (MNPSU) ME

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. What is meant by stress concentration ?

2. Define resilience, proof resilience and modulus of resilience.

3. What are the assumptions made in the theory of simple bending ? Write down the equation of bending and explain the terms.

4. Derive an expression for the deflection at the free end of a cantilever with span 'L' loaded with a concentrated load 'W' at the free end.

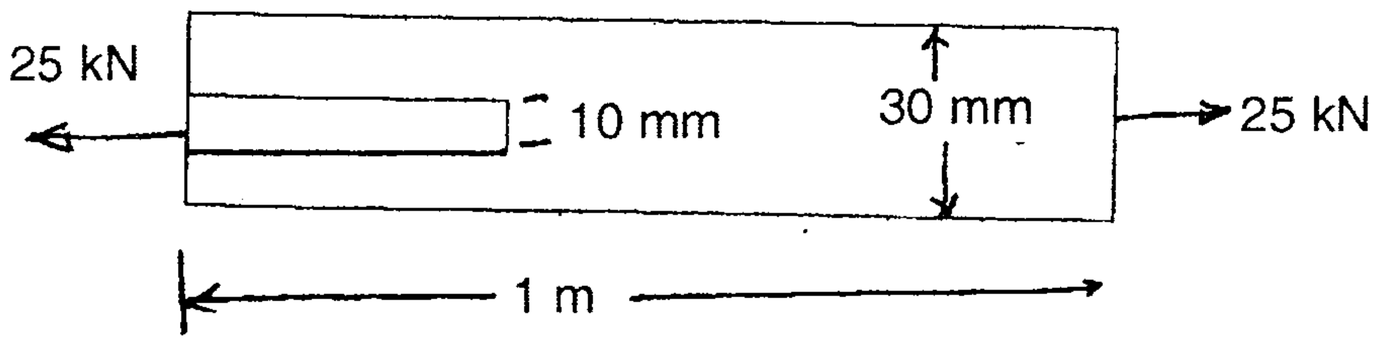
5. Define torsional rigidity and polar section modulus. **(5×4=20 Marks)**

PART – B

Answer **one full** question from **each** Module. **Each full** question carries **20** marks.

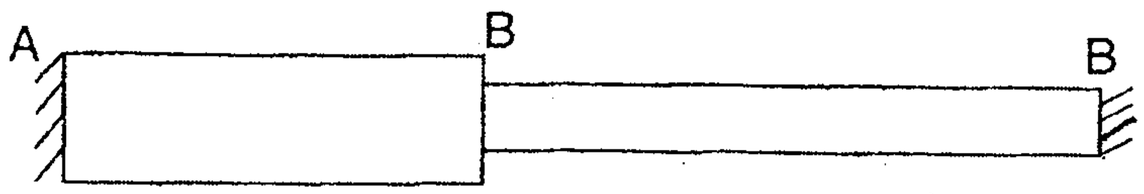
Module – 1

6. a) A bar of length 1 m and diameter 30 mm is centrally bored for 400 mm, the diameter of bore 10 mm. Under an axial load of 25 kN if the extension of the bar is 0.185 mm, what is the Modulus of elasticity of the bar. **10**



P.T.O.

b) A composite bar is rigidly fixed at the supports A and B as shown in fig. Determine the forces acting at the supports when the temperature is raised by 20°C. Take $E_s = 200$ GPa $E_a = 70$ GPa, $\alpha_s = 12 \times 10^{-6}/°C$, $\alpha_a = 18 \times 10^{-6}/°C$.



Aluminium, $A_a = 600$ mm^2 1 m long Steel, $A_s = 300$ mm^2, 3 m long **10**

7. A hollow copper tube 50 mm internal diameter and 5 mm thickness is fitted inside a steel tube of 5 mm thickness and internal diameter 60 mm. Both the tubes are connected at the ends using 18 mm pins near each end and are heated through 50°C. Determine the stresses developed in the tubes and pins. Given $E_s = 200$ GPa $E_c = 100$ GPa $\alpha_s = 12 \times 10^{-6}/°C$ $\alpha_c = 18 \times 10^{-6}/°C$. **20**

Module – 2

8. A rectangular block 350 mm long 100 mm wide and 80 mm thick is subjected to axial load as follows. 50 kN tensile force in the direction of length, 100 kN compressive force in the direction of thickness and 60 kN tensile force in the direction of width. Determine i) change in volume ii) Bulk Modulus and iii) Modulus of rigidity. Take E = 200 GPa and $\mu = 0.25$. **20**

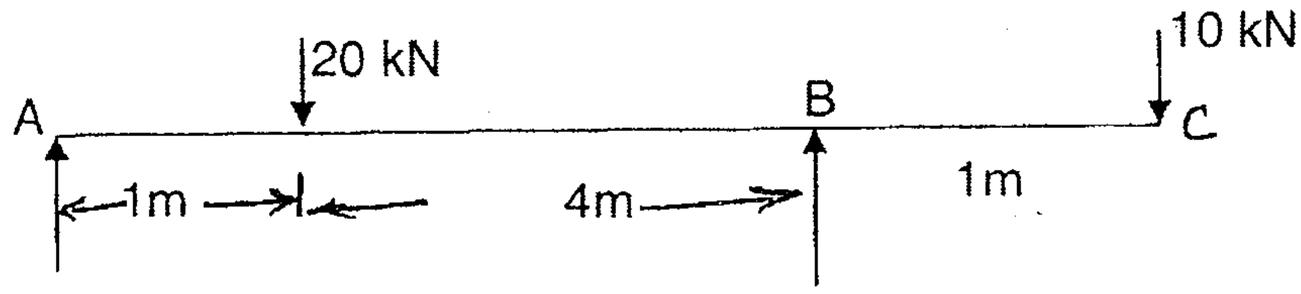
9. Normal stresses acting on two mutually perpendicular planes are 150 kpa (compressive on a vertical plane) and 60 kpa (tensile on a horizontal plane). The shear stress on these planes is 110 kN/m^2. Determine the principal stresses, principal planes and shear and normal stresses on a plane making an angle 70° with vertical. Solve by Mohr's circle. **20**

Module – 3

10. a) For a given stress compare the moment of resistance of a beam of square section placed a) with two sides horizontal b) with a diagonal horizontal. **10**

b) Calculate the width and depth of the strongest beam of rectangular section that can be cut of a cylinder log of wood whose diameter is 250 mm. **10**

11. Determine i) deflection below each load ii) Maximum deflection and its point for the beam loaded as shown in fig. Take E = 200 Gpa, I = 85 × 10^6 mm^4. Use Macaulay's method. **20**



Module – 4

12. a) Derive expressions for the hoop and longitudinal stresses in thin cylindrical shells. **10**

    b) A cylindrical vessel of 1 m diameter and 2.5 m long is closed with rigid end plates and subjected to an internal pressure of 2.5 N/mm^2. Estimate the thickness of the shell if the maximum principal stress is not to exceed 120 N/mm^2. Also calculate the change in diameter, length and volume. **10**

13. A hollow steel shaft 240 mm external and 160 mm internal diameter is to be replaced by a solid alloy shaft. If both the shafts should have the same polar modulus, determine the diameter of the latter and the ratio of the torsional rigidities. Take N for steel and 2N for alloy. **20**