

14/11/2024 MECH SEM-III C SCHEME SOM QP CODE: 10066930

3 Hours

Total Marks: 80

- Question-1 is compulsory.
- Answer any three from remaining five questions.
- Assume any suitable data, wherever required, but justify the same. Assumptions made should be clearly stated.
- Illustrate the answers with sketches, wherever required.

1 Answer any four of the following:

- A material has Young's modulus of $2 \times 10^5 \text{ N/mm}^2$ Poisson's ratio of 0.32, determine rigidity and Bulk modulus of the material. (05)
 - A rectangular beam 300mm deep is simply supported over a span 4m. What uniformly distributed load the beam can carry if the bending stress is not to exceed 120MPa. Take $I = 8 \times 10^6 \text{ mm}^4$. (05)
 - A water main 800mm diameter contains water at a pressure head of 100m. If the weight of water 10 kN/m^3 , find the thickness of metal required for the water main if permissible stress in metal is 20 N/mm^2 . (05)
 - State the assumptions made in the analysis of struts and columns by Euler's buckling theory. (05)
 - Draw shear stress distribution for I section, T section and rectangular section. (05)
 - Establish the relationship between shear force, bending moment and rate of loading. (05)
- 2 a) A solid circular shaft has to transmit 300 kW power at 100 rpm. If the shear stress is not to exceed 80 N/mm^2 , find the diameter of the shaft. If this shaft were replaced by a hollow one whose internal diameter is 0.6 of its external diameter, What will be the % of saving of material. The length, material and shear stress are kept same. (10)
- 2 b) A composite bar is made of Steel and Aluminium is held between two supports as shown in fig 1. The bars are stress free at temp 38°C . What will be the stress in the two bars when temperature decreased to 21°C , the supports come near to each other by 0.1mm. Take $E_s = 210 \text{ GN/m}^2$, $E_{Al} = 100 \text{ GN/m}^2$, $\alpha_s = 11.7 \times 10^{-6}/^\circ\text{C}$ and $\alpha_{Al} = 23.4 \times 10^{-6}/^\circ\text{C}$ (10)

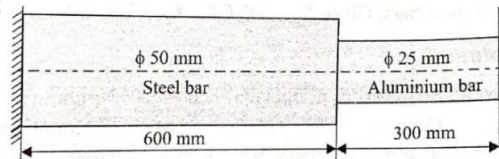


Fig.1

- 3 a) A T section (Flange = $200 \text{ mm} \times 10 \text{ mm}$, web = $10 \text{ mm} \times 240 \text{ mm}$) is used as struts which is 6m long, one end is hinged and other end is fixed. Determine the buckling load using Euler's formula. $E = 200 \times 10^3 \text{ N/mm}^2$ (10)

- 3 b) Figure 2, shows a C section subjected to a shear force of 18 kN intensity. Draw the shear stress distribution diagram across the section and obtain the shear stress values at all the salient points including the neutral axis. (10)

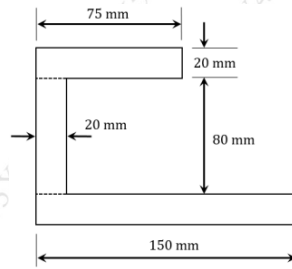


Fig.2

- 4 a) A cylindrical vessel of 1.5m diameter and 4m long is closed at ends by rigid plate. It is subjected to an internal pressure of 3N/mm^2 . If the maximum circumferential stress is not to exceed 150N/mm^2 , find the thickness of shell. Also change in diameter length and volume of the shell. Take $E=2 \times 10^5 \text{ N/mm}^2$, $1/m=0.25$ (10)

- 4 b) Draw shear force and bending moment diagram for beam shown in fig. 3 (10)

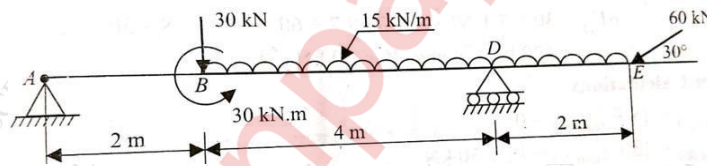


Fig.3

- 5 a) The beam has a T-shaped cross-section with a top flange measuring $90 \text{ mm} \times 20 \text{ mm}$ and a web measuring $20 \text{ mm} \times 90 \text{ mm}$. The beam is a simply supported on a span of 8m and subjected to 1200N/m over entire span. Determine bending stresses in compression and tension, also sketch the bending stress distribution. (10)

- 5 b) Find the slope at A and deflection at a point C for the beam loaded shown in fig.4. Assume moment of inertia and modulus of elasticity as $I=20 \times 10^6 \text{ mm}^4$ and $E=200 \text{ kN/mm}^2$. (10)

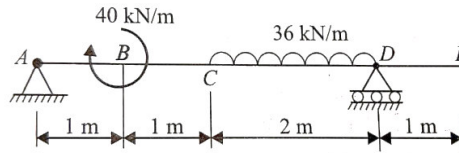


Fig. 4

- 6 a) Two mutually perpendicular plane of an element subjected to $\sigma_x = 100\text{MPa}$ (tensile) and $\sigma_y = 40\text{MPa}$ (compressive) and shear stress $= 30\text{MPa}$. Locate the principal planes and determine the principal stresses, maximum shear stresses using Mohr's circle verify answers with analytical method. (10)

- 6 b) Determine instantaneous stress and deformation of a rod of length 1.2m and the diameter 8mm. If a mass of 90kg falls through a height f 15cm and strike the bottom of the rod. The rod is freely suspended and fixed at the top. Take $E=210\text{GPa}$. (10)