R09

Code No: 09A30103

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech II Year I Semester Examinations, May/June-2013
Strength of Materials-I
(Civil Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1.a) For an elastic material, express Poisson's ratio in terms of bulk modulus and shear modulus. Derive the expression from first principles.

b) A composite bar of length 860 mm is made up of an aluminum bar of length 460 mm and steel bar of length 400 mm. The cross-sectional areas of aluminum and steel bars are 120 mm × 120 mm and 80 mm × 80 mm respectively. Assuming that the bars are prevented from buckling sideways, calculate the compressive force P to be applied to the composite bar that will cause the total length of the bar to decrease by 0.4 mm. Assume the modulus of elasticity of aluminum and steel as 72 kN/mm^2 and 212 kN/mm^2 respectively. [15]

2.a) Define the terms 'Shear Force' and 'Bending Moment'.

b) Draw shear force and bending moment diagrams for the beam shown in Figure.1. [15]

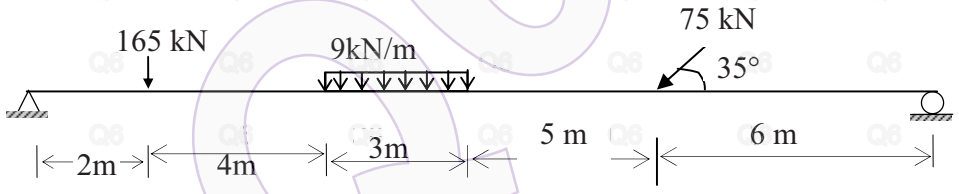

Figure 1

3.a) State the assumptions involved in the theory of simple bending.

b) A beam has an I-section with top flange 120 mm × 35 mm, web 30 mm × 140 mm and bottom flange 180 mm × 40 mm. If tensile stress is not to exceed 36 MPa and compressive stress 95 MPa, what is the maximum uniformly distributed load the beam can carry over a simply supported span of 7.2 m if the larger flange is in tension? [15]

4.a) Prove that the ratio of maximum shear stress to average shear stress in a rectangular cross-section is equal to 1.8 when it is subjected to a transverse shear force F. Derive from first principles variation of shear stress and sketch the distribution of shear stress across the section.

b) A T-beam has the following dimensions:
Flange = 230 mm wide and 25 mm thick. Web = 230 mm deep and 20 mm thick.
Draw shear stress distribution across the depth marking values at salient points. [15]

5. Find the slope and deflection at the free end for the beam shown in Figure.2 using Moment-Area method. Take E = 2.2×10^5 MPa and I = 97×10^6 mm^4. [15]

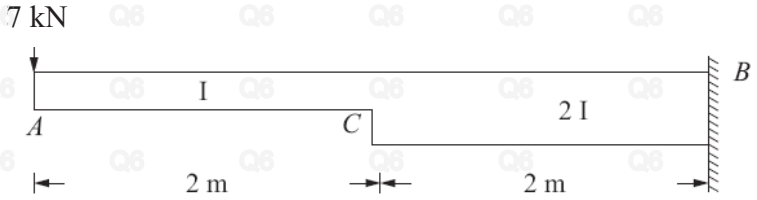

Figure 2

6. A plane element is subjected to stresses as shown in Figure.3. Determine the Principal stresses, maximum shear stress and their planes. Use Mohr's Circle Method. [15]

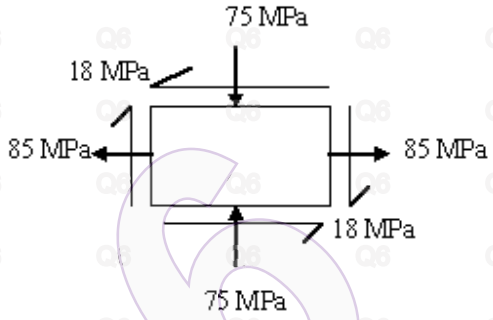

Figure 3

7.a) At atmospheric pressure, a thin spherical shell has diameter 760 mm and thickness 10 mm. Find the stress introduced and changes in diameter and volume when the fluid pressure is increased to 3 MPa. Take E = 205 kN/mm^2 and Poisson ratio = 0.3.

b) A spherical shell of diameter 1.6 m and wall thickness 8 mm, is filled with fluid under pressure. The volume change is 206×10^3 mm^3. Calculate the fluid pressure if E = 207 kN/mm^2 and Poisson's ratio = 0.27. [15]

8.a) Derive the Lame's equations for the circumferential stress and the radial pressure, for thick cylinders.

b) A thick cylindrical pipe of outside diameter 360 mm and internal diameter of 230 mm is subjected to an internal fluid pressure of 26 MPa and external fluid pressure of 9 MPa. Determine the maximum hoop stress developed and draw the variation of hoop stress and radial stress across the cross-section. [15]

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