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10ME34/10AU34

Third Semester B.E. Degree Examination, June/July 2018
Mechanics of Materials

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Draw stress-strain diagram, for a mild steel subjected to tension and indicate salient points on the diagram. **(06 Marks)**

b. Define : (i) Nominal stress (ii) True stress (iii) Hook's law. **(04 Marks)**

c. A member is subjected to point loads as shown in Fig. Q1 (c). Calculate P_2 necessary for equilibrium. Take $E = 2.05 \times 10^5 N/mm^2$. **(10 Marks)**

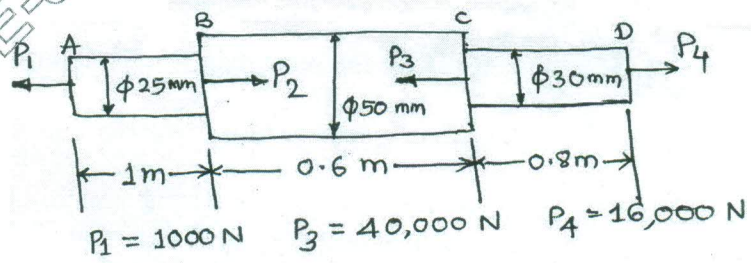

Fig. Q1 (c)

2 a. Define : (i) Poisson's ratio (ii) Modulus of rigidity (iii) Bulk modulus and (iv) Volumetric strain. **(04 Marks)**

b. Establish the relationship between modulus of elasticity and Bulk modulus in case of a cube subjected to three mutually perpendicular like compressive stresses of equal intensity 'P'. **(06 Marks)**

c. A composite bar is rigidly fitted at the supports A and B as shown in Fig. Q2 (c). Determine the reactions at supports when temperature rises by 20°C. Take $E_a = 70\ GN/m^2$, $E_S = 200\ GN/m^2$, $\alpha_a = 11 \times 10^{-6}/^\circ C$, $\alpha_S = 12 \times 10^{-6}/^\circ C$. **(10 Marks)**

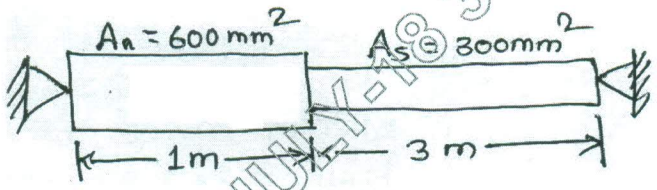

Fig. Q2 (c)

3 a. The state of stress at a point in a strained material is as shown in Fig. Q3 (a). Determine :
(i) The magnitude of principal stresses.
(ii) The direction of principal stresses and
(iii) The magnitude of the maximum shear stress and its direction.
Indicate all the planes by a sketch. **(10 Marks)**

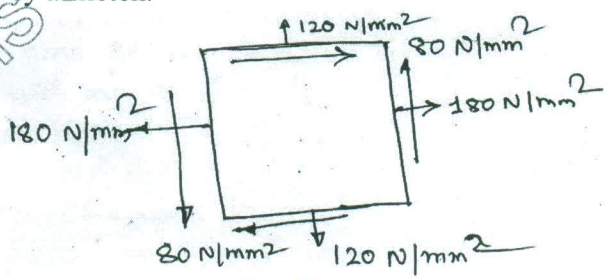

Fig. Q3 (a)

b. The direct stresses at a point in a strained material are 100 N/mm^2 and 60 N/mm^2 as shown in Fig. Q3 (b). Determine stress on the inclined plane AC. **(10 Marks)**

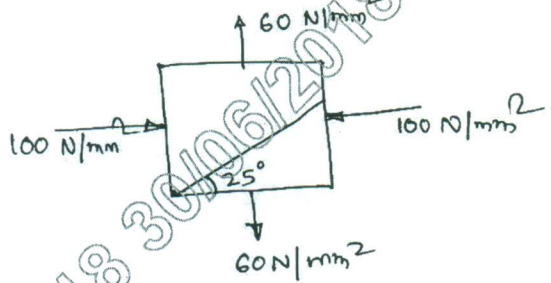

Fig. Q3 (b)

4 a. Define strain energy and Resilience. **(02 Marks)**

b. Two bars, each of length L and of different materials are each subjected to the same tensile force P. The first bar has a uniform diameter 'D' and the second bar has a diameter of $\frac{D}{2}$ for a length $\frac{L}{4}$ and a diameter D for the remaining length. Compare the strain energies of the two bars if, (i) $\frac{E_1}{E_2} = \frac{4}{7}$ and (ii) $E_1 = E_2$ **(08 Marks)**

c. A thin cylindrical shell 2 m long has 200 mm diameter and thickness of metal 10 mm. It is filled completely with a fluid at atmospheric pressure. If an additional fluid of 25000 mm^3 is pumped in, find the pressure developed. Find also the changes in diameter and length. Take $E = 2\times10^5$ N/mm^2 and $\mu = 0.3$. **(10 Marks)**

PART – B

5 a. With neat sketches explain: (i) Types of beams. (ii) Types of loads (iii) Types of supports. **(06 Marks)**

b. The simply supported beam shown in Fig. Q5 (b), carries two concentrated loads and a uniformly distributed load. Draw shear force diagram and bending moment diagram. **(14 Marks)**

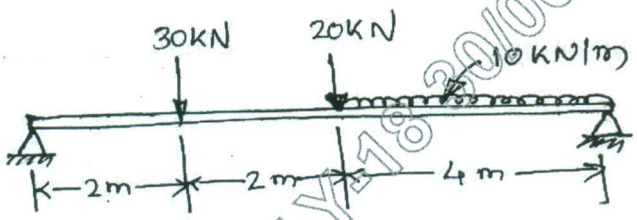

Fig. Q5 (b)

6 a. State the assumptions made in simple theory of bending. **(04 Marks)**

b. A circular pipe of external diameter 70 mm and thickness 8 mm is used as a simply supported beam over an effective span of 2.5 m. Find the maximum concentrated load that can be applied at the centre of the span if permissible stress in tube is 150 N/mm^2. **(08 Marks)**

c. A wooden section 300mm×300mm has a central bore of 100 mm diameter as shown in Fig. Q6 (c). If it is used as a beam to resist a shear force of 10 kN, find the shearing stress at crown of the bore and at neutral axis. **(08 Marks)**

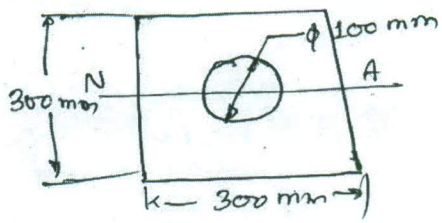

Fig. Q6 (c)