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10ME/AU34

Third Semester B.E. Degree Examination, June/July 2016
Mechanics of Materials

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. State Hooke's law. Sketch the typical stress – strain diagram for mild steel indicating all salient points and zones on it. **(04 Marks)**

b. Derive an expression for the extension of uniformly tapering circular bar subjected to axial load. **(08 Marks)**

c. A round bar with stepped portion is subjected to the forces as shown in fig.Q1(c). Determine the magnitude of force P, such that net deformation in the bar does not exceed 1mm. E for steel is 200 GPa and Aluminium is 70 GPa. Big end diameter and small end diameter of the tapering bar are 40mm and 12.5mm respectively. **(08 Marks)**

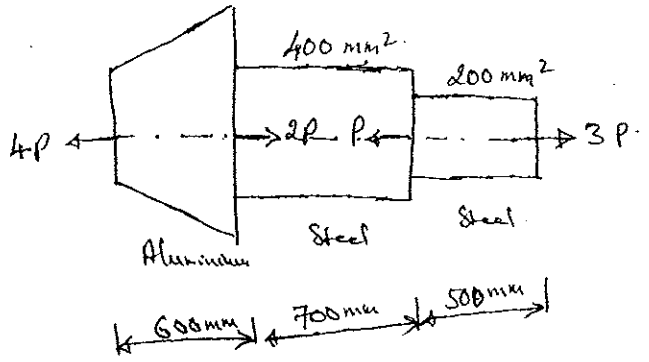

Fig.Q1(c)

2 a. Define Poisson's ratio. Derive an expression for volumetric strain of a rectangular bar, subjected to normal stress along the axis. **(10 Marks)**

b. When a bar of 25mm diameter is subjected to a pull of 61kN, the extension on a 50mm gauge length is 0.1mm and decrease in diameter is 0.013mm. Calculate the values of elastic constants E, G, K and μ. **(10 Marks)**

3 a. Derive an expression for the normal stress and shear stress on a plane inclined at 'θ' to the vertical axis in a biaxial stress system. **(08 Marks)**

b. At a point in a loaded elastic member, there are normal stresses of 60MPa and 40MPa (both tensile) respectively, at right angles to each other with positive shear stress of 20MPa. Draw the Mohr's circle diagram and find i) Principal stresses and their planes ii) Maximum shear stress and its plane. **(12 Marks)**

4 a. Derive an expression for strain energy stored in a plain bar subjected to axial load F. **(05 Marks)**

b. Derive an expression for circumferential stress for thin cylinder. **(05 Marks)**

c. A thick cylinder of 500mm inner diameter is subjected to an internal pressure of 9MPa. Taking the allowable stress for the material of the cylinder as 40MPa, determine the wall thickness of the cylinder. **(10 Marks)**

PART – B

5 a. Derive an expression to establish a relationship between the intensity of load, shear force and bending moment. **(05 Marks)**

b. Draw the shear force and bending moment diagram for the beam shown in fig. Q5(b). Locate the point of contra flexure. **(15 Marks)**

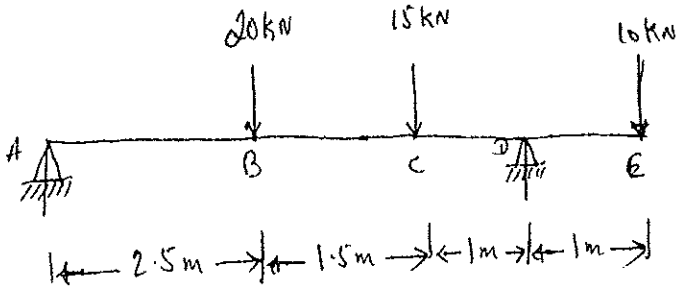

Fig.Q5(b)

6 a. List the assumptions made in simple bending theory and establish the relationship between bending stress and radius of curvature. **(10 Marks)**

b. A uniform I – section beam is 100mm wide and 150mm deep with a flange thickness of 25mm and web thickness of 10mm. The beam is simply supported over a span of 5m. It carries a udl of 83.4kN/m throughout its length. Determine the bending stress in the beam. **(10 Marks)**

7 a. Find the expression for the slope and deflection of a cantilever of length L carrying uniformly distributed load over the whole length. **(10 Marks)**

b. A beam of length 6mts is simply supported at its ends and carries two point loads of 48kN and 40kN at a distance of 1m and 3m respectively from the left support. Find i) Deflection under each load ii) Maximum deflection iii) Point at which maximum deflection occurs. Take $E = 2 \times 10^5$ MPa and $I = 85 \times 10^6$ mm^4. **(10 Marks)**

8 a. Determine the diameter of the shaft which will transmit 440kW at 280 rpm, if maximum torsional shear stress is to be limited to 40N/mm^2. Assume G = 84kN/mm^2. **(10 Marks)**

b. A solid round bar of 60mm diameter and 2.5m long is used as a strut. Find the safe compressive load for the strut if i) Both ends are hinged ii) Both ends are fixed. Take $E = 2 \times 10^5$ N/mm^2 and factor of safety = 3. **(10 Marks)**

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