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10CV/EV33

Third Semester B.E. Degree Examination, June/July 2019
Strength 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. Draw stress – strain curve for mild steel specimen subjected to axial tension and indicate salient points. **(05 Marks)**

b. Determine the elongation caused by an axial load of 54 kN applied to flat bar of 12.5mm thickness, tapering from 100mm to 50mm in a length of 450mm. Take E = 200 GPa. **(07 Marks)**

c. A stepped bar is subjected to forces as shown in fig. Q1(c). Determine the magnitude of force P. Also find the net deformation induced. Take E = 210 GPa. **(08 Marks)**

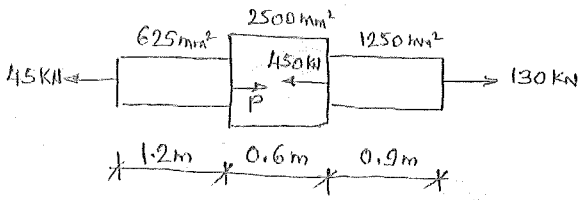

Fig.Q1(c)

2 a. Establish the relationship between E, K and Poisson's ratio. **(08 Marks)**

b. A bar 30mm in diameter was subjected to tensile load of 54kN and the measured extension on a 300mm gauge length was 0.112mm and change in diameter was 0.00366mm. Calculate Poisson's ratio and the values of three modulii. **(12 Marks)**

3 a. What are principal stresses and principal planes? **(06 Marks)**

b. An element has a tensile stress of 600MN/m^2 and a compressive stress of 400 MN/m^2 acting on two mutually perpendicular planes. It has two equal shear stresses of 200MN/m^2 on these planes. Determine i) Magnitude and direction of principal stresses and ii) Magnitude and direction of maximum shear stress. **(14 Marks)**

4 a. Explain the terms i) Shear force ii) Bending moment iii) Point of contra flexure. **(06 Marks)**

b. Draw SFD and BMD for the beam loaded as shown in fig. Q4(b), indicating the salient values. **(06 Marks)**

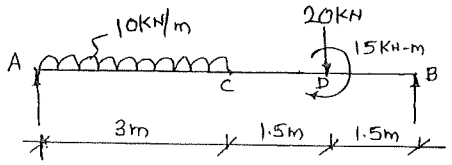

Fig.Q4(b)

c. Draw SFD and BMD for the overhanging bean loaded as shown in fig. Q4(c), indicating the salient values and locate the point of contra flexure, if any. **(08 Marks)**

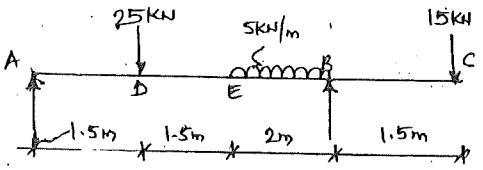

Fig.Q4(c)

PART - B

5 a. What are the assumptions made in the theory of pure bending? **(06 Marks)**

b. A T – section of flange 150mm wide and 15mm thick and overall depth of 200mm, with 15mm web thickness is loaded such that, the section has a moment of 25kN – m and shear force of 150kN. Sketch the bending and shear stress distribution diagram indicating salient values. **(14 Marks)**

6 a. Distinguish between slope and deflection. Explain with examples of a simply supported beam and a cantilever beam. **(08 Marks)**

b. A beam AB of 6m span is simply supported at the ends and is loaded with a point load of 10kN at the centre of the span and a udℓ of 5kN/m for the first half span of the beam. Find i) deflection under point load ii) max deflection.
Take E = 200 GPa , $I = 25 \times 10^6$ mm^4. **(12 Marks)**

7 a. Prove that a hollow shaft is stronger and stiffer than solid shaft of the same material, length and weight. **(08 Marks)**

b. A solid circular shafts transmits 294 kW at 300 rpm. If the maximum shear stress should be less than 42MN/m^2 and the angle of twist in a length of 3m, should not exceed 1 degree. Find the diameter of the shaft. Take C = 80 GN/m^2. **(12 Marks)**

8 a. List the assumptions made in the Euler's theory of columns. **(06 Marks)**

b. A cast iron column with 100mm external diameter and 80mm internal diameter is 3m long. Calculate the safe load using Rankine's formula if
i) Both ends are fixed ii) Both ends are hinged.
Take $\sigma_c = 600$N/mm^2 $\alpha = 1/1600$. Adopt a factor of safety = 3. **(14 Marks)**

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