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06CV33

Third Semester B.E. Degree Examination, June-July 2009
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. Explain i) Nominal stress and True stress ii) Principle of superposition. **(04 Marks)**

b. Determine the elongation caused by an axial load of 100 kN applied to a flat bar 20mm thick, tapering from 120mm to 40mm in a length of 10 meter. E = 200 GPa. Derive the expression you use. **(08 Marks)**

c. A rigid bar BDE is supported by two links AB and CD made of aluminium and steel as shown in Fig. Q1. (c). For the 30kN load shown, determine i) stress in aluminium and steel ii) change in length of aluminium and steel. **(08 Marks)**
Es = 200 GPa Eal = 70 GPa.

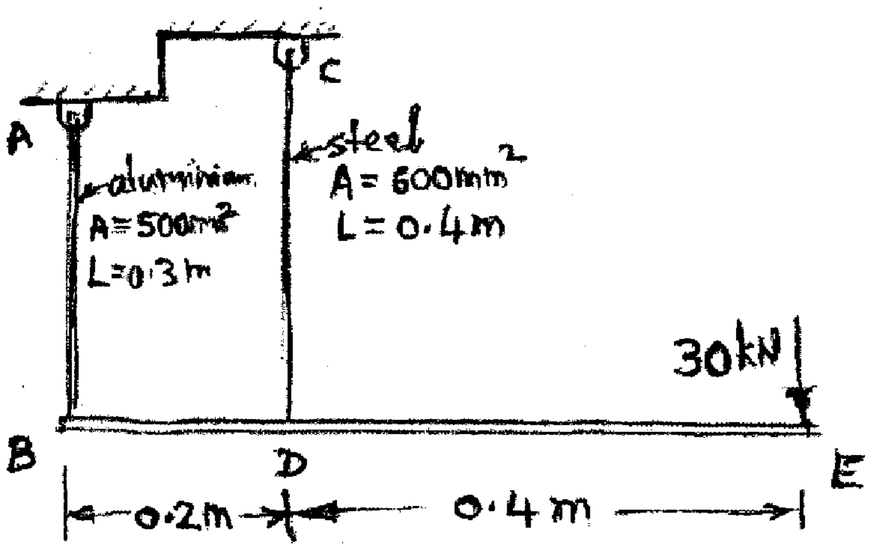

Fig. Q1.(c)

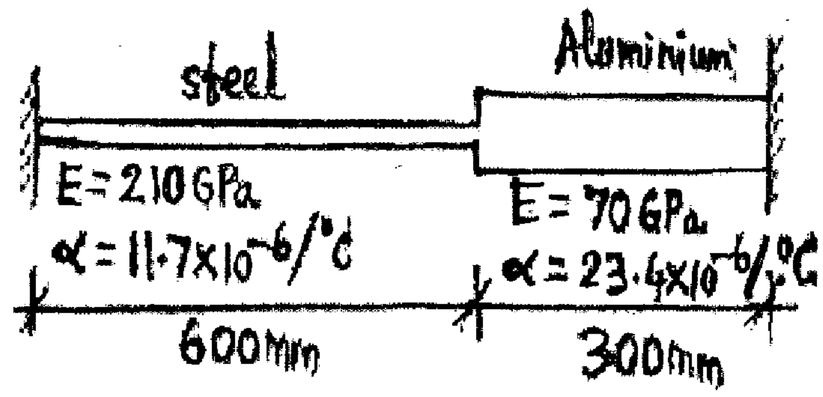

Fig. Q2.(c)

2 a. Derive the relation between Young's modulus, bulk modulus and Poisson's ratio. **(06 Marks)**

b. A bar having 10mm diameter, was subjected to an axial pull of 10kN. The diameter was changed by 0.003mm, due to the load. Calculate Young's modulus and Poisson's ratio, given that rigidity modulus is 51 GPa. **(06 Marks)**

c. A composite bar made of aluminium and steel is held between two supports as shown in Fig. Q2.(c). What will be the stress in bars when temperature falls by 20^0C, given that the bars were initially stress free. The supports are unyielding C/s area of steel bar = 200 mm^2. C/s area of aluminium = 300mm^2. **(08 Marks)**

3 a. For the state of stress shown in Fig. Q3.(a), determine principal stresses and locate principal planes. Also obtain maximum tangential stress and locate corresponding planes. **(10 Marks)**

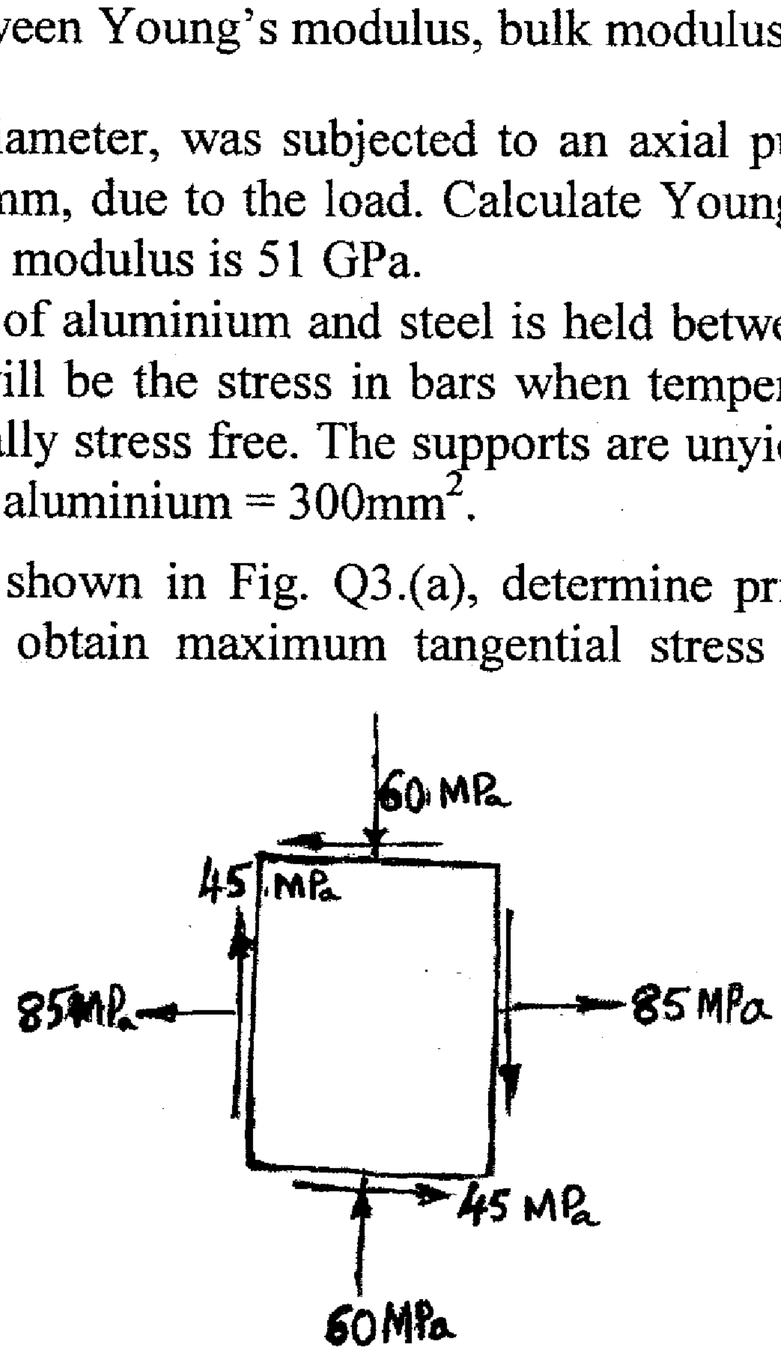

Fig. Q3(a)

b. Determine the wall thickness necessary for a thick steel cylindrical shell having 200mm inner diameter, to withstand an internal pressure of 40 MPa. Permissible tensile stress in the material is 100 MPa. Also sketch the variation of hoop stress and radial stress across the thickness. **(10 Marks)**

4 a. For a simply supported beam of span L, carrying a UDL of ω/m throughout , obtain equations for SF and BM. Plot SFD and BMD. **(06 Marks)**

b. For the beam shown in fig. Q4.(b), obtain SFD and BMD. Locate points of contra flexure, if any. **(14 Marks)**

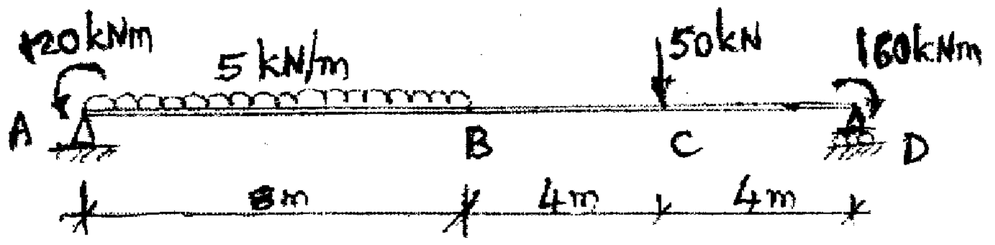

Fig. Q4. (b)

PART – B

5 a. A simply supported beam having a cross – section of 20mm × 20mm fails when a central point load of 400N is applied. Span of beam = 2m. What UDL will break a cantilever of same material, 40mm wide, 60mm deep and 3 meter long? **(10 Marks)**

b. A hollow box section 120mm wide 200mm deep is having a uniform wall thickness of 10mm. Obtain the shear stress variation across the cross – section. Shear force at the section is 120kN. **(10 Marks)**

6 a. A cantilever of length L, carry a UDL of ω/m throughout. Obtain equation for slope and deflection and determine maximum slope and deflection. **(06 Marks)**

b. For the beam shown in Fig. Q6.(b), determine slope at the supports and midspan deflection. **(14 Marks)**

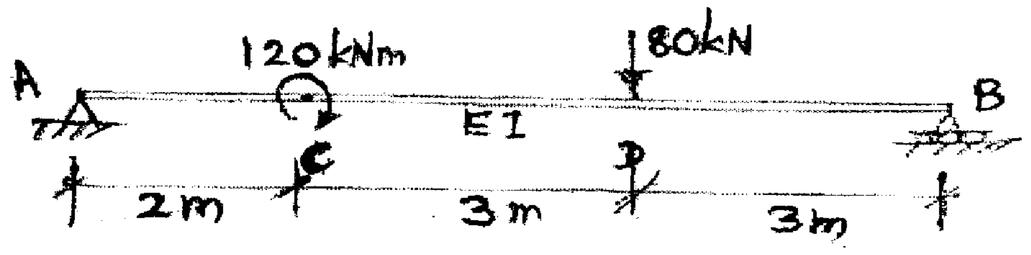

Fig. Q6(b)

7 a. Prove with usual notations, torsion equation. $\frac{T}{J}=\frac{\tau}{r}=\frac{G\theta}{L}$. **(06 Marks)**

b. A hollow shaft having internal diameter 40% of external diameter, transmits 562.5 kW power at 100 r.p.m. Determine the cross – sectional dimensions of the shaft if shear stress is not to exceed 60 MPa and twist in a length of 2.5m should not exceed 1.3^0. Maximum torque transmitted is 25% higher than average torque.
Rigidity modulus = 90 GPa. **(14 Marks)**

8 a. Derive the expression for Euler's crippling load for a long column with both ends hinged. **(04 Marks)**

b. There are two columns, one is a solid column 150mm in diameter and the other is a hollow column of same cross – sectional area with a wall thickness of 25mm. Both columns have same length and end conditions. Determine the ratio of Euler's buckling load carried by Hollow column and solid column. **(08 Marks)**

c. Using Rankine's formula, determine the crippling load for a mild steel strut 500mm long, with a rectangular section 50mm × 12.5mm having i) hinged ends ii) fixed ends. $\alpha=\frac{1}{6500}$ $\sigma_c=330N/mm^2$ **(08 Marks)**

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