CBCS SCHEME

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18CV32

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Strength of Materials

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Derive the expression for elongation of tapering circular bar subjected to an axial tensile load P. **(08 Marks)**

b. A circular bar of uniform cross sectional area of 1000 mm^2 is subjected to forces as shown in Fig.Q1(b). If Young's modulus of the material is 200 GPa, determine the total deformation.

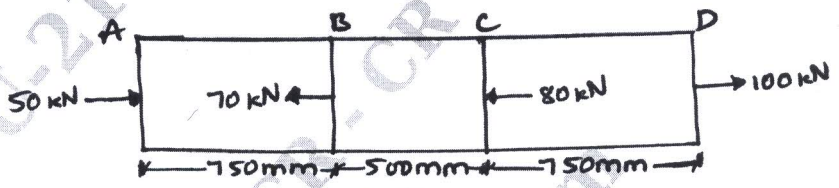

Fig.Q1(b) **(12 Marks)**

OR

2 a. Derive relation between Young's modulus, Rigidity Modulus and Poisson's ratio. **(08 Marks)**

b. A steel rod of 20mm diameter passes centrally through a copper tube of 50mm external diameter and 40mm internal diameter. The tube as closed at each end and the nuts are tightened on the projecting points of rod. If the temperature of assembly is raised by 50°C. Calculate the temperature stresses developed in copper and steel. Take E_s = 200 GN/m^2, E_c = 100 GN/m^2 and $\alpha_s = 12\times10^{-6}$ per °C and $\alpha_c = 18\times10^{-6}$ per °C. **(12 Marks)**

Module-2

3 a. Define i) Principal stress ii) Principal plane. **(04 Marks)**

b. Derive an expression for normal stress and tangential stress for a member subjected to uniaxial loading. **(06 Marks)**

c. The stresses acting at a point in a two dimensional system is shown in Fig.Q3(c). Determine the principal stresses and planes, maximum shear stress and planes normal and shear stress on plane AB.

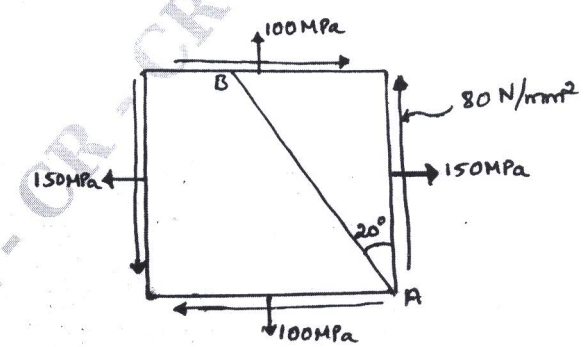

Fig.Q3(c) **(10 Marks)**

OR

4 a. Differentiate between thin and hick cylinders. **(04 Marks)**

b. A element is subjected to a tensile stress of 120 N/mm^2 on the vertical plane and another compressive stress of 80 N/mm^2 on the horizontal plane. Compute the normal and tangential stresses on a plane making an angle of 30° anticlockwise with the vertical plane. **(06 Marks)**

c. A closed cylindrical steel vessel 8m long and 2m internal diameter is subjected to an internal pressure of 5 MPa with the thickness of vessel being 36mm. Compute loop stress, longitudinal stress, maximum shear stress **(10 Marks)**

Module-3

5 a. Derive the relationship between load intensity, Shear force and Bending moment. **(08 Marks)**

b. For the simply supported beam shown in Fig.Q5(b), draw SFD and BMD. Also find point of zero shear and its bending moment.

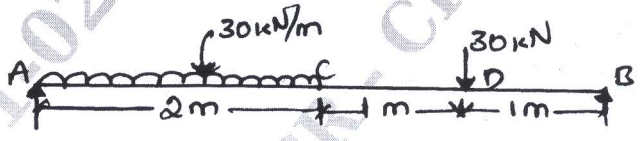

Fig.Q5(b) **(12 Marks)**

OR

6 a. Sketch SFD and BMD for the beam shown in Fig.Q6(a), indicating salient points.

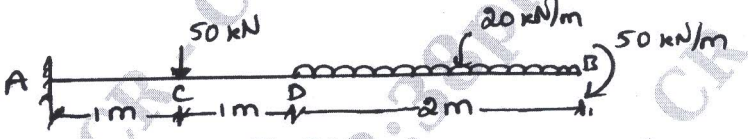

Fig.Q6(a) **(08 Marks)**

b. Sketch SFD and BMD for the beam shown in Fig.Q6(b), indicating salient points including point of contraflexure.

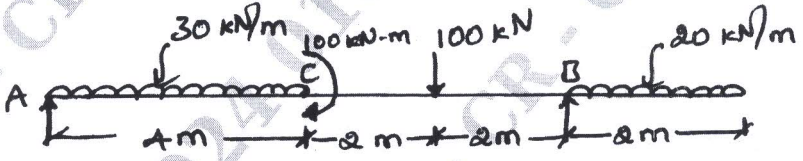

Fig.Q6(b) **(12 Marks)**

Module-4

7 a. Derive equation of pure bending with usual notations. **(10 Marks)**

b. A I-section consists of flanges 200 × 15 mm with web 10mm thick. Total depth of section is 500mm. If the beam carries a UDL of 65 kN/m over a span of 8m. Compute the bending and shear stresses at centre and support. Sketch their distributions. **(10 Marks)**

OR

8 a. Derive the torsion equation with usual notations. **(10 Marks)**

b. A solid shaft is to transmit 300 kN-m at 100 rpm. If the shear stress of the material should not exceed 80 MPa, find the diameter required. What percentage saving in weight would be obtained if this shaft is replaced by a hollow one whose $d_i = 0.6d_o$, the length, material and shear stress remaining same. **(10 Marks)**

Module-5

9 a. Derive an expression for slope and deflection in a simply supported beam subjected to an UDL throughout. Calculate maximum slope and deflection. **(08 Marks)**

b. Determine the slopes at A and B, deflections at C, D and F in the beam shown in Fig.Q9(b) in terms of EI.

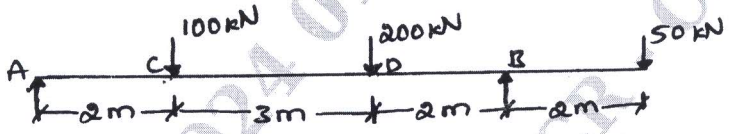

Fig.Q9(b) **(12 Marks)**

OR

10 a. Derive the Euler's equation for buckling load on an elastic column with both ends pinned. **(08 Marks)**

b. A simply supported beam of length 4m is subjected to a UDL of 30 kN/m over the whole span and deflects 15mm at the centre. Determine the crippling loads when this beam is used as column with the following conditions.
(i) One end fixed and other end hinged.
(ii) Both ends pin jointed. **(12 Marks)**

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