CBCS SCHEME

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15CV/CT32

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Strength of Materials

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Stating the assumptions made, derive the deformation equation for a uniform tapering bar of circular section. **(08 Marks)**

b. A load of 2MN is applied on a short concrete column 500mm × 500mm square section. The column is reinforced with four steel bars of 10mm diameter, one in each corner. Compute the stresses in concrete and steel bars. Take Young's modulus of steel as $2.1 \times 10^5 N/mm^2$ and for concrete as $1.4 \times 10^4 N/mm^2$. **(08 Marks)**

OR

2 a. Explain all three elastic constants briefly. **(06 Marks)**

b. A steel rod of 30mm diameter and 5m long is connected to two grips and the rod is maintained at a temperature of 95°C. Compute the stress and pull exerted when the temperature falls to 30°C, if

i) The ends do not yield

ii) The ends yield by 1.2mm

Take $E = 2 \times 10^5 MN/m^2$ and $\alpha = 12 \times 10^{-6}/°C$. **(10 Marks)**

Module-2

3 a. Explain the construction of Mohr's circle for a body subjected to two mutually perpendicular tensile stresses accompanied by a simple shear stress. **(08 Marks)**

b. A thick hollow metallic cylindrical shell of 150mm internal diameter and external diameter 'd' is required to withstand an internal pressure of $8N/mm^2$. Calculate the necessary thickness of cylinder if permissible stress in the section is $20N/mm^2$. **(08 Marks)**

OR

4 a. For a thin cylinder subjected to internal pressure 'P' derive the equations for circumferential stress and longitudinal stress. **(08 Marks)**

b. Direct stresses of $120N/mm^2$ tension and $90N/mm^2$ compression are applied on an elastic material at certain point on the planes at right angles. The maximum principal stress is limited to $150N/mm^2$. Calculate the corresponding shear stress on the given planes and the maximum shearing stress at that point. **(08 Marks)**

Module-3

5 a. Explain the terms hogging bending moment, sagging bending moments and point of contraflexure. **(06 Marks)**

b. From the given shear force diagram as shown in Fig.Q.5(b). Develop the load intensity diagram and draw the corresponding bending moment diagram indicating the salient features. **(10 Marks)**

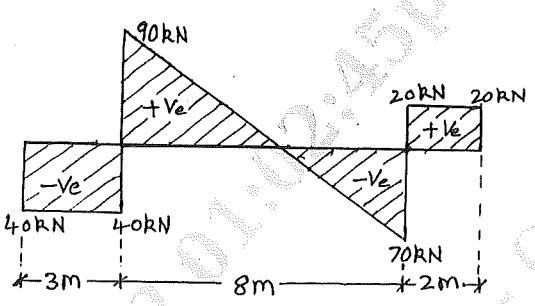

Fig.Q.5(b)

OR

6 a. Explain the terms bending moment and shear force. **(04 Marks)**

b. Analyze the beam shown in Fig.Q.6(b) and draw bending moment shear force diagram indicating the salient points. **(12 Marks)**

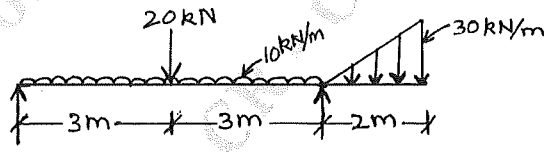

Fig.Q.6(b)

Module-4

7 a. Distinguish between pure bending and ordinary bending. **(06 Marks)**

b. A 2.5m long column with hollow circular section is hinged at both ends. External diameter is 140mm and thickness of wall is 20mm. Taking $E = 80 \times 10^9 N/m^2$, $\sigma_c = 550 N/mm^2$ and Rankine's constant $= \frac{1}{1600}$, calculate and compare buckling loads obtained using both Euler's and Rankine's formula. Also find the length of column for which both formulae give same load. **(10 Marks)**

OR

8 a. Explain Slenderness ratio, Buckling load and street. **(06 Marks)**

b. A beam having T-section with its flanges of 180mm × 10mm and web of 220 × 10mm is subjected to sagging bending moment of 15kN-m. Compute the maximum tensile stress and maximum compressive stress along the section of the beam. Draw a sketch showing bending stress distribution. **(10 Marks)**

Module-5

9 a. Stating the assumptions, derive torsional equation. **(12 Marks)**

b. Explain maximum shearing stress theory. **(04 Marks)**

OR

10 a. List the Theory's of failure. **(04 Marks)**

b. A 60mm diameter solid brass shaft is to be replaced by a hollow steel shaft. The outer diameter of hollow shaft is equal to the diameter of solid brass shaft. Considering length, angle of twist and torque transmitted to be equal in both cases, calculate the inner diameter of hollow shaft. Modulus of rigidity of steel is twice that of brass. **(12 Marks)**

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