CBCS SCHEME

USN | | | | | | | | | | |

15CV/CT32

Third Semester B.E. Degree Examination, June/July 2023
Strength of Materials

Time: 3 hrs. Max. Marks: 80

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

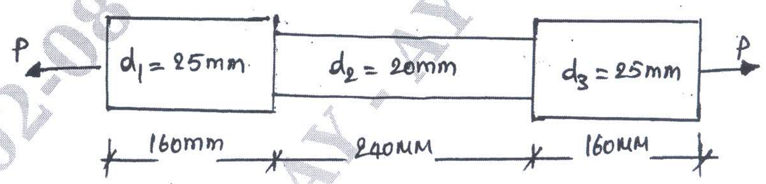
Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define : i) Bulk modulus ii) Rigidity modulus iii) Poisson's ratio. **(06 Marks)**

b. The bar shown in Fig. Q1(b) is tested in universal testing machine. It is observed that at a load of 40kN, the total extension of the bar is 0.285mm. Determine the Young's modulus of the material. **(10 Marks)**

Fig. Q1(b)



OR

2 a. Show that for Multiaxial loading , Volumetric strain is equal to the algebraic sum of the three linear strains in three mutually perpendicular directions. **(06 Marks)**

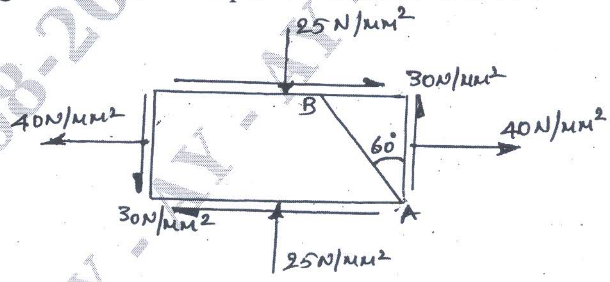
b. A steel rod 20mm in diameter and 6m long is connected to two grips at ends at a temperature of 120°C. Find the pull exerted when the temperature falls to 40°C.
i) If the ends do not yield ii) If the ends yielded by 1.1mm.
Take $\alpha = 1.2 \times 10^{-5}$ / °C and $E = 2 \times 10^5$ N/mm^2. **(10 Marks)**

Module-2

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

b. At a point in a piece of elastic material, there are three mutually perpendicular planes on which the stresses are as shown in Fig. Q3(b). Determine
i) Principal stresses and Principal planes.
ii) Normal and tangential stress on a plane AB inclined at 60°. **(12 Marks)**

Fig. Q3(b)



OR

4 a. Derive an expression for volumetric strain of a cylinder of internal diameter 'd' and thickness 't' subjected to an internal pressure of intensity 'p'. **(06 Marks)**

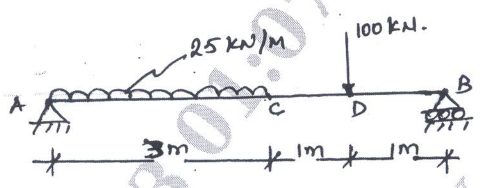
b. A cylindrical thin shell 800mm diameter and 3m long is 1mm thick has closed ends and is subjected to an internal fluid pressure of 2.8N/mm^2. If E = 210000N/mm^2 , Poisson's ratio = 0.3 , estimate the percentage inverse in internal volume of the tube. **(10 Marks)**

Module-3

5 a. Derive the relationship between the Intensity of load, Shear force and Bending moment. **(06 Marks)**

b. Draw Shear force and Bending moment diagram for the beam shown in Fig. Q5(b). **(10 Marks)**

Fig. Q5(b)

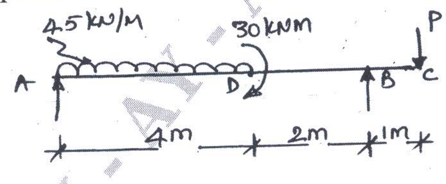


OR

6 a. Define i) Shear force ii) Bending moment iii) Point of Contra flexure. **(03 Marks)**

b. For the beam shown in Fig. Q6(b), determine the magnitude of the load 'P' acting at 'C' such that the reactions at the supports A and B are equal. Draw Shear force and bending moment diagrams. Also locate point of contra flexure if any. **(13 Marks)**

Fig. Q6(b)



Module-4

7 a. State the Assumptions in Bending theory. **(04 Marks)**

b. A rectangular beam 100mm × 150mm is simply supported over a span of 5m. Determine the safe udℓ on this span, if the bending stress is not to exceed 1000N/mm^2 and shear stress not to exceed 700N/mm^2. **(12 Marks)**

OR

8 a. Show that the maximum shear stress for a rectangular section is 1.5 times average shear stress. **(08 Marks)**

b. A mild steel tube 3.5m long, 25mm internal diameter and 5mm thick is used as a short column with i) Both ends hinged ii) Both ends fixed iii) One end fixed and other end free. Find the crippling load and the corresponding critical stress developed. Take $E = 2.1 \times 10^5$ N/mm^2. **(08 Marks)**

Module-5

9 a. Derive the torsion equation with usual notations. **(06 Marks)**

b. A hollow circular shaft with 250mm external diameter and thickness of metal 25mm transmits power at 180 r.p.m. The angle of twist over a length of 3m was found to be 0.72 degrees. Calculate the power transmitted and the maximum shear stress induced in the section. Take modulus of rigidity $C = 84 \times 10^9$ N/mm^2. **(10 Marks)**

OR

10 a. Explain : i) Maximum Principal Shear theory ii) Maximum Shearing Stress theory. **(06 Marks)**

b. A solid circular shaft is subjected to a bending moment of 9000Nm and a twisting moment of 12000Nm. In a simple uniaxial tensile test of the same material, it gave the following particulars : Stress at yield point = 3000N/mm^2, E = 200GN/mm^2. Estimate the diameter required using Maximum Principal Stress theory. **(10 Marks)**

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