CBCS SCHEME

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17CV32

Third Semester B.E. Degree Examination, July/August 2022
Strength of Materials

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Missing data, if any, may be suitably assumed.***

Module-1

1 a. Draw the stress strain curve for mild steel and explain its salient features. **(04 Marks)**

b. Obtain expression for extension of a tapering bar of length L and diameters D_1 and D_2 subjected to a tensile load P. **(08 Marks)**

c. A circular rod of diameter 20mm and 500mm long is subjected to tensile force 45kN. The modulus of elasticity for steel may be taken as 200kN/mm^2. Find stress, strain and elongation of the bar due to applied load. **(08 Marks)**

OR

2 a. Derive an expression between Young's modulus, modulus of rigidity and Poisson's ratio. **(10 Marks)**

b. A bar of 20mm diameter is tested in tension. It is observed that when a load of 37.7kN is applied. The extension measured over a gauge length of 200mm is 0.12mm and contraction in diameter is 0.0036mm. Find Poisson's ratio and elastic constants E, G, K. **(10 Marks)**

Module-2

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

b. Explain the brief procedure to construct Mohr's circle to determine Normal and tangential stresses on any plane. **(04 Marks)**

c. The direct stresses at a point in a strained material are 100N/mm^2 compressive and 60N/mm^2 tensile as shown in Fig Q3(c). Find the stresses on the plane AC.

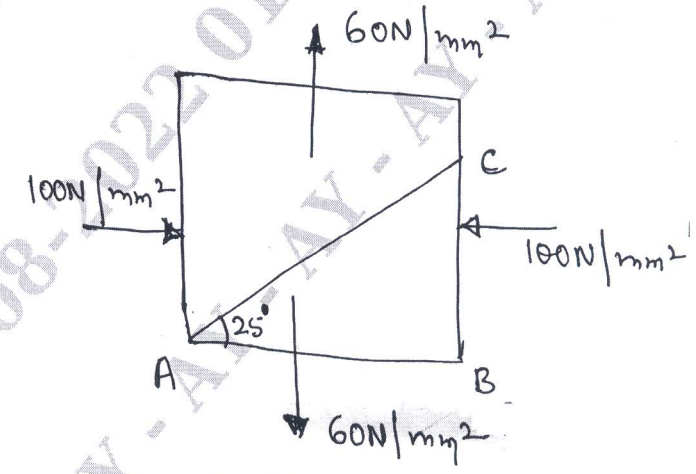

Fig Q3(c) **(12 Marks)**

OR

4 a. Derive an expression of circumferential stress and longitudinal stresses in thin cylinders. **(06 Marks)**

b. A pipe of 400mm internal diameter and 100mm thickness contains a fluid at a pressure 80N/mm^2. Find the maximum and minimum hoop stresses across the section. Also sketch the radial and hoop stress distribution across the section. **(14 Marks)**

Module-3

5 a. Define :
i) Bending moment ii) Shear force iii) Shear force diagram
iv) Bending moment diagrams. **(08 Marks)**

b. Draw the shear force and bending moment diagrams for the cantilever beam shown in Fig Q5(b).

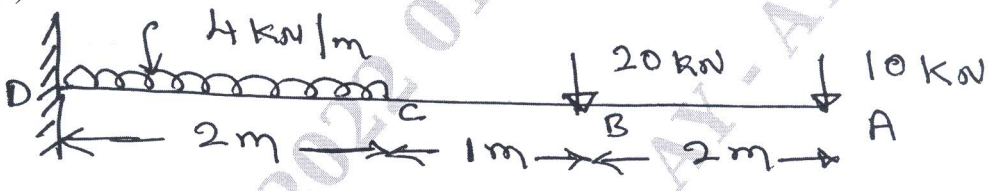

Fig Q5(b) **(12 Marks)**

OR

6 a. Derive the relation between load intensity, bending moment and shear force. **(06 Marks)**

b. Draw the shear force and bending moment diagram in Fig Q6(b) and mark salient points. Find the point of contra flexure and maximum bending moment.

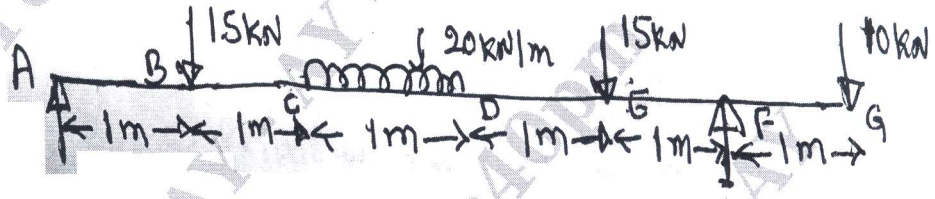

Fig Q6(b) **(14 Marks)**

Module-4

7 a. What are the assumptions in the theory of pure Torsion? **(04 Marks)**

b. Derive torsinal equation for circular shaft. **(06 Marks)**

c. Determine the diameter of solid shaft which will transmit 440kW at 280rpm. The angle of twist must not exceed one degree per meter length and maximum shear stress is $40N/mm^2$. Assume $G = 84kN/mm^2$. **(10 Marks)**

OR

8 a. Explain the following Theories
i) Rankines Theory
ii) Coulomb's theory
iii) St. Vansant's theory
iv) Beltrami and Haigh's theory. **(10 Marks)**

b. Determine the diameter of the bolt subjected to axial pull of 12kN and shear force of 6kN by using
i) Maximum principal stress theory
ii) Maximum strain theory
Take following data :
Elastic limit in tension = $300N/mm^2$
Factor of safety = 3
Poisson's ratio = 0.3 **(10 Marks)**

Module-5

9 a. What are the assumptions in simple bending theory? **(06 Marks)**

b. Define :

i) Section modulus

ii) Flextural rigidity **(04 Marks)**

c. A circular pipe of external diameter 70mm and thickness 8mm is used as a simply supported beam over an effective span 2.5m. Find the maximum concentrated load that can be applied at the centre of the span if the permissible stress in tube is $150N/mm^2$. **(10 Marks)**

OR

10 a. Derive an Euler crippling load when both ends of the column are pinned. **(08 Marks)**

b. Mention the expression for effective length of various end conditions of the column. **(04 Marks)**

c. A solid round bar 60mm diameter and 2.5 long is used as column. One end of the column is fixed, other end is pinned. Find the safe compressive load of the column. Using Euler's formula. Assume $E = 2 \times 10^5 N/mm^2$ and factor of safety as 3. **(08 Marks)**

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