CBCS SCHEME

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18MN34

Third Semester B.E. Degree Examination, July/August 2022
Mechanics 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. Explain the stress strain diagram for mild steel with salient features. **(10 Marks)**

b. The tensile test was conducted on a mild steel bar. The following data was obtained from the test. Diameter of the specimen = 16mm, gauge length of specimen = 80mm, Load at proportionality limit = 72kN. Extension under a load of 60kN = 0.115mm, Load at failure = 80kN, final gauge length of Bar 104mm, Diameter of the rod at failure = 12mm. Determine :
i) Young's modulus
ii) Proportionality Limit
iii) True breaking stress
iv) Percentage elongation. **(10 Marks)**

OR

2 a. Derive an expression for the total elongation of uniformly tapering rectangular bar when it is subjected to axial load P. **(10 Marks)**

b. A steel rod of cross sectional area 1600mm^2 and two brass rods each of cross sectional area of 1000mm^2 together support a load of 50kN as shown in Fig.Q2(b). Find the stresses in the rods, E for steel is 2×10^5N/mm^2, E for brass 1×10^5N/mm^2. Also find the load carried by each bar and shortening in length of each.

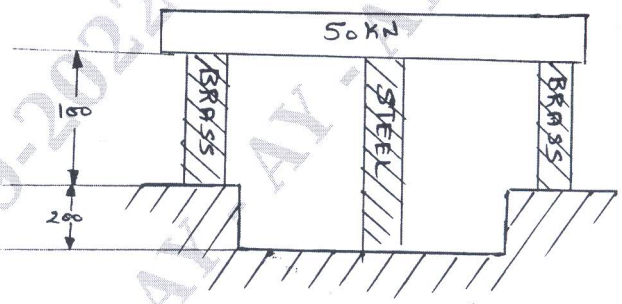

Fig.Q2(b) **(10 Marks)**

Module-2

3 a. Derive an expression for volumetric strain. **(10 Marks)**

b. Explain the following :
i) Shear stress
ii) Shear strain
iii) Lateral strain
iv) Poisson's ratio
v) Bulk modulus. **(10 Marks)**

OR

4 a. Derive an expression for circumferential stress induced in a thin cylindrical shell subjected to an internal pressure. **(08 Marks)**

b. A thin cylindrical shell 1m in diameter and 3m long has a metal thickness of 10mm. It is subjected to an internal fluid pressure of 3 MPa.

Determine :

i) Circumferential and longitudinal stress

ii) Circumferential, longitudinal and volumetric strain

iii) Change in length, diameter and volume. Also find the maximum shearing stress in the shell. Assume Poisson's ratio as 0.3 and E = 210GPa. **(12 Marks)**

Module-3

5 Draw the shear force diagram and bending moment diagram for the beam loaded as shown in Fig.Q5. Locate the point of contraflexure if any.

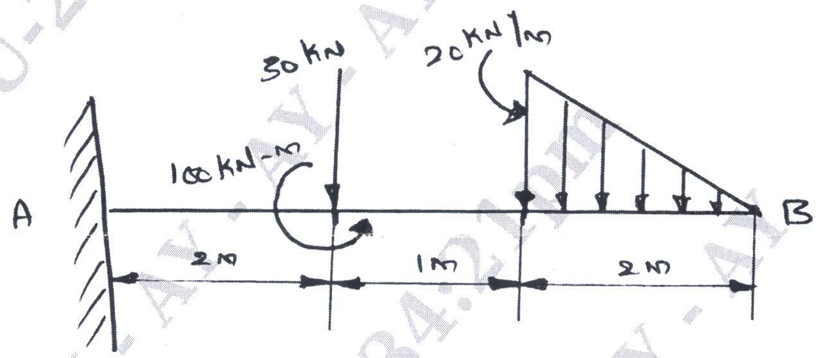

Fig.Q5 **(20 Marks)**

OR

6 Draw SFD and BMD for a simply supported beam shown in Fig.Q6.

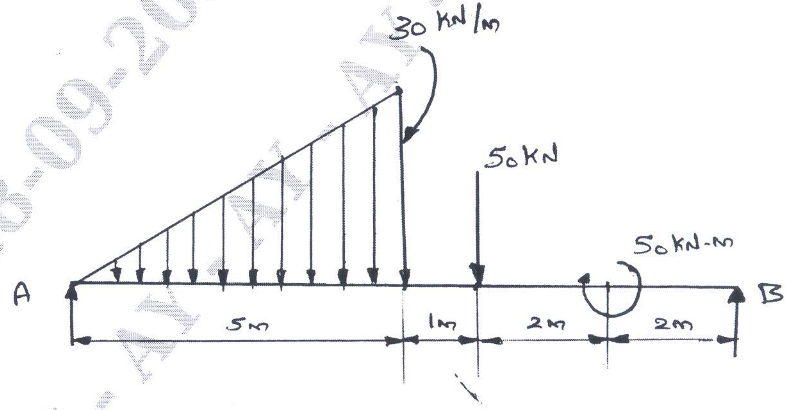

Fig.Q6 **(20 Marks)**

Module-4

7 a. Prove that $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ with usual notations. **(10 Marks)**

b. The T-section shown in Fig.Q7(b) is used as a simply supported beam over a span of 4m. It carries an uniformly distributed load of 8kN/m over its entire span. Calculate the maximum tensile and compressive stress occurring in the section.

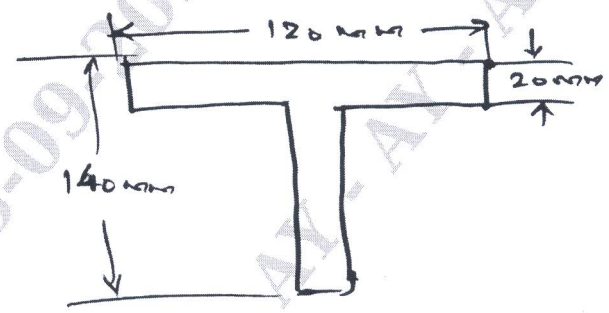

Fig.Q7(b) **(10 Marks)**

OR

8 a. Derive an expression relating slope, deflection and radius of curvature in a beam. **(10 Marks)**

b. State the assumptions made in moment curvature relationship. **(04 Marks)**

c. Explain MaCaulay's method. **(06 Marks)**

Module-5

9 a. State the assumptions made in the theory of Pure Torsion. **(06 Marks)**

b. Explain Torsional Rigidity and Torsional strength. **(04 Marks)**

c. Derive an expression showing the relation between torque and shear stress in a solid circular shaft. **(10 Marks)**

OR

10 a. State the assumptions made in Euler's column theory. **(08 Marks)**

b. Explain the following :

i) Slenderness ratio
ii) Radius of gyration
iii) Buckling
iv) Stability
v) Critical load
vi) Euler's column theory. **(12 Marks)**

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