CBCS SCHEME

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18ME32

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025
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. Define the following terms:
(i) Strain (ii) Young's modulus (iii) True stress
(iv) Poisson's ratio (v) Factor of safety **(05 Marks)**

b. Determine the stress in each section of bar shown in Fig.Q1(b) when subjected to an axial load of 20 KN. The central section is of square cross-section. Other portions are of circular cross-section. What will be the total extension of bar? Take E = 210 GPa.

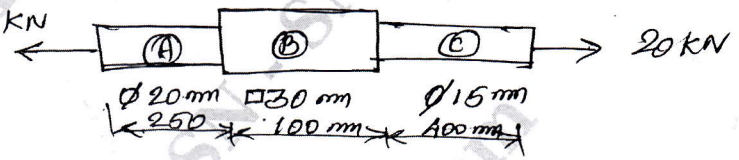

Fig.Q1(b) **(15 Marks)**

OR

2 a. Derive an expression for extension of tapered circular bar. **(08 Marks)**

b. Derive the relation between Young's modulus , Rigidity modulus and Bulk modulus E, G, K. **(12 Marks)**

Module-2

3 a. A rectangular bar of cross sectional area of 11000 mm^2 is subjected to tensile load P as shown in Fig.Q3(a). The permissible normal and shear stress on the oblique plane BC are given as 7 N/mm^2 and 3.5 N/mm^2 respectively. Determine the safe value of P.

Fig.Q3(a) **(12 Marks)**

b. Explain the procedure for constructing Mohr circle for an element acted upon by two tensile stress and shear stresses. **(08 Marks)**

OR

4 a. Derive the expressions for circumferential stress and longitudinal stress in thin cylinder subjected to an axial internal pressure. **(08 Marks)**

b. A thin cylinder 60 mm internal diameter 225 mm long with wall thickness 2.7 mm subjected to an internal pressure of 6 MN/mm^2, Take E = 200 GPa, $\gamma = 0.3$. Calculate (i) Hoop stress (ii) Longitudinal stress (iii) Change in length (iv) Change in diameter. **(12 Marks)**

Module-3

5 a. What are the different types of beams? Explain briefly. **(10 Marks)**

b. Draw SFD and BMD for a simply supported beam of length L carrying a concentrated load w at mid span. **(10 Marks)**

OR

6 a. Prove the relation $\frac{M}{I} = \frac{\sigma}{Y} = \frac{E}{R}$, with usual notations. **(12 Marks)**

b. A beam of an I-section 200 mm × 300 mm has web thickness 10 mm and flange thickness 10 mm. It carries a shearing force of 10 kN at a section. Sketch the shear stress distribution across the section. **(08 Marks)**

Module-4

7 a. Explain the factor of safety.
Write short note on : (i) Maximum shear stress theory (ii) Normal stress theory **(10 Marks)**

b. Derive the torsion equation with usual notation and state the assumptions made in derivations. **(10 Marks)**

OR

8 a. Find the diameter of shaft required to transmit 60 KW at 150 rpm. If maximum exceeds 25% of mean torque for a maximum permissible shear stress of 60 MN/m^2. Find the angle of twist for length of 4 m. Take G = 80 GPa. **(10 Marks)**

b. Prove that Hollow shaft is stronger than solid shaft **(10 Marks)**

Module-5

9 a. Derive an expression for central load in a column with both ends hinged and mention the assumption made. **(10 Marks)**

b. A solid round for 3 m long and 5 cm in diameter is used as a strut with both end hinged. Determine the crippling load. Take $E = 2\times10^5$ N/mm^2. **(10 Marks)**

OR

10 a. Derive the expression for central load in a column with both ends fixed. **(10 Marks)**

b. Write short notes on :
(i) Strain energy
(ii) Castigliano theorem **(10 Marks)**

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