CBCS SCHEME

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18MR34

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Derive an expression for the extension of uniformly tapering circular bar subjected to axial load. **(10 Marks)**

b. A stepped bar made up of steel and brass is subjected to a pull of 25kN as shown in Fig.Q1(b). Determine the deformation of each material and stress in each material. Take, E_S = 200GPa, E_B = 100GPa. Thickness = 20cm. **(10 Marks)**

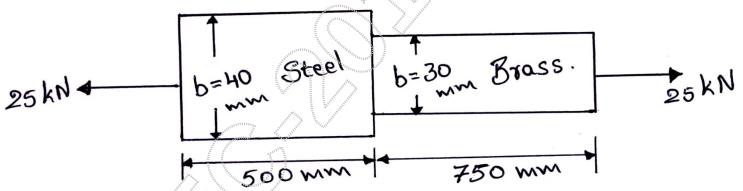

Fig.Q1(b)

OR

2 a. Derive the volumetric strain of a cylinder bar subjected t o an axial load (P). **(10 Marks)**

b. A steel rod of cross sectional are 1600mm^2 and two brass rods each of cross sectional area of 1000mm^2 together support a load of 50kN as shown in Fig.Q.2(b). Find the stresses in the rod E for steel = 2×10^5 N/mm^2, E for brass = 1×10^5N/mm^2 **(10 Marks)**

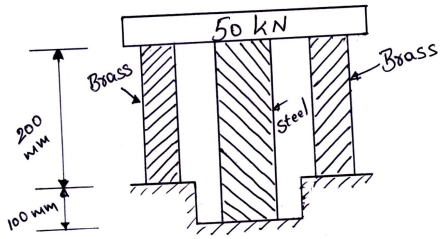

Fig.Q.2(b)

Module-2

3 a. Explain the construction procedure of Mohr's circle. **(10 Marks)**

b. A plane element is subjected to a stresses as shown in Fig.Q.3(b). Determine principal stresses, maximum shear stress and their planes. Sketch the planes determined. **(10 Marks)**

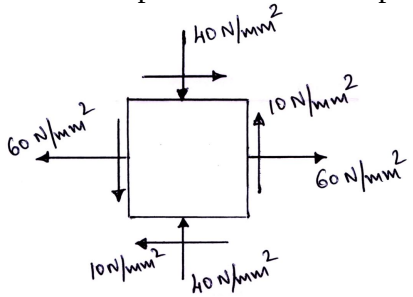

Fig.Q.3(b)

OR

4 a. Derive the expressions for longitudinal stress and circumferential stress for thin cylinder. **(10 Marks)**

b. A pipe of 400mm internal diameter and 100mm thickness contains a fluid at a pressure of 80N/mm^2. Find the maximum and minimum hoop stress across the section. Also, sketch the radial pressure distribution and hoop stress distribution across the section. **(10 Marks)**

Module-3

5 a. Explain with sketches, different types of Beams and different types of load acting on a beam. **(10 Marks)**

b. A simply supported beam AB of span 8 meters carrying concentrated loads of 4kN, 10kN and 7kN at distances of 1.5m, 4m and 6m from the left support. Draw the SFD and BMD for the Fig.Q.5(b) **(10 Marks)**

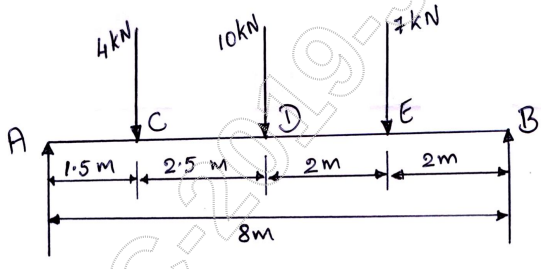

Fig.Q.5(b)

OR

6 a. Derive the relation between load, shear force and bending moment of a beam carrying udl of 'w' per meter length. **(08 Marks)**

b. A simply supported beam of length 10m, carries the uniformly distributed load and two point loads as shown in Fig.Q.6(b). Draw SFD and BMD for the beam. Also calculate the maximum BM. **(12 Marks)**

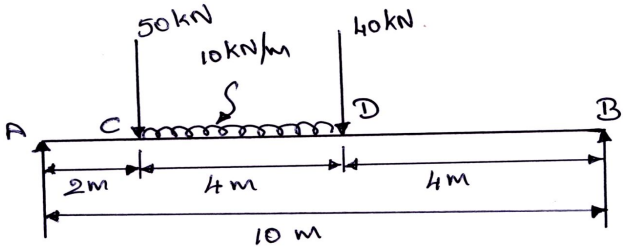

Fig.Q.6(b)

Module-4

7 a. Write the assumptions in simple bending and derive the relationship between bending stress and radius of curvature. **(10 Marks)**

b. A square beam 20mm × 20mm in section and 2m long is supported at the ends. The beam fails when a point load of 400N is applied at the centre of the beam. What uniformly distributed load per metre length will break a cantilever of the same material 40mm wide, 60mm deep and 3m long? **(10 Marks)**

OR

8 a. Derive an expression for shear stress distribution across a rectangular section. **(10 Marks)**

b. Draw shear stress distribution for an I-shaped section of a beam as shown in Fig.Q.8(b). The shear force on this section is 200kN. **(10 Marks)**

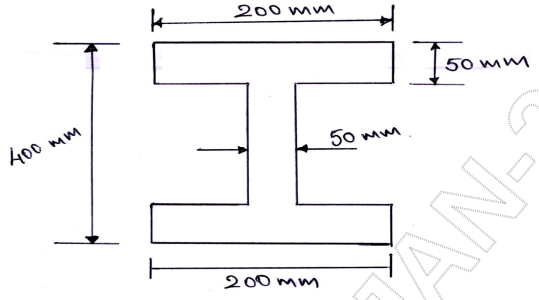

Fig.Q.8(b)

Module-5

9 a. State the assumptions made in pure torsion and derive the torsional equations for solid shaft. **(10 Marks)**

b. A solid shaft rotating at 500rpm transmits 30kW. Maximum torque is 20% more than mean torque. Allowable shear stress 65MPa and modulus of rigidity 81GPa, angle of twist in the shaft should not exceed 1° in 1 meter length. Determine suitable diameter. **(10 Marks)**

OR

10 a. Derive the Euler's crippling load for a column when one end fixed and the other end Hinged. **(10 Marks)**

b. A column of timber section 15cm × 12cm is 6m long both ends being fixed. If the Young's modulus for timber = 17.5kN/mm^2. Determine: i) Cripling load ii) Safe load for the column if factor of safety = 3. **(10 Marks)**

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