CBCS SCHEME

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17MR34

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.

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) Elasticity
ii) Plasticity
iii) Ductility
iv) Malleability
v) Factor of safety. **(05 Marks)**

b. Derive the expression of change in length for uniformly tapering circular bar. **(10 Marks)**

c. Calculate the nature and magnitude of stress induce in the rod of 2m long and 20mm diameter, when its temperature rises by 70°C, with both ends constrained. Take $E = 1 \times 10^5$ N/mm^2 and $\alpha = 1.2 \times 10^{-5}$/°C. **(05 Marks)**

OR

2 a. Determine the load P_4 and stresses in various segments of the circular bar shown in Fig.Q.2(a). Compute the total elongation taking E = 195GPa. **(10 Marks)**

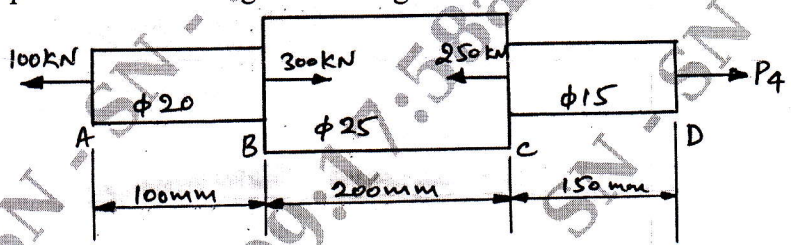

Fig.Q.2(a)

b. Establish the relation between modulus of elasticity and modulus of rigidity. **(10 Marks)**

Module-2

3 a. Find the expressions of normal stress and tangential stress for member subjected to direct stresses on two mutually perpendicular directions. **(10 Marks)**

b. A point in a strained material is subjected to a tensile stress of 120N/mm^2 and a compressive stress of 80N/mm^2 acting at right angles to each other. Find the normal stress, tangential stress, resultant stress and its obliquity on a plane inclined at angle of 30° with the axis of compressive stress. Also find the maximum shear stress. **(10 Marks)**

OR

4 a. Derive the expressions for circumferential stress and longitudinal stress in thin cylinder. **(08 Marks)**

b. Derive the Lame's equations for thick cylinder. **(12 Marks)**

Module-3

5 a. Explain the terms:
   i) Sagging bending moment
   ii) Hogging bending moment
   iii) Point of contra flexure **(06 Marks)**

b. Draw SFD and BMD for the beam shown in Fig.Q5(b). Locate the point of contra flexure if any. **(14 Marks)**

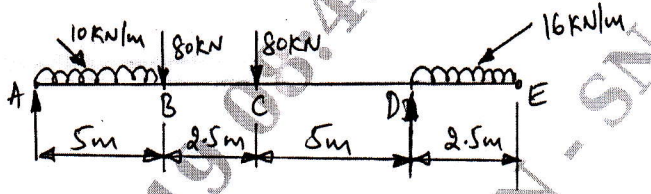

Fig.Q.5(b)

OR

6 a. What are the different types of beams and loads? Explain with neat sketches. **(12 Marks)**

b. Draw shear force and bending moment diagrams for a simply supported beam with a point load at mid-point. **(08 Marks)**

Module-4

7 a. Derive the bending equation. **(10 Marks)**

b. A simply supported beam of 'I' section carries a uniformly distributed load of 40kN/m run on entire span of beam of length 10m. If 'I' section is having dimensions of flange 200mm × 20mm and wed of 360mm × 10mm determine the maximum stress produced due to bending. Draw stress distribution. **(10 Marks)**

OR

8 a. Prove that in a rectangular cross-section, maximum shear stress at the neutral surface is 1.5 times the average shear stress. **(10 Marks)**

b. A beam of a T section has flanges 100mm × 20mm and web 200mm × 12mm is subjected to a vertical shear force of 200kN. Find the shear stress at the flange, junction and neutral axis. Sketch the stress distribution. **(10 Marks)**

Module-5

9 a. Derive the torsion equation. What are the assumptions made in torsion equation? **(12 Marks)**

b. Determine the diameter of the solid steel shaft which will transmit 90kW at 160rpm. Also, determine the length of shaft if the twist must not exceed 1° over the entire span. The maximum shear stress is limited to 60N/mm^2. Take the value of modulus of rigidity as 8×10^4 N/mm^2. **(08 Marks)**

OR

10 a. Derive the expression for Euler's crippling load for a column when both ends are fixed. **(12 Marks)**

b. A column of timber section is 200mm × 300mm and 5m long. One end of the column is fixed and the end is free. If E = 17.5 kN/mm^2. Determine: i) Crippling load ii) Safe load if FOS is 2.5. **(08 Marks)**

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