CBCS Scheme

USN

15AU34

Third Semester B.E. Degree Examination, June/July 2017

Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define : i) Stress ii) Strain iii) Modulus of elasticity iv) Poisson's ratio. **(08 Marks)**

b. The stepped bar shown in Fig Q1(b) is subjected to a pull of 25 kN. The bar is made up of two different materials having Young's Modulus E_1 200GPa and E_2 100GPa. Find the extension of the bar and stresses in each materials. **(08 Marks)**

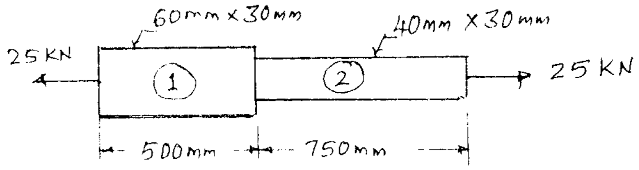

Fig Q1(b)

OR

2 a. 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 ration and elastic constants E, G and K. **(08 Marks)**

b. A compound bar of a circular rod of steel of diameter 20mm rigidly fitted into a copper tube of internal diameter 20mm and thickness 5mm. If the bar is subjected to a load of 100kN, determine the stresses developed in the two materials.
Take : E_s 2×10^5 N/mm², E_c 1.2×10^5 N/mm². **(08 Marks)**

Module-2

3 a. Define : i) Principal plane ii) Principal stress
iii) Plane of maximum shear iv) Maximum shear stress. **(06 Marks)**

b. The state of stress in a two dimensionally stressed body is shown in Fig Q3(b). Determine :
i) Principal stresses and its planes ii) Maximum shear stress and its planes. **(10 Marks)**

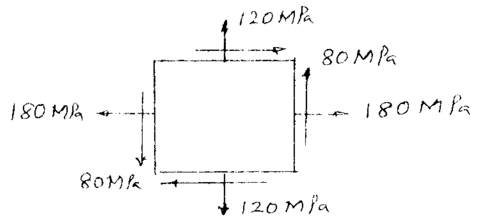

Fig Q3(b)

OR

4 a. Show that the circumferential stress is twice that of longitudinal stress for thin cylinder. **(08 Marks)**

b. A thick cylindrical pipe outside diameter of 300mm and inside diameter of 200mm is subjected to an internal fluid pressure of 14N/mm². Determine the maximum hoop stress developed. Also sketch the radial and hoop stress distribution across the section. **(08 Marks)**

Module-3

5 Draw SFD and BMD for the overhang beam shown in Fig Q5. Indicate all significant values including point of contraflexure, if any. **(16 Marks)**

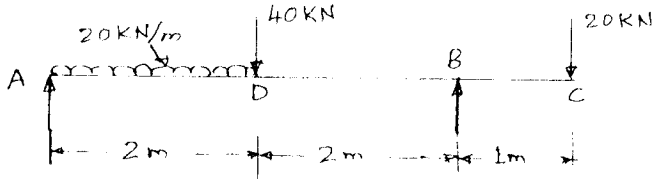

Fig Q5

OR

6 a. Write bending equation and explain each notation with units. Also list the assumptions made theory of simple bending. **(08 Marks)**

b. A un form beam of I-section is 100mm wide and 200mm deep with a flange thickness of 10mm and web thickness of 5mm. The beam is simply supported over a span of 10m. It carries an udl and 10kN/m throughout its length. Determine and sketch the variation of bending stress distribution across the section **(08 Marks)**

Module-4

7 a. Derive the Torsion equation with usual notations. **(08 Marks)**

b. A solid shaft transmits 100kW at 150rpm. Determine the suitable diameter of the shaft if the maximum torque transmitted exceeds the mean by 20% in each revolution. The shear stress is not to exceed 60MPa. Also find the maximum angle of twist in a length of 4m of the shaft. Take G = 80GPa. **(08 Marks)**

OR

8 a. Derive the expression for Euler's critical load for a column with both ends are fixed. **(08 Marks)**

b. A hollow cast iron column whose outside diameter is 200mm and inside diameter is 160mm is 4.5 m long and is fixed at both ends. Find the ratio of Euler's to Rankine's critical loads. Take: E = 1×10^5 N/mm^2, Rankine's constant a = 1/1600 and σ_c = 550N/mm^2. **(08 Marks)**

Module-5

9 a. Define strain energy and modulus of resilience. **(04 Marks)**

b. State Castigliano's theorem I and II. **(04 Marks)**

c. Determine the strain energy stored in the stepped bar with circular cross section shown in Fig Q9(c) subjected to a load of 10kN. Take : E = 210 GPa **(08 Marks)**

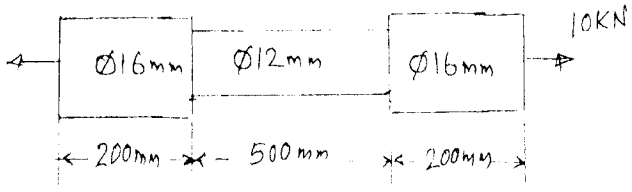

Fig Q9(c)

OR

10 a. Determine the strain energy and hence the deflection at the free end of a cantilever beam of length L carrying a point load W at its free end. **(08 Marks)**

b. Explain : i) Maximum principal stress theory ii) Maximum shear stress theory. **(08 Marks)**

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