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10ME/AU34

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

Mechanics of Materials

Time: 3 hrs.

Max. Marks: 100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART - A

- 1 a. List and explain the mechanical properties of engineering materials. (10 Marks)
- b. A round stepped bar is subjected to an axial force of 30 kN. Diameter and length of first portion are 40 mm and 200 mm respectively and those of second portion are 20 mm and 100 mm respectively. Determine change in deformation when a uniform bar with same volume and length as that of stepped bar is subjected to 30 kN. Take $E = 200 \text{ GPa}$. (10 Marks)
- 2 a. Show the relation between Young's modulus and modulus of rigidity. (10 Marks)
- b. A compound bar consisting of steel, Bronze and aluminium bars connected in series is held between two supports as shown in Fig.Q2(b). When the temperature of the compound bar is increased by 50°C , determine the stresses induced in each bar. Consider the two cases: i) Rigid supports and ii) Supports yield by 0.5 mm. Take $\alpha_s = 12 \times 10^{-6}/^\circ\text{C}$, $\alpha_B = 19 \times 10^{-6}/^\circ\text{C}$, $\alpha_{AL} = 22 \times 10^{-6}/^\circ\text{C}$, $E_s = 200 \text{ GPa}$, $E_B = 83 \text{ GPa}$ and $E_{AL} = 70 \text{ GPa}$.

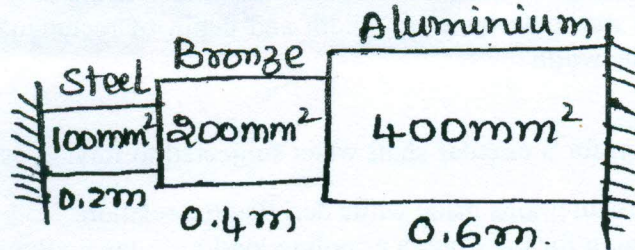


Fig.Q2(b)

(10 Marks)

- 3 a. Explain : i) Principal planes and principal stresses and ii) Maximum and minimum shear stresses with respect to compound stress. (06 Marks)
- b. Describe the construction of Mohr's circle for plane stress. (06 Marks)
- c. A point in a beam is subjected to maximum tensile stress 110 MPa and shear stress 30 MPa. Find the magnitudes and directions of principal stresses. If the point in the beam is in the compression zone under the same magnitude of bending stress and shear stress. Find the magnitudes of principal stresses and their directions. (08 Marks)
- 4 a. Explain the concept of circumferential stress and longitudinal stress corresponding to thin cylinders. (10 Marks)
- b. A cylindrical pressure vessel of 1 meter inner diameter and 1.5 meters long is subjected to an internal pressure P , thickness of the cylinder wall is 15 mm. Taking allowable stress for cylinder material as 90 MPa. Determine: i) Magnitude of maximum internal pressure P that the pressure vessel can with stand and ii) Change in dimensions. Take $E = 200 \text{ GPa}$ and $\gamma = 0.3$. (10 Marks)

