CBCS Scheme

USN | | | | | | | | | | 15MR34

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
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 Hooke's law and draw stress – strain diagram for ductile material indicating the characteristic points. **(04 Marks)**

b. A stepped bar is subjected to forces as shown Determine the force P, such that the net deformation in the bar is 1.2mm. Tapering bar has diameters of 40mm and 20mm. Modulus of elasticity for steel is 200 GPa and aluminium is 70 GPa. Determine elongation of middle part of steeped bar. **(12 Marks)**

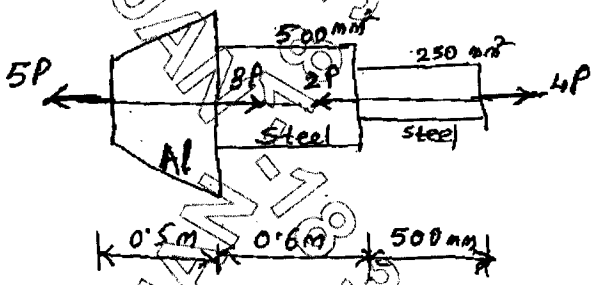

Fig.Q1(b)

OR

2 a. Define volumetric strain and thermal strain. Derive relation for bulk modulus and the modulus of elasticity. **(08 Marks)**

b. For a steel bar, determine the maximum temperature rise which will not produce stress in the bar. Find the stress induced in the bar when the temperature rise is 75°C. Assume $E_S = 200GPa$ $\alpha_S = 12 \times 10^{-6}/°C$. **(08 Marks)**

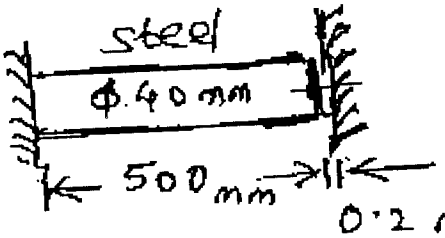

Fig.Q2(b)

Module-2

3 a. Derive an expression for the normal stress and shear stress on a plane inclined at angle 'θ' to the vertical in a biaxial stress system. **(08 Marks)**

b. Explain the construction of Mohr's circle and also represent principal stresses and normal and shear stresses. **(08 Marks)**

OR

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

b. A pipe of 400mm internal diameter and thickness 100mm contains a fluid at a pressure of 80MPa. Sketch the radial and hoop stress distribution across the section. **(08 Marks)**

Module-3

5 a. Derive expression for load, shear force and bending moment. Sketch different types of beams with various loads. **(08 Marks)**

b. A simply supported beam of span 6m is subjected to a point load of 20 kN acting at a distance of 2m from the left end. Uniformly distributed load of 10kN/m is acting on entire length of the beam. Draw SFD and BMD. **(08 Marks)**

OR

6 a. Derive relation for shear force and bending moment for a cantilever beam subjected to uniformly distributed load (W kN/m) over complete span. **(06 Marks)**

b. Draw SFD and BMD for the given beam and find the points of contra-flexure. **(10 Marks)**

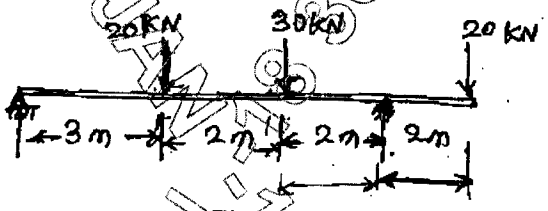

Fig Q6(b)

Module-4

7 a. Write the assumptions in simple bending and derive relation for bending equation. **(08 Marks)**

b. A beam of I–section, has following dimensions width = 100mm; depth = 150mm with the flange thickness of 25mm and web thickness of 10mm. The beam is simply supported over a span of 5 meters and carries uniformly distributed load of 85 kN/m over complete length. Determine the bending stress in the beam. **(08 Marks)**

OR

8 a. Derive an expression for deflection of beam, with usual notations. **(08 Marks)**

b. A simply supported beam fo 6m span is subjected to a point load of 18 kN at 4m from left. Determine position and maximum deflection using Macaulay's method. Take E = 200GPa $I = 15 \times 10^6 mm^4$. **(08 Marks)**

Module-5

9 a. Derive torsion equation for solid shaft. **(08 Marks)**

b. A solid shaft transmits 100KW at 150rpm. Determine the diameter of shaft, if the shear stress in the shaft material is not to exceed 60Mpa. And also find angle of twist, if shaft length is 4m. Assume G = 80GPa. **(08 Marks)**

OR

10 a. State assumptions for long columns and derive relation for buckling load with both ends of column are hinged. **(08 Marks)**

b. A column of 60mm diameter and 2.5m long is fixed at both ends. Determine the safe compressive load. Assume $E = 2 \times 10^5 N/mm^2$, factor of safety = 3. **(08 Marks)**

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