CBCS SCHEME

USN | | | | | | | | | | |

17AU34

Third Semester B.E. Degree Examination, Aug./Sept.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. Explain Stress – Strain diagrams for ductile and brittle materials. **(08 Marks)**

b. A stepped bar shown in fig. Q1(b) is subjected to forces. Determine i) Stress induced in each portion and ii) Net Deformation. Take E = 200GPa. **(12 Marks)**

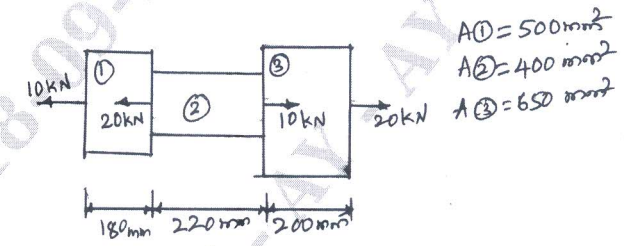


Fig.Q1(b)

OR

2 a. Define i) Modulus of rigidity ii) Bulk modulus iii) Volumetric strain iv) Poisson's ratio v) Co-efficient of thermal expansion. **(10 Marks)**

b. A block of size 200mm × 80mm × 20mm is subjected to the forces as shown in fig, Q2(b). Determine i) Change in dimensions ii) Change in volume. Take E = 200GPa and μ = 0.3. **(10 Marks)**

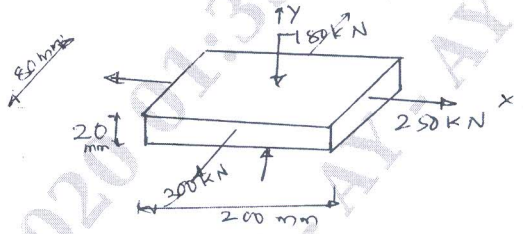


Fig.Q2(b)

Module-2

3 a. A point in a member is subjected to stresses as shown in fig. Q3(a). Determine
i) Stresses on a plane whose normal is at angle 40^0 with reference to horizontal axis.
ii) Principle stresses iii) Maximum and minimum shear stresses with their directions. **(12 Marks)**

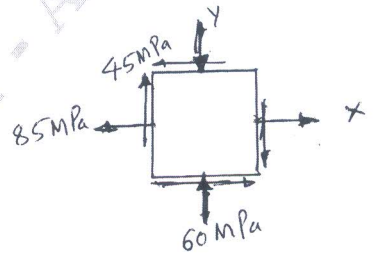


Fig.Q3(a)

b. Derive expression for circumferential and longitudinal stress of thin cylinder. **(08 Marks)**

OR

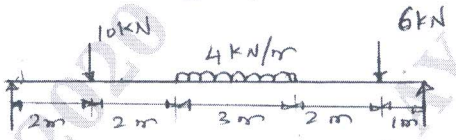
4 a. A thick cylinder of outer diameter 300mm and internal diameter 200mm is subjected to an internal fluid pressure of $14N/mm^2$. Determine the maximum hoop stress developed in the cross section. Sketch the variation of hoop stress across the thickness of cylinders. **(12 Marks)**

b. Derive an expression for normal stress and shear stress on an oblique plane inclined at an angle θ with vertical axis for a two dimensional stress system. **(08 Marks)**

Module-3

5 a. Draw SFD and BMD for the beam shown in fig. Q5(a). **(10 Marks)**

Fig.Q5(a)



b. Derive equation of bending. **(10 Marks)**

OR

6 a. Draw SFD and BMD for the following cases :
i) Cantilever beam with point load of free end ii) Cantilever beam with UDL
iii) Cantilever beam with UVL. **(06 Marks)**

b. Explain different types of loads and beams. **(06 Marks)**

c. A rectangular beam of width 60mm and depth 120mm is subjected to a bending moment of 12KN-m. Determine the stress induced along X and Y axis. **(08 Marks)**

Module-4

7 a. Derive equation of torsion. **(10 Marks)**

b. A 1.5m long column with circular section of 30mm diameter has its both ends hinged. Discuss regarding the stability of column when it is subjected to the axial loads :
i) W = 15kN ii) W = 35kN iii) W = 40kN. Take E = 200 GPa. **(10 Marks)**

OR

8 a. Give the relation between effective length and actual length of column for different boundary conditions. **(05 Marks)**

b. A solid shaft rotating at 500 rpm transmits 30KW. Maximum torque is 20% more than mean torque. Angle of twist should not exceed 10 per meter length. Take τ = 65 MPa and G = 81GPa. **(15 Marks)**

Module-5

9 a. Explain Maximum Principal Stress theory and Maximum Shear Stress theory. **(10 Marks)**

b. Derive an expression for strain energy of bar under its own weight. **(06 Marks)**

c. Define i) Strain energy ii) Resilience iii) Proof – Resilience
iv) Modulus of toughness. **(04 Marks)**

OR

10 a. Explain Castigliano's theorem I and II. **(10 Marks)**

b. A bolt is subjected to an axial pull of 12kN together with transverse shear force of 6kN. Determine diameter of the bolt by using
i) Maximum Principal Stress theory.
ii) Maximum Shear Stress theory.
Take Elastic limit in tension = 300 MPa , Factor of safety = 3. **(10 Marks)**

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