CBCS SCHEME

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17MN34

Third Semester B.E. Degree Examination, Feb./Mar. 2022
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. Define : i) Stress ii) Strain iii) Young's modulus iv) Hooke's Law. **(08 Marks)**

b. Derive an expression for deformation of tapering bar (Circular cross section) **(12 Marks)**

OR

2 a. Explain the principle of superposition. **(06 Marks)**

b. Different portions of a stepped bar are subjected to the force as shown in Fig Q2(b). Determine: i) Stress induced in each portion ii) Net deformation in the bar. Take E = 200GPa

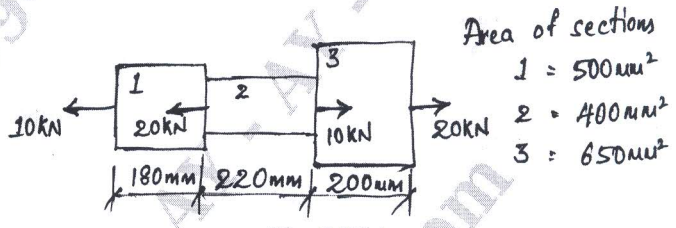

Fig Q2(b) **(14 Marks)**

Module-2

3 a. Define Thick and Thin cylinder. Also derive an expression for circumferential stress in thin cylinder. **(10 Marks)**

b. A thin cylindrical shell of 0.6meters diameter and 0.9 meters long is subjected to internal pressure 1.2 N/mm^2. Thickness of cylinder wall is 15mm. Determine: i) Longitudinal stress ii) Circumferential stress iii) Maximum shear stress induced. Take E = 200GPA. **(10 Marks)**

OR

4 a. Define : i) Principle stresses ii) Principal plane iii) Maximum and Minimum shear stress. **(06 Marks)**

b. A point in a body is subjected to tensile stresses 100MPa and 70MPa along two mutually perpendicular direction. The points is also subjected to shear stress of magnitude 50MPa. Determine :

i) Normal stress and shear stress acting on a plane which is at an angle of 120° with reference to 100MPa stress plane.

ii) Maximum and minimum shear stress

iii) Normal stress on the Planes of maximum and minimum shear stresses.

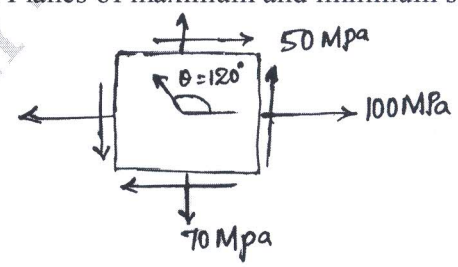

Fig Q4(b) **(14 Marks)**

Module-3

5 a. Explain the types of beams. **(06 Marks)**

b. Draw the shear force diagram and Bending moment diagram for the Fig Q5(b)

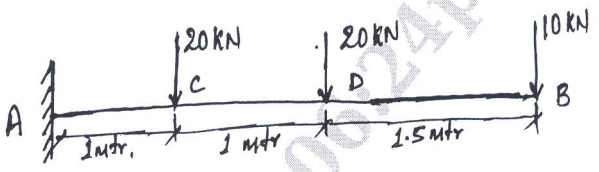

Fig Q5(b) **(14 Marks)**

OR

6 A girder 6 meter long rests on two supports with equal overhangs on either sides and carries a uniformly distributed load of 30kN per meter run over the entire length. Calculate the overhangs if the maximum bending moment positive or negative is to be as small as possible. Draw SF and BM diagrams for double overhang beam.

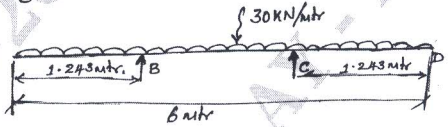

Fig Q6 **(20 Marks)**

Module-4

7 a. Explain the theory of simple bending list the assumption in simple theory of bending. **(10 Marks)**

b. Write the relationship between the Bending Moment and radius of Curvature. **(10 Marks)**

OR

8 a. A beam supports a maximum bending moment of magnitude 10kN-m. Determine the maximum flexural stress induced in the beam by considering.

i) Rectangular section (100mm × 200mm)

ii) Circulate section of equal area

Take $E = 200GN/m^2$. **(10 Marks)**

b. A cantilever is subjected to the forces as shown in Fig Q8(b). Determine the deflection at the free end. Taking E = 210GPa and $I = 20 \times 10^{-4} m^4$.

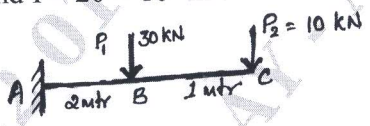

Fig Q8(b) **(10 Marks)**

Module-5

9 a. Derive an expression $\frac{T}{J_P} = \frac{G\theta}{L} = \frac{\tau}{R}$. **(12 Marks)**

b. A 150mm long and 25mm diameter steel bar undergoes a deformation of 0.046mm when subjected to a tensile test under a load of 30kN. The same specimen undergoes an angular twist of 1° when subjected to torque of 357 N-mtr. Determine: i) Young's modulus ii) Modulus of rigidity. **(08 Marks)**

OR

10 a. List the assumption made while deriving the buckling load formula. **(06 Marks)**

b. A 2meter long column has a square cross section of side 40mm. Taking the factor of safety as 4. Determine the safe load for the end conditions.

i) Both ends are hinged ii) One end is fixed and other end free iii) Both ends fixed.

Take E = 210GPa. **(14 Marks)**

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