CBCS SCHEME

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18MT33

Third Semester B.E. Degree Examination, July/August 2021
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Define the following : i) Stress ii) Modulus of Rigidity iii) Bulk modulus iv) Proof stress. **(04 Marks)**

b. Explain the stress strain curve of mild steel. **(04 Marks)**

c. Different portions of stepped bar are subjected to forces as shown in Fig Q1(c). Determine:
   i) Stress induced in each portion
   ii) Net deformation in bar. Take E = 200GPa.

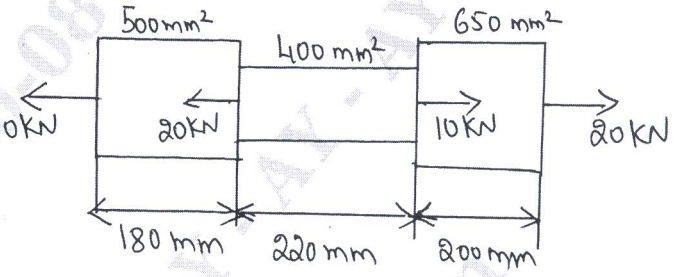

Fig Q1(c) **(12 Marks)**

2 a. Derive the Expression for analysis of deformation of uniformly tapering circular bar. **(08 Marks)**

b. Derive the Relation between modulus of Elasticity and modulus of Rigidity. **(08 Marks)**

c. A material has Young's modulus E = 200GPa and Poisson's ration γ = 0.3. Determine modulus of rigidity G and Bulk modulus K. **(04 Marks)**

3 a. Determine the expression for normal and tangential stress in a General 2D-stress system. **(10 Marks)**

b. The state of stress at a point in a strained material is shown in Fig. Q3(b). Determine the principle stresses, principle planes, Maximum shear stress and shear planes.

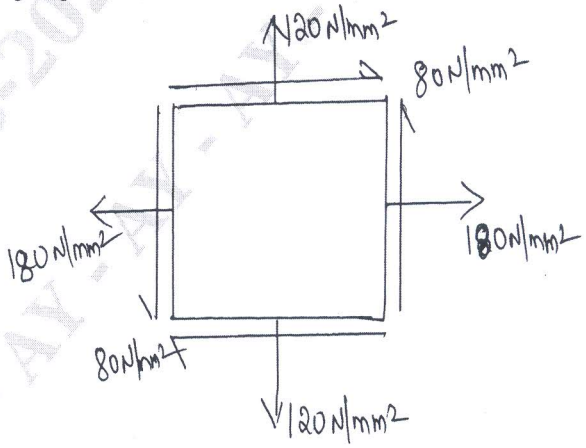

Fig. Q3(b) **(10 Marks)**

4 a. Define :
   i) Principle stresses
   ii) Principle planes. **(04 Marks)**

b. An element with the stresses acting on it is as shown in Fig Q4(b), Using the Mohr's circle method, determine : i) Principal stresses and orientation of their planes ii) Maximum and minimum shear stresses and orientation of their planes.

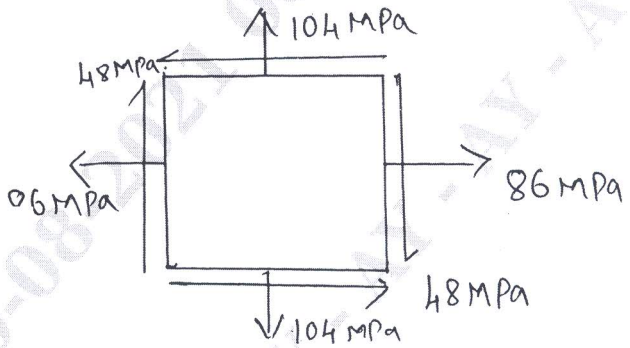

Fig Q4(b)

(16 Marks)

5 a. Define Beam, Explain the types of Beams. **(06 Marks)**

b. Draw the shear force and Bending moment diagram for the simply supported Beam subjected to the loads as shown in Fig Q5(b), also find the location of point of contraflexure.

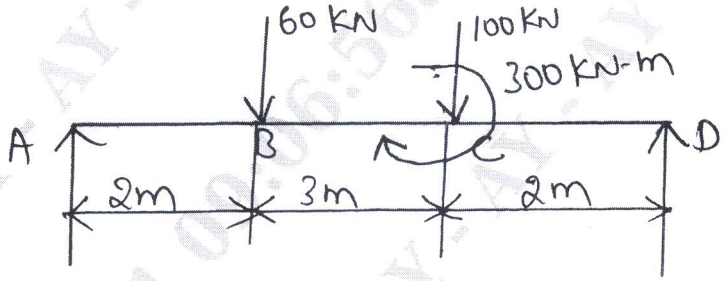

Fig Q5(b) **(14 Marks)**

6 a. Derive the Relationship between Load, shear force and bending moment. **(06 Marks)**

b. Draw shear force and bending moment diagram for a beam shown in the Fig Q6(b). Locate point of inflexion if any

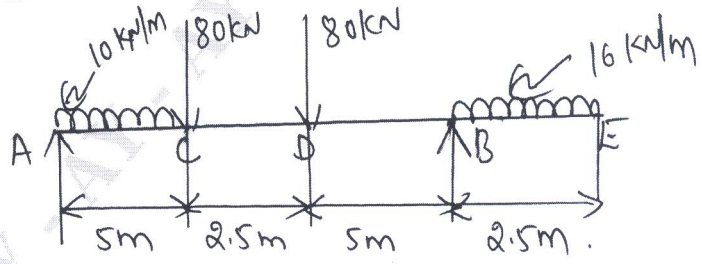

Fig Q6(b) **(14 Marks)**

7 a. With assumption derive bending movement equation $\frac{M}{I} = \frac{\sigma}{Y} = \frac{E}{R}$. **(10 Marks)**

b. Explain theory of pure bending. **(04 Marks)**

c. A 1 meter long cantilever with a rectangular section of depth 75mm and width 38mm is subjected to a bending moment 2kN-m at its free end. Determine: i) Maximum Bending stress ii) Radius of circular arc and curvature of the beam take E = 200GPa. **(06 Marks)**

8 a. Derive the expression for Euler Bernoulli's equation for deflection. **(10 Marks)**

b. Derive an expression for deflection of simply supported beam subjected to point load at mid span. **(10 Marks)**

9 a. With the assumptions and derive the expression for torsion equation for a circular shaft. **(10 Marks)**

b. A Hollow shaft with inner diameter to outer diameter ratio of 0.8 is to transmit a torque of 2500Nm. Taking the allowable shear stress of the shaft material as 45MPa and the limiting angle of twist in 2m length of shaft as 1.5°. Determine the inner and outer diameter of the shaft. Take G = 81 kN/mm^2. **(10 Marks)**

10 a. Derive the Euler Crippling load for columns both ends are fixed. **(10 Marks)**

b. A 2 meters long column has a square 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 is free iii) Both ends are fixed iv) One end is fixed and other end is hinged. Take E = 210GPa. **(10 Marks)**

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