CBCS SCHEME

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

17MT33

Third Semester B.E. Degree Examination, Jan./Feb. 2023
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. Derive an expression for deformation of uniformly tapering rectangular bar. **(10 Marks)**

b. Find the extension of the bar shown in Fig Q1(b) under axial load of 20kN E = 200GN/m^2.

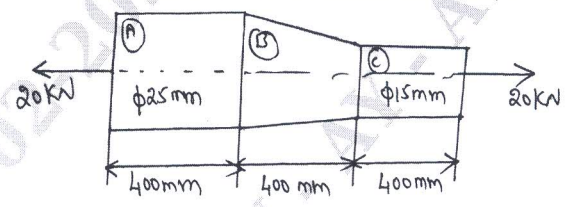

Fig Q1(b) **(10 Marks)**

OR

2 a. Derive a relationship between Young's modulus and modulus of Rigidity. **(10 Marks)**

b. A brass bar having cross sectional area of 1000mm^2, is subjected to axial forces shown in Fig Q2(b), Compute the total elongation of the bar. Take E = 100GN/m^2.

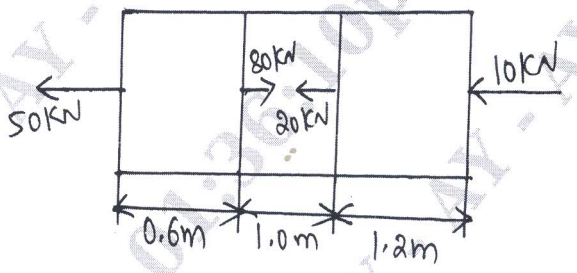

Fig Q2(b) **(10 Marks)**

Module-2

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

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

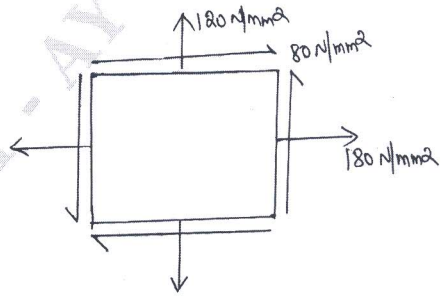

Fig Q3(b) **(10 Marks)**

OR

4 For the state of stress shown in Fig Q4. Determine principle stresses and principle planes also obtain maximum shear stress [tangential stress] verify your answer by constructing Mohr's circle.

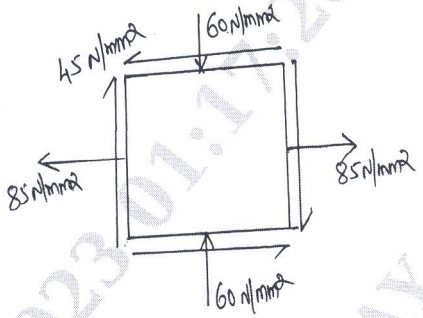

Fig Q4 **(20 Marks)**

Module-3

5 a. Define Beam. Explain the types of Beams. **(05 Marks)**

b. Draw the shear force and bending moment diagram for a cantilever subjected to the forces as shown in Fig Q5(b) and locate the point of Contra-flexure .

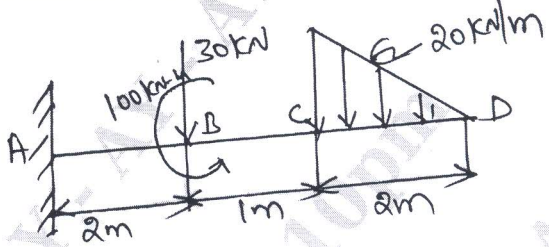

Fig Q5(b) **(15 Marks)**

OR

6 a. Explain the terms : i) Sagging Bending moment ii) Hogging Bending moment. **(04 Marks)**

b. Draw the shear force and Bending moment diagram for the beam given in Fig Q6(b). Locate the point of Contra-flexure.

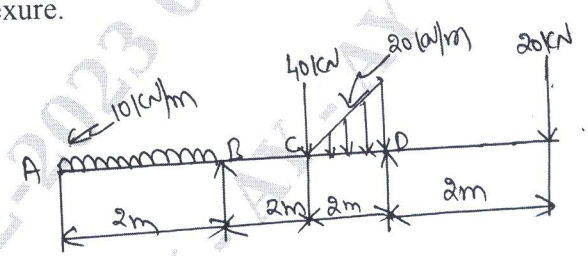

Fig Q6(b) **(16 Marks)**

Module-4

7 a. Prove that $\frac{M}{I} = \frac{\sigma}{Y} = \frac{E}{R}$ with usual notations. **(10 Marks)**

b. A simple steel beam of 4m span carrier a uniformly distributed load of 6kN/m over its entire span and a point load 2kN at its centre. If the permissible stress does not exceed 100MPa, Find the cross section of the beam, Assuming depth to be twice of breadth. **(10 Marks)**

OR

8 a. Define Deflection. Derive Euler Bernoulli equation for deflection. **(10 Marks)**

b. Derive an expression for maximum deflection in a cantilever beam subjected to a point load at free end. **(10 Marks)**

Module-5

9 a. With assumptions, derive Torsion equation for circular shaft. **(10 Marks)**

b. Compare the weight, strength of hollow shaft of same external diameter as that of solid shaft. The inner diameter of hollow shaft is half the external diameter, Both the shafts have the same material, Length **(10 Marks)**

OR

10 a. Derive Euler's expression for buckling load for column with both ends hinged. **(10 Marks)**

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

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

Take E = 210GPa. **(10 Marks)**

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