CBCS SCHEME

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

18MT33

Third Semester B.E. Degree Examination, June/July 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. Define the following: i) Poisson's Ratio ii) Young's modulus iii) Proof stress iv) Modulus of rigidity v) Bulk modulus **(10 Marks)**

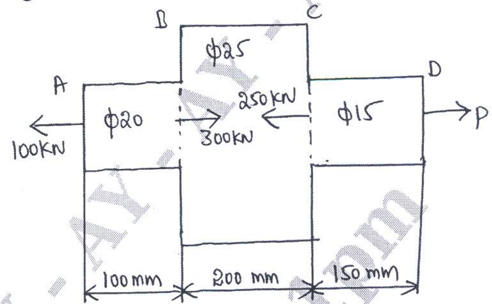
b. Derive an expression for deformation of uniformly tapering circular bar. **(10 Marks)**

OR

2 a. Derive the relation between modulus of elasticity and modulus of rigidity. **(10 Marks)**

b. Determine the stresses in various segments of circular bar shown in Fig.Q.2(b). Compute the total elongation taking youngs modulus = 195GPa. **(10 Marks)**

Fig.Q.2(b)

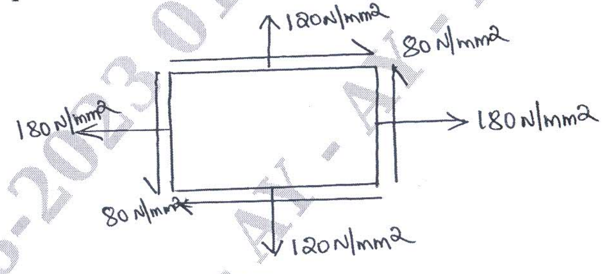


Module-2

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 shown in Fig.Q.3(b). Determine the principal planes, principal stresses, maximum shear stress and its direction. **(10 Marks)**

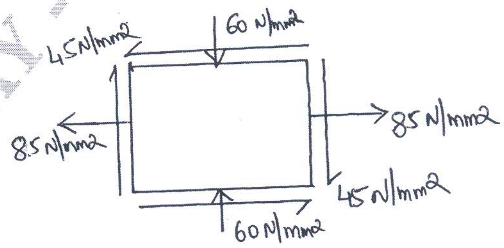
Fig.Q.3(b)



OR

4 For the state of stress shown in Fig.Q.4. Determine principal stresses and principal planes also obtain maximum shear stress. Verify your answer by constructing Mohr's circle. **(20 Marks)**

Fig.Q.4



Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

5 a. Explain Sagging and Hagging moment. **(06 Marks)**

b. Draw the shear force and bending moment diagram for a simply supported beam subjected to the loads as shown in Fig.Q.5(b) also find the location of point of contraflexure. **(14 Marks)**

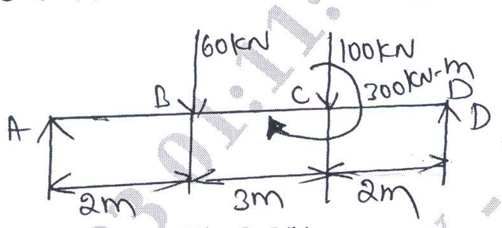


Fig.Q.5(b)

OR

6 a. Define Beam. Explain the types of beams. **(06 Marks)**

b. Draw the shear force and bending moment diagram for the beam shown in Fig.Q.6(b). Find the location of point of contraflexture and magnitude of maximum bending moment. **(14 Marks)**

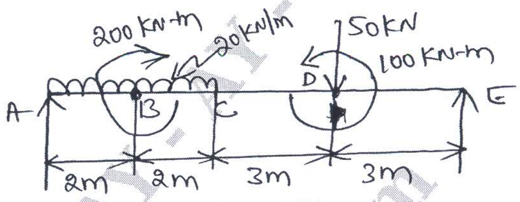


Fig.Q.6(b)

Module-4

7 a. With assumptions derive bending moment equation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$. **(10 Marks)**

b. A 2m long beam with rectangular section (100mm × 50mm) is simply supported at its ends and is subjected to a point load 10kN at its mid span. Draw a sketch showing bending stress distribution along the depth of the section under maximum bending moment. **(10 Marks)**

OR

8 a. Derive the expression for Euler's Bernoulis 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. Prove that a hollow shaft is stronger and stiffer than the solid shaft of the same material, length and weight. **(10 Marks)**

OR

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

b. Define: i) Slenderness ratio ii) Crippling load. **(04 Marks)**

c. Calculate the critical load of a strut which is made of a bar which is circular in section 5m long and is pin jointed at both ends. The same bar when used as a simply supported beam gives a mid span deflection of 10mm with a load of 10N at the centre. **(06 Marks)**

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