CBCS SCHEME

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

18AE/AS33

Third Semester B.E. Degree Examination, June/July 2024
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Any missing data may be suitably assumed.***

Module-1

1 a. Derive the equilibrium equation for a 3-D stress system. **(10 Marks)**

b. With neat sketches, explain stress-strain curves for ductile and brittle materials. **(10 Marks)**

OR

2 a. Derive an expression for the extension of a tapering bar whose diameter 'D' at one end taper linearly to a diameter 'd' in a length L, under an axial pull 'F' and Young's. Modulus E. **(10 Marks)**

b. At room temperature the gap between bar A and bar B is shown in Fig Q2(b) is 0.25mm, what are the stresses induced in the bars. If the temperature rise is 35°C.

Take : $A_A = 1000mm^2$; $E_A = 2 \times 10^5$ N/mm^2 ; $\alpha_A = 12 \times 10^{-6}$/°C

$A_B = 800mm^2$; $E_B = 1 \times 10^5$ N/mm^2 ; $\alpha_B = 23 \times 10^{-6}$/°C **(10 Marks)**

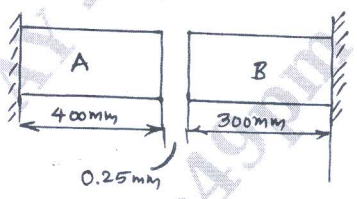

Fig Q2(b)

Module-2

3 a. Draw the shear force and bending moment diagram for a overhanging beam as shown in Fig Q3(a) locate the point of contra flexure. **(10 Marks)**

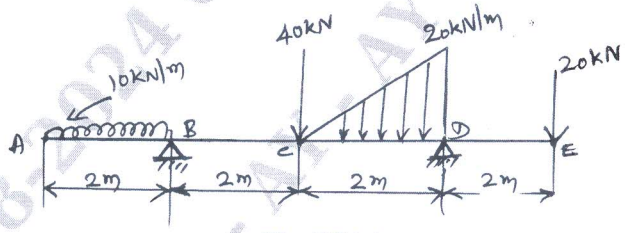

Fig Q3(a)

b. Draw shear force and bending moment diagram for the beam shown in Fig Q3(b), calculate maximum bending moment.

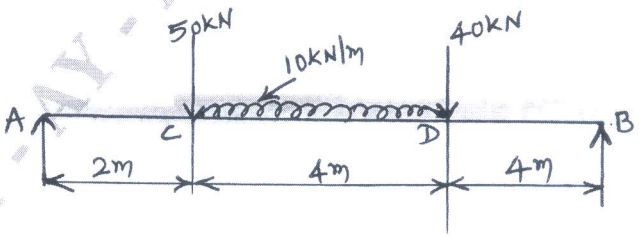

Fig Q3(b) **(10 Marks)**

OR

4 a. Derive the Euler-Bernoulli's beam theory equation. **(10 Marks)**

b. A T- shaped cross –section of a beam shown in Fig Q4(b) is subjected to a vertical shear force of 100kN. Calculate the shear stress at the neutral axis, junction and flange, moment of inertia about horizontal, neutral axis is 0.0001134 m^4.

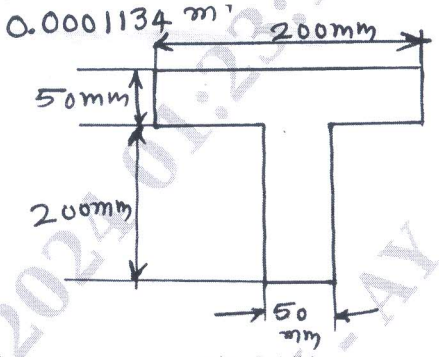

Fig Q4(b) **(10 Marks)**

Module-3

5 a. Derive the deflection equation $EI \frac{d^2y}{dx^2} = M$. **(06 Marks)**

b. A simply supported beam having uniform cross-section is 14m span and is simply supported at its ends. It carrier a concentrated load of 120kN and 80kN at its two points at 3m and 4.5m from the left and right end respectively. If the M.I of the section is $160 \times 10^7 mm^4$ and E = 200GPa. Calculate the deflection of the beam at load points and mid span by using Macaulay's method. **(14 Marks)**

OR

6 a. State the assumption made in pure Torsion theory and derive Torsion equation. **(10 Marks)**

b. A solid shaft rotating at 1000 rpm transmits 50kW. Maximum torque is 20% more than the mean torque. Shaft material has allowable shear stress of 50MPa and modulus of rigidity 80GPa. Angle of twist in the shaft should not exceed 1° in one meter length. Determine the diameter of the shaft. **(10 Marks)**

Module-4

7 a. Explain the principle of virtual work for a particle and write the statements. **(10 Marks)**

b. Define principles of virtual work for a rigid body and state the difference between principle of virtual work and complementary virtual work. **(10 Marks)**

OR

8 a. State and explain Castigliano's I and II theorem. **(10 Marks)**

b. State and derive Maxwell's reciprocal theorem. **(10 Marks)**

Module-5

9 a. Define Fracture, with sketches explain. Type I, II and III fractures. **(10 Marks)**

b. Define Creep, with neat sketch, explain the different stages of creep. **(10 Marks)**

OR

10 a. Draw typical S-N curves for mild steel and Aluminum and explain S-N-diagram in detail. **(10 Marks)**

b. Write down the factors affecting Fatigue life. **(10 Marks)**

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