School of Mechanical Engineering

Mechanical Engineering
ETE - Jun 2023

Time : 3 Hours **Marks : 100**

Sem IV - G3UB401B / BTME2008
Mechanics of Materials

Your answer should be specific to the question asked
Draw neat labeled diagrams wherever necessary

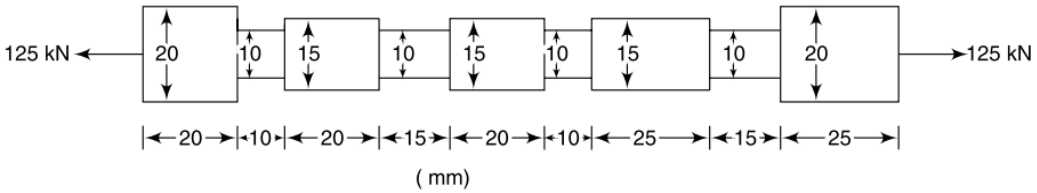
1. Deduce expressions to determine the elongation of a trapezoidal section of uniform thickness. K2 CO1 (5)

2. Find a formula for the self-weighted elongation of a rectangular bar. K2 CO1 (5)

3. Deduce the relation $E = 3K(1 - 2\nu)$ K2 CO1 (5)

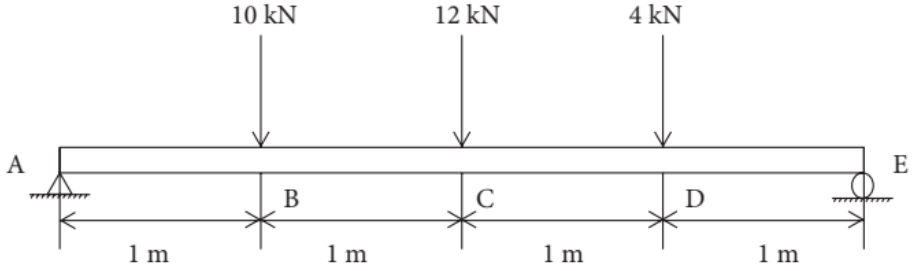
4. A 120-mm wide and 10-mm thick steel plate is bent into a circular arc of 8 m radius. Determine the maximum value of stress produced. Also find the bending moment which will produce the maximum stress. E = 200 GPa. K3 CO2 (10)

5. A rod made up of a number of circular cross-sections as shown in Figure is subjected to a tensile force of 125 kN. Determine the elongation of the rod. E = 205 GPa. K3 CO2 (10)



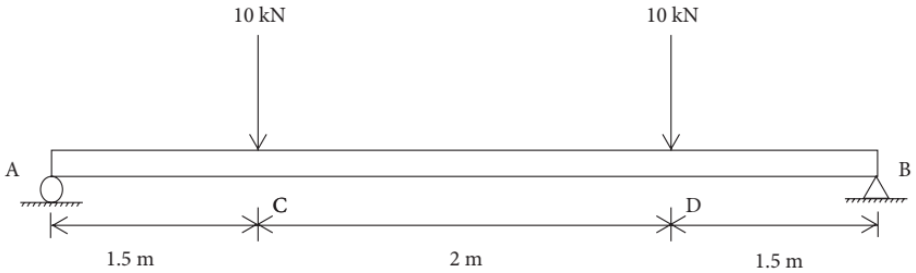
6. Prove the relation for simple bending: $M/I = \sigma/y = E/R$ K2 CO1 (10)

7) Draw the SFD and BMD for the beam shown below. K3 CO2 (10)



OR

Plot the shear force diagram and bending moment diagram for the system given below. K3 CO2 (10)



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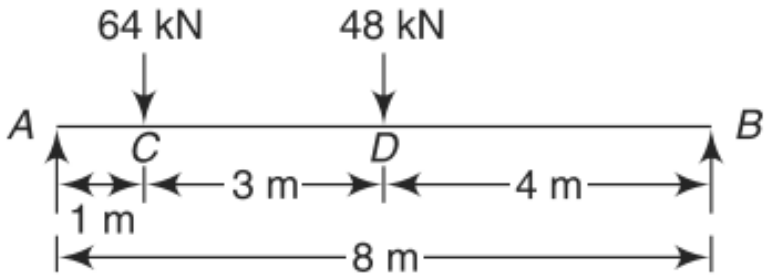
8) Determine the shortest length for a pin-jointed steel column of cross-section 75 mm x 48 mm using Euler's formula.Take critical stress value as 220 MPa and E = 205 GPa. K4 CO3 (15)

OR

A 4-m long circular bar deflects 20 mm at the centre when used as simply supported beam under a 200-N load at the centre. Determine critical load for the same bar when used as a strut which is firmly fixed at one end and pin-jointed at the other. K4 CO3 (15)

9. A simply supported beam of 8-m length carries two point loads of 64 kN and 48 kN at 1 m and 4 m respectively from the left-hand end. Find the deflection under each load. E = 210 GPa and $I = 180 \times 10^6 mm^4$ K4 CO3 (15)



10. A 6 metre long thin cylindrical cell is 800 mm in diameter and 10 mm thick. It is subjected to an internal pressure of 4 MPa. Determine the change in diameter, change in length and change in volume of the shell. Young's modulus is 205 GPa and poison's ratio is 0.3. K3 CO2 (15)