

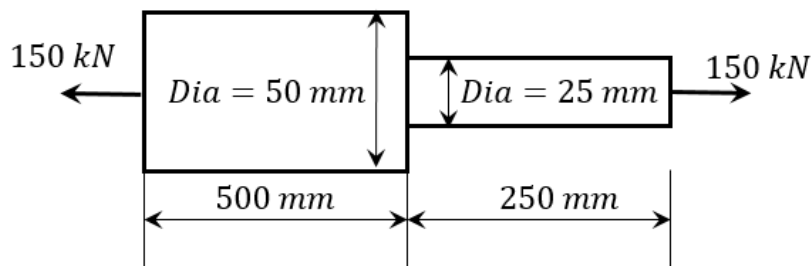
Time: 3 Hrs

Max. Marks: 80

- N.B. 1. Question number **one** is **compulsory**.
 2. Attempt any **three** from the remaining five questions.
 3. Figures to the right indicates **full marks**.
 4. Assume suitable data **if needed** and state it clearly.
 5. Notations used carries usual meaning.

Q1 Attempt any **four** of the following

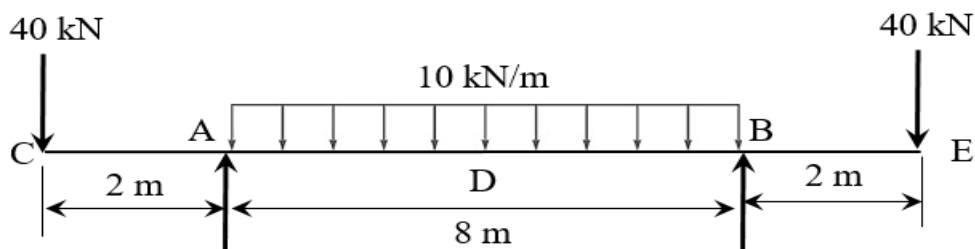
- (a) Derive relation between modulus of elasticity and bulk modulus (5)
 (b) Draw the shear force and bending moment diagrams for a simply supported beam of length L and loaded with uniformly varying load of intensity w kN/m at one end and zero at the other end. (5)
 (c) Derive differential equation for the elastic curve (5)
 (d) Determine the strain energy for the specimens shown in figure loaded with load of 150 kN intensity. Take $E = 2 \times 10^5$ N/mm². (5)



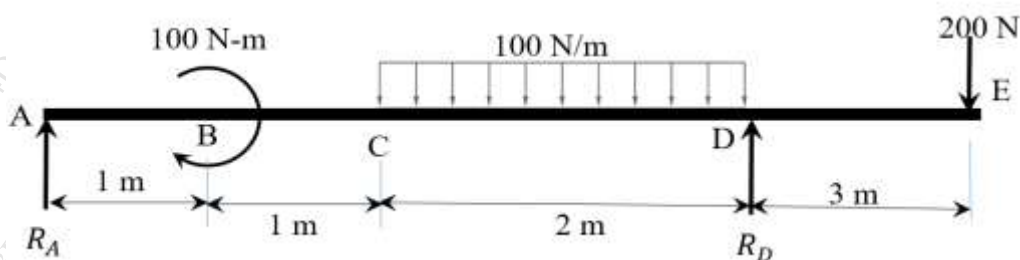
- (e) Describe the types of end conditions for column. (5)

Q2 (a) At a point in a bracket the stresses on two mutually perpendicular planes are 35 MPa and 15 MPa both tensile. The shear stress across these planes is 9 MPa. Find analytically, the magnitude and direction of the resultant stress on a plane making an angle of 40 degrees with the plane of first stress. Find also the normal and tangential stresses on the planes. Verify the answer graphically. (10)

- (b) An overhanging beam with supports at point A and B is loaded as shown in figure. Compute the slope at A and deflection at the midpoint. Take $EI = \text{Constant}$. (10)

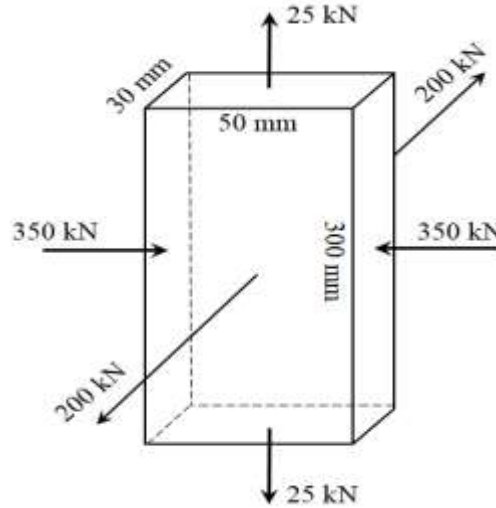


Q3 (a) Beam, A-E is loaded as shown in figure. Determine the shear force and bending moment diagram. (10)



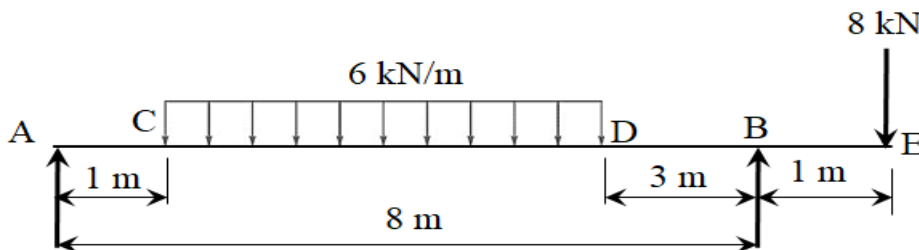
- (b) A cylindrical shell 3m long which is closed at the ends has an internal diameter of 1m and a wall thickness of 15mm. Calculate the circumferential and longitudinal stresses induced and also change in the dimensions of the shell if subjected to an internal pressure of 1.5 MPa. Take $E = 200 \text{ GPa}$ and $\nu = 0.3$ (10)

- Q4 (a) A cast iron bar 300 mm long and of 30 mm by 50 mm uniform section is acted upon by the forces as shown in figure. Determine the change in volume of bar. Take $E = 140 \text{ GPa}$ and $\nu = 0.4$. (10)



- (b) Classify beams and also explain concept of statically determinate and indeterminate beams. (10)

- Q5 (a) Beam AE is loaded as shown in figure. Determine the deflection at free end E and slope at A. Take $E = 210 \text{ GPa}$ and $I = 20 \times 10^6 \text{ mm}^4$ (10)



- (b) A vertically hung bar is 2m long and has a diameter of 25mm. A weight of 600N is dropped from a height h on a collar attached to the end of the bar. Find the height of drop if the stress in the bar is not to exceed 100 MPa. Also find the maximum weight that can be dropped from this height without causing any permanent deformation. The stress at elastic limit is 220 MPa and $E = 200 \text{ GPa}$. (10)

- Q6 (a) A thin spherical shell 1m in diameter with wall thickness of 12 mm is filled with a fluid at atmospheric pressure. What will be the intensity of pressure if 175 cm^3 more fluid is pumped into it? Also calculate circumferential stress at that pressure and increase in diameter. Take $E = 200 \text{ GPa}$ and $\nu = 0.3$. (10)

- (b) A 4m long fixed end hollow cast iron column supports an axial load of 1 MN. The external diameter of the column is 200mm. Determine the thickness of the column using Rankine formula taking a constant of $1/6400$ and working stress of 78 MPa. (10)