

All the questions may be attempted:-

First question (15-mark)

- (a) Determine the total elongation of the metallic bar has length L , cross-section area A , and suspended under its own weight W (5-mark).
- (b) Compute the total elongation of a steel bar 30 mm diameter when it subjected to an axial tensile loads of 45 kN at the end of steel bar, 27 kN at 30 cm from the end of bar, and 18 kN at 90 cm from the end of bar. The Young's modulus is 210 GN/m² (10-mark).

Second question (15-mark)

Calculate the dimensions of a hollow steel shaft which is required to transmit 756 kW at a speed of 401.07 rpm if the maximum torque exceeds the mean torque by 25% and the greatest intensity of shear stress is limited to 75 MN/m². The internal diameter of the shaft is to be 75% of the external diameter. (The mean torque is that derived from the horsepower equation).

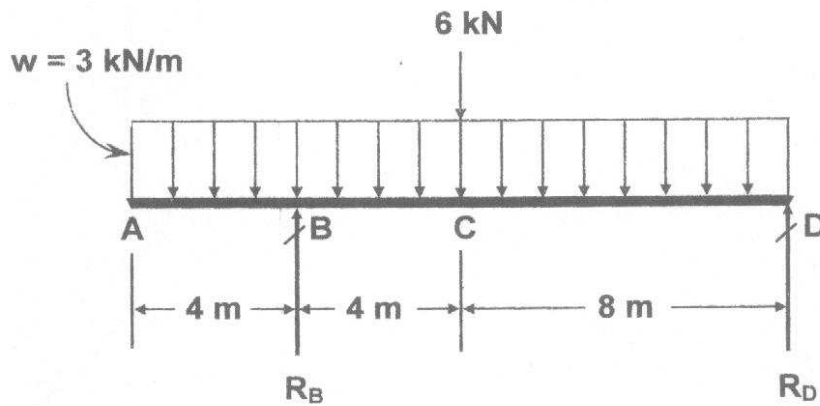
Third question (15-mark)

A circular sector has a curve equation of $dy = (3/2) k x^{1/2} dx$, base length of $a = 45$ cm, and height length of $b = 64$ cm, compute the following with respect to X and Y axes:

- (a) The entire area of the circular sector. (4-mark)
- (b) The centroid of the circular sector. (5-mark)
- (c) The moment of inertia. (6-mark)

Fourth question (15-mark)

Determine the maximum shear force V and the maximum bending moment M in the beam shown in the following figure:-



With my best wishes
Prof. Dr. Salah, M. ABDELLATIF