

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD
JUNE 2020

CYFNOD ARHOLIADAU
MEHEFIN 2020

MODULE CODE: M5X02064
CAE & Stress Analysis

TIME: 2 HOURS

ANSWER ALL QUESTIONS

Equipment or materials required – Calculator

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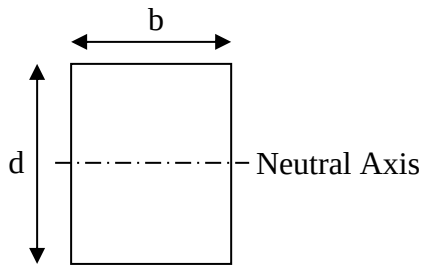
FORMULAE BOOKLET

Simple Bending Equation:

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

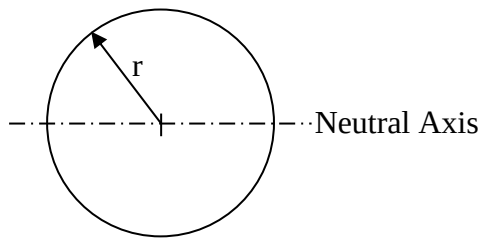
Second Moment of Area of common shape:

a. Rectangular cross-section:



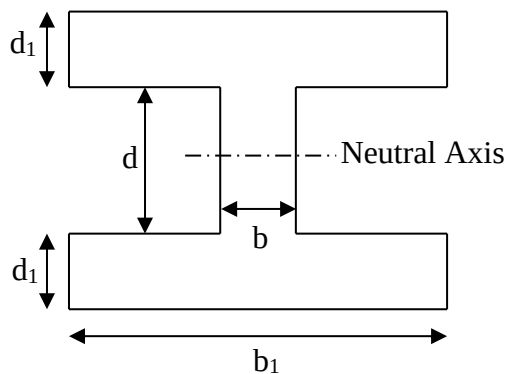
$$I = \frac{b \cdot d^3}{12}$$

b. Circular cross-section:



$$I = \frac{\pi \cdot r^4}{4}$$

c. I section:



$$I = \frac{b_1 \cdot (d + 2 \cdot d_1)^3}{12} - \frac{(b_1 - b) \cdot d^3}{12}$$

Slope and Deflection of Beams:

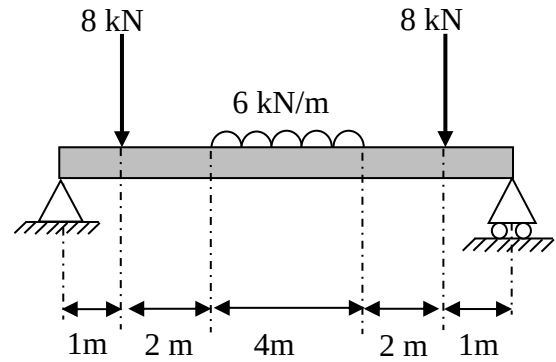
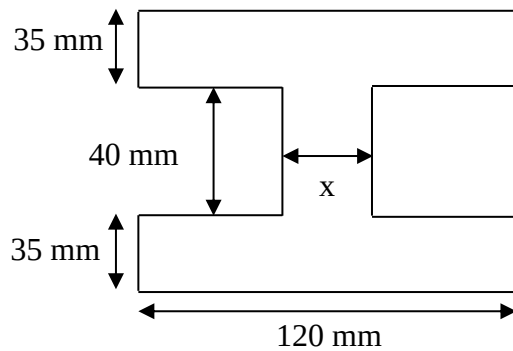
deflection = y

slope = $\frac{dy}{dx}$

Bending Moment $M(x) = EI \frac{d^2y}{dx^2}$

1. QUESTION ONE (30 marks)

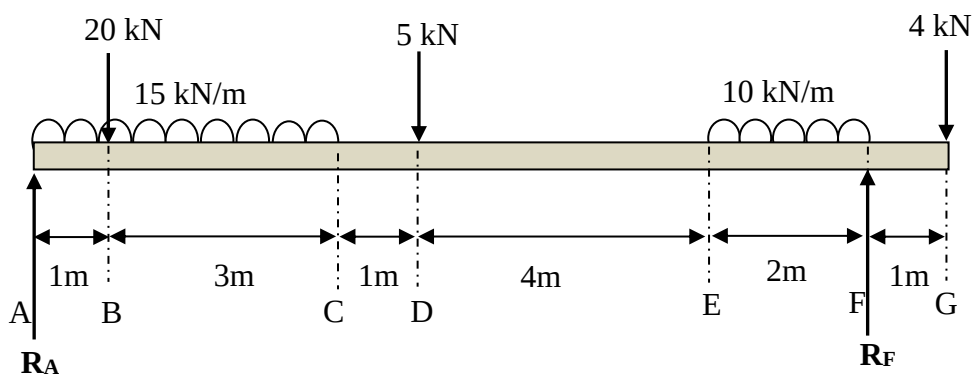
A girder 10 m long has the cross section shown in Fig. 1 and is simply supported over its entire span as shown in Fig. 2. If the maximum direct stress in the girder is limited to $70 \times 10^6 \text{ N/m}^2$, determine the girder web dimension x considering the loading applied to the girder as stated in Fig. 2.



2. QUESTION TWO (35 marks)

Consider the 12 m long beam loaded as shown in Fig. 3.

- Draw the Shear Force and Bending Moment Diagrams. Values of shear force and bending moment at all critical points should be provided on the diagrams.
- Determine the position and magnitude of the maximum Bending Moment.
- Determine the position of any point of contraflexure.



3. QUESTION THREE (35 marks)

The beam shown in Fig. 4 is 13 m long with an E value of 210 GN/m^2 and a circular cross section as shown in Fig. 5.

- Draw the Shear Force and Bending Moment Diagrams.
- Determine slope at the point of maximum bending.

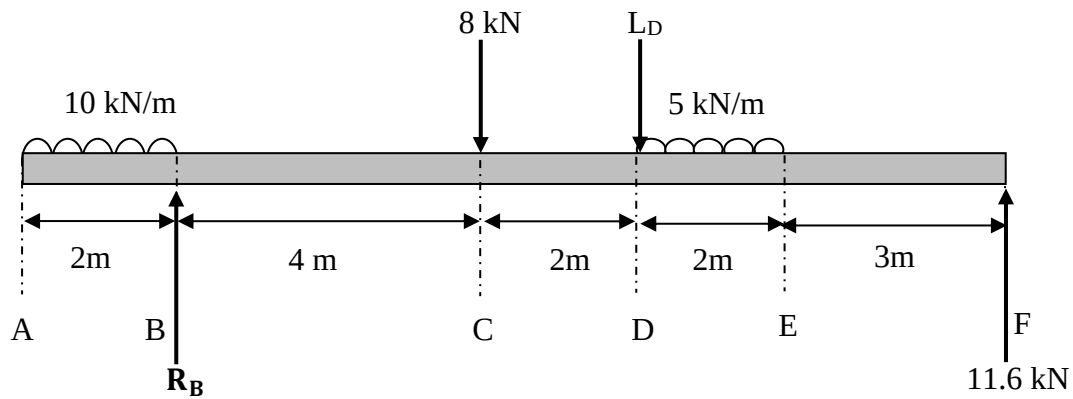


Fig. 4: Beam's applied loads and supports

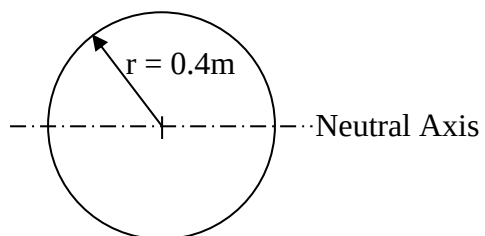


Fig. 5: Beam's cross section

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