

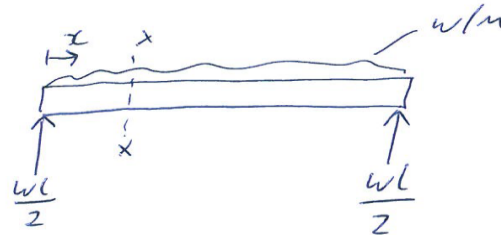
Continuation Sheet

Module/Unit:	CAE and Stress Analysis	Page:	1 of
--------------	-------------------------	-------	------

Question No	Question	Marks
-------------	----------	-------

Q
1

1



$$M_{xx} = \frac{wlx}{2} - wx \cdot \frac{x}{2}$$

$$\therefore EI \frac{d^2 y}{dx^2} = \frac{wlx}{2} - \frac{wx^2}{2}$$

$$\therefore EI \frac{dy}{dx} = \frac{wlx^2}{4} - \frac{wx^3}{6} + A \quad **$$

$$\therefore EI y = \frac{wlx^3}{12} - \frac{wx^4}{24} + Ax + B \quad *$$

WHEN $x=0, y=0 \therefore B=0$

WHEN $x=l, y=0 \therefore$

FROM *
 $0 = \frac{wl^4}{12} - \frac{wl^4}{24} + Al \therefore Al = \frac{wl^4}{24} \therefore A = \frac{wl^3}{24}$

FROM *
 $y = \frac{1}{EI} \left[\frac{wlx^3}{12} - \frac{wx^4}{24} - \frac{wl^3x}{24} \right]$

y_{max} WHEN $x = \frac{l}{2}$

$$\therefore y_{max} = \frac{1}{EI} \left[\frac{wl}{12} \left(\frac{l^3}{8} \right) - \frac{w}{24} \left(\frac{l^4}{16} \right) - \frac{wl^3}{24} \left(\frac{l}{2} \right) \right]$$

$$= \frac{1}{EI} \left[\frac{wl^4}{96} - \frac{wl^4}{384} - \frac{wl^4}{48} \right]$$

$$= -\frac{5wl^4}{384EI}$$

[8 MARKS]

Continuation Sheet

Module/Unit: CAE and Stress Analysis

Page: 2 of

Question No

Question

Marks

(ii) FROM **

(2)

$$\frac{dy}{dx} = \frac{1}{EI} \left[\frac{wx^2}{2} - \frac{wx^3}{6} - \frac{wL^2}{24} \right]$$

WHEN $x = 0$:

$$\left(\frac{dy}{dx} \right)_{\max} = \frac{1}{EI} \left(-\frac{wL^2}{24} \right) = -\frac{wL^2}{24EI} \quad [2 \text{ MARKS}]$$

(b) i) FIND $\left(\frac{dy}{dx} \right)_{\max}$:



$$\left(\frac{dy}{dx} \right)_{\max} = \frac{10}{1000} = 0.01$$

• FIND udl : $w = \frac{5000 \times 9.81}{5} = 9810 \text{ N/m}$

• $\left(\frac{dy}{dx} \right)_{\max} = -\frac{wL^2}{24EI}$

$$\therefore EI = \frac{wL^2}{24 \left(\frac{dy}{dx} \right)_{\max}} = \frac{9810 \times 5^2}{24 \times 0.01} = 5.1 \text{ MNm}^2$$

[5 MARKS]

(ii) IF $E = 210 \text{ GPa}$

$$I = \frac{5.1 \times 10^6}{210 \times 10^9}$$

$$= 2.4 \times 10^{-5} \text{ m}^4$$

$$= 2.4 \times 10^{-5} \times (100^4)$$

$$= \underline{\underline{2400 \text{ cm}^4}}$$

FROM TABLE

$$\text{BEAM} = 254 \times 101.6$$

MASS

PER

$$\text{MASS} = 22 \text{ kg/m}$$

LENGTH

$$\therefore \text{TOTAL MASS} = 22 \times 6.5 = \underline{\underline{143 \text{ kg}}}$$

[5 MARKS]