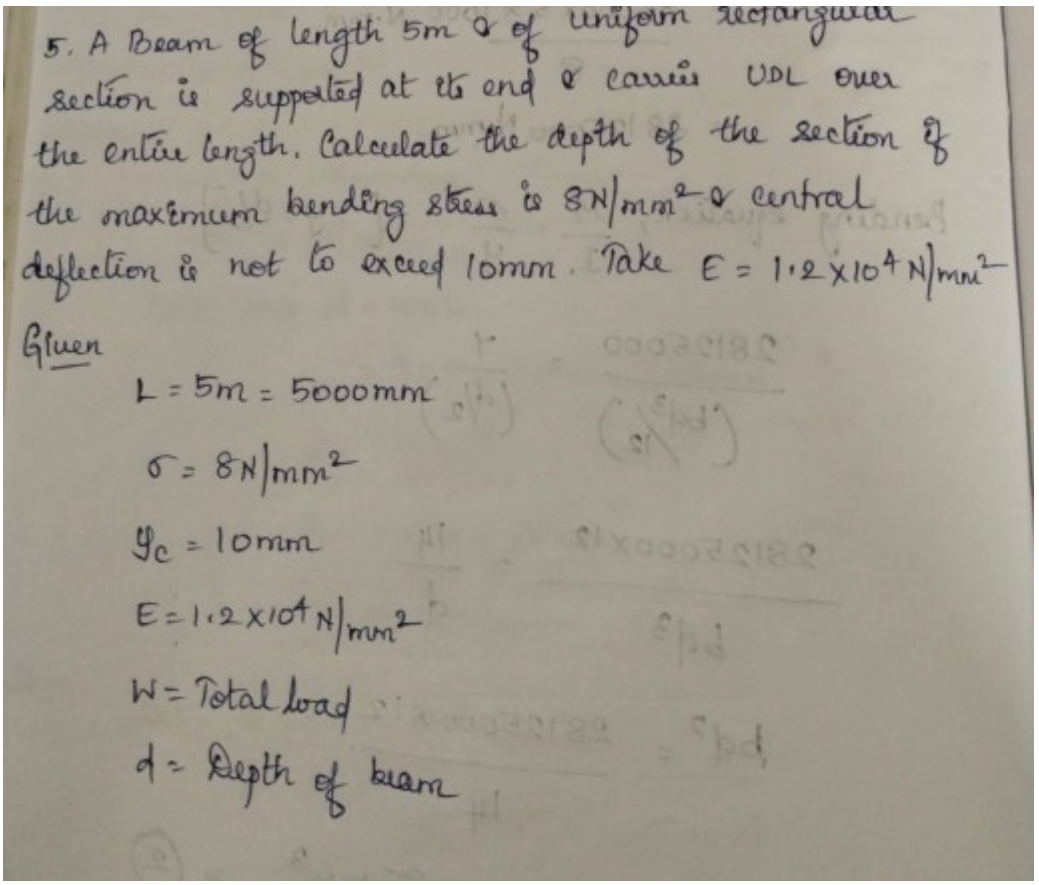
SNS COLLEGE OF TECHNOLOGY

DEPARTMENT OF AGRICULTURAL ENGINEERING

23AGT205-STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERING

NOTES UNIT III



5. A Beam of length 5m is of uniform rectangular section is supported at its end & carries UDL over the entire length. Calculate the depth of the section if the maximum bending stress is $8N/mm^2$ & central deflection is not to exceed 10mm. Take $E = 1.2 \times 10^4 N/mm^2$

Given

$L = 5m = 5000mm$

$\sigma = 8N/mm^2$

$y_c = 10mm$

$E = 1.2 \times 10^4 N/mm^2$

W = Total load

d = Depth of beam

Soln

Max. BM of SSB @ UDL

$$M = \frac{w \cdot L^2}{8}$$

$$= \frac{W \cdot L}{8} \quad \text{— (1)}$$

Now use bending equation,

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

$$M = \frac{\sigma \times I}{y} = \frac{8 \times I}{(d/2)}$$

$$M = \frac{16I}{d} \quad \text{— (2)}$$

Equating (1) & (2),

$$\frac{WL}{8} = \frac{16I}{d}$$

$$W = \frac{16 \times 8I}{L \times d} = \frac{128I}{L \times d} \quad \text{— (3)}$$

Deflection of beam @ centre,

$$y_c = \frac{5}{384} \frac{WL^3}{EI}$$

$$10 = \frac{5}{384} \times \frac{128I}{L \times d} \times \frac{L^3}{EI}$$

$$d = \frac{5}{384} \times \frac{128L^2}{10E} = \frac{5 \times 128 \times 5000^2}{384 \times 10 \times 1.2 \times 10^4}$$

$$= 347.2 \text{ mm} \; \underline{\Omega} \; 34.72 \text{ cm}$$