



SNS COLLEGE OF TECHNOLOGY

DEPARTMENT OF AGRICULTURAL ENGINEERING

23AGT205-STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERING

NOTES UNIT III

UNIT-III - SLOPE & DEFLECTION

Slope & Deflection at a Section - Double Integration & Macaulay's method for SSB - Introduction to Determinate & Indeterminate Structures - Static & Kinematic Indeterminacies.

INTRODUCTION

If a beam carries UDL or point load, the beam is deflected from its original position.

METHODS

- * Double Integration Method
- * Moment area method
- * Macaulay's method - used for several load

Used for single load

EQUATION FOR DOUBLE INTEGRATION METHOD

$$M = EI \frac{d^2y}{dx^2} \quad \text{or} \quad \frac{d^2y}{dx^2} = \frac{M}{EI}$$

1st integration $\frac{dy}{dx} = \text{Slope}$

2nd integration $y = \text{Deflection}$

DEFLECTION OF SSB WITH POINT LOAD ALONG WITH SLOPE

At ends, Slope ($\theta_B = \theta_A$) = $-\frac{WL^2}{16EI}$

At center, Deflection $y_c = \frac{WL^3}{48EI}$



$$\begin{aligned} &= \frac{50000 \times 6000^2}{16 \times 2.1 \times 10^5 \times 78 \times 10^6} \text{ Radians} \\ &= 0.06868 \text{ radian} \quad \left[\because 1 \text{ Radian} = \frac{180}{\pi} \text{ deg} \right] \\ &= 0.06868 \times \frac{180}{\pi} \text{ Degree} \\ &= 3.935^\circ \end{aligned}$$



PROBLEMS

7. A Beam 6m long, SS at its ends, is carrying a point load of 50kN at its centre. The moment of Inertia of the beam (I) is given as equal to $78 \times 10^6 \text{ mm}^4$. If E for the material of beam = $2.1 \times 10^5 \text{ N/mm}^2$, Calculate (i) deflection at Centre of beam & (ii) Slope at Support.

Given

$$L = 6\text{m} = 6000\text{mm}$$

$$W = 50\text{kN} = 50,000\text{N}$$

$$I = 78 \times 10^6 \text{ mm}^4$$

$$E = 2.1 \times 10^5 \text{ N/mm}^2$$

Sol
Deflection at centre of Beam

$$y_c = \frac{WL^3}{48EI}$$

$$= \frac{50000 \times 6000^3}{48 \times 2.1 \times 10^5 \times 78 \times 10^6}$$

$$= 18.736\text{mm}$$

Slope at Support

$$\theta_B = \theta_A = -\frac{WL^2}{16EI}$$

$$\text{Numerically, } \theta_B = \theta_A = \frac{WL^2}{16EI}$$