

AGBEDE GOODNESS YERINMINI

15/ENG03/003

CIVIL ENGINEERING.

ENG 381 (ENGINEERING MATHS)

$$1. \frac{d^2y}{d\theta^2} + 4\frac{dy}{d\theta} + 5y = 6\sin\theta$$

$$\text{let } 6\sin\theta = 0$$

$$m^2 + 4m + 5 = 0$$

$$a = 1 \quad b = 4 \quad c = 5$$

$$m = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-4 \pm \sqrt{4^2 - 4 \times 1 \times 5}}{2 \times 1}$$

$$= \frac{-4 \pm \sqrt{-4}}{2} = \frac{-4 \pm j2}{2}$$

$$m = -2 \pm j$$

$$m = \alpha \pm j\beta$$

$$C.F = y = e^{-2\theta}(A\cos\theta + B\sin\theta)$$

$$f(\theta) = 6\sin\theta$$

$$P.I = y = (C\cos\theta + D\sin\theta)$$

$$\frac{dy}{d\theta} = -C\sin\theta + D\cos\theta$$

$$\frac{d^2y}{d\theta^2} = -C\cos\theta - D\sin\theta$$

$$\frac{d^2y}{d\theta^2} + 4\frac{dy}{d\theta} + 5y = 6\sin\theta$$

$$- (C\cos\theta - D\sin\theta + 4C - 4C\sin\theta + 4D\cos\theta) + 5C\cos\theta + 6D\sin\theta = 6\sin\theta$$

$$-C\cos\theta - D\sin\theta - 4C\sin\theta + 4D\cos\theta + 5C\cos\theta + 5D\sin\theta = 6\sin\theta$$

$$4C\cos\theta + 4D\sin\theta - 4C\sin\theta + 4D\cos\theta = 6\sin\theta$$

$$4C\cos\theta + 4D\cos\theta + 4D\sin\theta - 4C\sin\theta = 6\sin\theta$$

$$(4C + 4D)\cos\theta + (4D - 4C)\sin\theta = 6\sin\theta$$

$$4C + 4D = 0 \quad \dots (i)$$

$$\frac{-4C + 4D = 6}{8D} \quad \dots (ii)$$

$$D = \frac{3}{4}$$

from eqn (i)

$$4C + 4\left(\frac{3}{4}\right) = 0$$

$$4C + 3 = 0$$

$$C = \frac{-3}{4}$$

$$P.I: y = \frac{-3}{4} \cos \theta + \frac{3}{4} \sin \theta$$

$$G.S = C.I + P.I$$

$$y = e^{-2x} (A \cos \theta + B \sin \theta) - \frac{3}{4} \cos \theta + \frac{3}{4} \sin \theta$$

Steady state eqn.

$$y' = \frac{3}{4} \sin \theta + \frac{3}{4} \cos \theta = 0$$

$$\frac{3/4 \sin \theta}{3/4 \cos \theta} = \frac{-3/4 \cos \theta}{3/4 \cos \theta}$$

$$\tan \theta = -1$$

$$\theta = \tan^{-1}(-1)$$

$$\theta = 45^\circ$$

$$2. EI \frac{d^2 y}{dx^2} = \frac{w}{2} (L-x)^2$$

$$EI m^2 = 0$$

$$m^2 = 0$$

$$m = \pm \sqrt{0}$$

$$m = \pm 0$$

$$y = e^{0x} (A + Bx)$$

$$C.I = y = A + Bx$$

$$P.I = y = fx^2 + Gx^3 + Hx^4$$

$$\frac{dy}{dx} = 2fx + 3Gx^2 + 4Hx^3$$

$$\frac{d^2 y}{dx^2} = 2f + 6Gx + 12Hx^2$$

$$G.I (2f + 6Gx + 12Hx^2) = \frac{w}{2} (L-x)^2$$

$$2fEI + 6GxEI + 12HEIx^2 = \frac{w}{2} (L-x)^2$$

$$4fEI + 12GxEI + 24HEIx^2 = w(L^2 - 2Lx + x^2)$$

$$24HEI = w$$

$$H = \frac{w}{24EI}$$

$$12GEI = -2WL$$

$$G = \frac{-2wl}{12EI} = -\frac{wl}{6EI}$$

$$4FEI = wl^2$$

$$F = \frac{wl^2}{4EI}$$

$$y = \left[\frac{wl^2}{4EI} \right] x^2 - \left[\frac{wl}{6EI} \right] x^3 + \left[\frac{wl}{24EI} \right] x^4$$

$$= \frac{wl^2 x^2}{4EI} - \frac{wl x^3}{6EI} + \frac{wl x^4}{24EI}$$

$$y = \frac{6wl^2 x^2 - 4wl x^3 + wl x^4}{24EI}$$

$$G.S = y = A + Bx + \frac{wl}{24EI} [6l^2 x^2 - 4lx^3 + x^4]$$

$$\text{at } y=0, x=0 \text{ and } \frac{dy}{dx} = 0$$

$$\text{At } 0 = A + B(0) + \frac{wl}{24EI} [6l^2(0)^2 - 4l(0)^3 + 0^4]$$

$$A = 0$$

$$\frac{dy}{dx} = B + \frac{wl}{24EI} [12x^2 l^2 - 12x^2 l + 4x^3]$$

$$0 = B + \frac{wl}{24EI} [12(0)^2 l^2 - 12(0)^2 l + 4(0)^3]$$

$$B = 0$$

$$y = fx^2 + Gx^3 + Hx^4$$
$$= \frac{wl^2 x^2}{4EI} + \frac{wl x^3}{6EI} + \frac{wl x^4}{24EI}$$

$$y = \frac{wl}{24EI} [6l^2 x^2 - 4lx^3 + x^4]$$

$$y = \frac{wl x^2}{24EI} [6l^2 - 4lx + x^2]$$

When $x=l$

$$y = \frac{wl^2}{24EI} [6l^2 - 4l^2 + l^2]$$

$$y = \frac{wl^2}{24EI} [3l^2]$$

$$y = \frac{3\omega l^4}{24EI}$$

$$y = \frac{\omega l^4}{8EI}$$