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300level

15/ENG03/022

Civil Engineering

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

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 $= y = C\cos\theta + D\sin\theta$

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

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

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

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

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

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

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

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

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

$-4C + 4D = 6 \quad \cdots (ii)$

$8D = 6$

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

from eqn (i)

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

Standard eqn.

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

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

$$\tan\theta = -1$$

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

$$\theta = -45^0$$

2. $EI\frac{d^2y}{dx^2} = \frac{1}{2}(1-x)^2$

$m^2 = 0$

$m = \pm\sqrt{0}$

$m = \pm 0$

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

C.F $= y = A + Bx$

P.I $= y = \bar{A}x^2 + Cx^3 + Dx^4$

$y = 2Ax + 3Bx^2 + 4Cx^3$

$\frac{dy}{dx}$

$$= \frac{6L^2x^2}{4EI} - \frac{4Lx^2}{6EI} + \frac{wx^4}{24EI}$$

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

$$y = Ax^2 + Bx^3 + Hx^4$$

$$= \frac{6l^3}{48EI}x^2 * \frac{6l}{6EI}x^3 + \frac{6}{24EI}x^4$$

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

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

when $x = l$

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

$$y = \frac{6l^2}{24EI}\left[3l^2\right]$$

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

$$y = \frac{wl^4}{8EI}$$