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Computer Engineering

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

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

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

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

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

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

$$= \frac{-4 \pm \sqrt{16 - 20}}{2} = \frac{-4 \pm \sqrt{-4}}{2}$$

$$m = -2 \pm j$$

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

$$CF \Rightarrow y = e^{-2x} (A \cos \theta + B \sin \theta)$$

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

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

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

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

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

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

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

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

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

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

Agenda
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$$4C + 4D = 0$$

$$4C + 4D = 6$$

$$8D = 6$$

$$D = 3/4$$

$$4C + 4(3/4) = 0$$

$$4C + 3 = 0$$

$$4C = -3$$

$$C = -3/4$$

$$P.I. \Rightarrow y = -3/4 \cos \theta + 3/4 \sin \theta$$

$$G.S. \Rightarrow C.F. + P.I.$$

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

Steady state eqn

$$y' = 3/4 \sin \theta + 3/4 \cos \theta = 0$$

$$3/4 \sin \theta = -3/4 \cos \theta$$

$$3/4 \cos \theta \quad 3/4 \cos \theta$$

$$\tan \theta = 1$$

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

$$\theta = 45^\circ$$

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$$EI \frac{d^3 y}{dx^2} = \frac{\omega}{2} (L-x)^2$$

$$EI m^2 = 0$$

$$m^2 = 0$$

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

$$m = \pm 0$$

$$y = e^{2x} (A+Bx)$$

$$C=L \Rightarrow y = A+Bx$$

$$PI \Rightarrow y = Fx^2 + Gx^3 + Hx^4$$

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

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

$$6I(2F + 6Gx + 12Hx^2) = \omega(L-x)^2$$

$$2FEI + 6Gx EI + 12HEI x^2 = \omega(L-x)^2$$

$$4FEI + 12Gx EI + 24HEI x^2 = \omega(L^2 - 2Lx + x^2)$$

$$24HEI = \omega \quad \text{comparing both equations.}$$

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

$$12GEI = 2\omega L$$

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

$$4FEI = \omega L^2$$

$$F = \frac{\omega L^2}{12EI} = \frac{-\omega L^2}{6EI}$$

$$4EI = wl^2$$

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

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

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

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

~~G.S~~ \Rightarrow y at $y=0, x=0$ and $dy/dx = 0$

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

$$A = 0$$

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

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

$$B = 0$$

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

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

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

when $x=l$

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

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

$$y = \frac{3\omega l^3}{2EI}$$

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