

Assignment 2

① $y'' + 4y' + 5y = 6\sin x$
 $m^2 + 4m + 5 = 0$

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

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

P.I. $\Rightarrow y = C \cos x + D \sin x$

$$y' = -C \sin x + D \cos x$$

$$y'' = -C \cos x - D \sin x$$

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

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

$$4D - 4C = 6 \sin x$$

$$D - C = \frac{3}{2}$$

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

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

At steady state; $\theta = \omega$ & $y' = 0$

$$0 = \frac{3}{4} \sin x + \frac{3}{4} \cos x$$

$$-\frac{3}{4} = \frac{3}{4} \tan x$$

$$-1 = \tan x$$

$$\theta = 145^\circ$$

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

Soln

$$EI m^2 = 0$$

$$m^2 = 0$$

$$m = \sqrt{0}$$

$$m = 0$$

$$C.F.: y = e^{0x} (A+Bx)$$

$$= A+Bx$$

$$y = Cx^2 + Dx^3 + Ex^4$$

$$\frac{dy}{dx} = 2Cx + 3Dx^2 + 4Ex^3$$

$$\frac{d^2 y}{dx^2} = 2C + 6Dx + 12Ex^2$$

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

$$EI(2C + 6Dx + 12Ex^2) = \frac{w}{2} (L-x)^2$$

$$EI2C + EI6Dx + EI12Ex^2 = \frac{w}{2} (L^2 - 2Lx + x^2)$$

$$EI4C + EI12Dx + EI24Ex^2 = wL^2 - wLx + wx^2$$

$$EI24Ex^2 = wx^2$$

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

$$EI12Dx = -wLx$$

$$D = \frac{-wL}{12EI}$$

$$EI4C = wL^2$$

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

$$P-I: y = \frac{wl^2}{4EI}x^2 + \frac{-2wl}{12EI}x^3 + \frac{w}{24EI}x^4$$

$$G-S: C + P-I$$

$$y = A + Bx + \frac{wl^2}{4EI}x^2 - \frac{2wl}{12EI}x^3 + \frac{w}{24EI}x^4$$

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

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

$$0 = A + 0 + 0 + 0$$

$$\therefore A = 0$$

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

$$0 = B + 0 + 0 + 0$$

$$B = 0$$

$$\therefore \text{Particular equation; } y = \frac{wl^2}{4EI}x^2 - \frac{wl}{6EI}x^3 + \frac{w}{24EI}x^4$$

When $x = l$

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

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

$$y = \frac{1}{24EI} (6wl^4 - 4wl^4 + wl^4)$$

$$= \frac{3wl^4}{24EI} \Rightarrow \frac{wl^4}{8EI} //$$