

15/ENG001/1007

Electrical/Electronics Engineering

ENG351 Assignment 2

$$D) \frac{dy}{dt} + \frac{4y}{t} + 5y = 6 \sin \theta$$

Soⁿ

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

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

$$\frac{-4 \pm \sqrt{4^2 - 4(1)(5)}}{2}$$

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

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

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

$$= \frac{-4 \pm 2j}{2} = -2 \pm j$$

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

$$P.F \quad y = C \cos kx + D \sin kb$$

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

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

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

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

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

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

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

$$4C + 4D = 0 \quad , \quad 4C = -4D \quad , \quad C = -D$$

$$4D - 4C = 6$$

$$4D - 4(-D) = 6$$

$$4D + 4D = 6$$

$$8D = 6$$

$$D = \frac{6}{8} = \frac{3}{4}$$

$$4C + 4D = 0$$

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

$$4C = -5$$

$$C = -5/4$$

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

$$G.S \quad y = e^{-2\theta} (C \cos \theta + D \sin \theta) - 3/4 \cos \theta + 3/4 \sin \theta$$

$$iii) \quad \text{at } \theta = 0 \quad \text{and} \quad \frac{dx}{dt} = 0 \quad \text{OR} \quad \frac{dy}{d\theta} = 0$$

$$\frac{dy}{d\theta} = (e^{-2\theta}) (-C \sin \theta + D \cos \theta) + (C \cos \theta + D \sin \theta) (-2e^{-2\theta}) + 3/4 \sin \theta + 3/4 \cos \theta$$

$$\frac{dy}{d\theta} = (e^{-2\theta}) (D \cos \theta - C \sin \theta) - 2e^{-2\theta} (C \cos \theta + D \sin \theta) + 3/4 \sin \theta + 3/4 \cos \theta$$

$$\text{at } \theta = 0$$

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

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

$$-\sin \theta = \cos \theta$$

$$-\frac{\sin \theta}{\cos \theta} = 1$$

$$-\tan \theta = 1$$

$$\tan \theta = -1$$

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

$$\theta = 45^\circ$$

$$2) \quad \frac{d^2 y}{dx^2} = \frac{10}{2} (L - x)^2$$

$$EIM^2 = 0$$

$$M^2 = 0$$

$$M = \pm 0$$

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

$$y = A + Bx$$

P.I

$$y = Fx^2 + Gx^3 + Hx^4$$

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

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

$$EI [2F + 6Gx + 12Hx^2] = \frac{w}{2} (L-x)^2$$

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

$$2FEI + 6GEIx + 12HEIx^2 = \frac{w}{2} (L^2 - 2Lx + x^2)$$

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

$$4FEI + 12GEIx + 24HEIx^2 = wL^2 - 2wLx + wx^2$$

$$24HEI = w$$

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

$$12GEI = -2wL$$

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

$$4FEI = wL^2$$

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

$$y = \left(\frac{wL^2}{4EI} \right) x^2 - \left(\frac{wL}{6EI} \right) x^3 + \left(\frac{w}{24EI} \right) x^4$$

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

$$P.E \Rightarrow y = \frac{w}{24EI} [6L^2x^2 - 4Lx^3 + x^4]$$

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

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

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

$$P.E \quad y = \frac{w}{24EI} [6L^2x^2 - 4Lx^3 + x^4]$$

$$\text{When } x=L$$

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

$$y = \frac{wL^4}{24EI}$$