ADEDIPE E. SEGUN

15/ENG06/001

MECHANICAL ENGINEERING.

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

we observe homogenity

$y'' + 4y' + 5y = 6\sin\theta$

where $y = e^{k\theta}$

$y' = ke^{k\theta}$

$y'' = k^2e^{k\theta}$

$k^2e^{k\theta} + 4(ke^{k\theta}) + 5(e^{k\theta}) = 6\sin\theta$

$k^2e^{k\theta} + 4ke^{k\theta} + 5e^{k\theta} = 0$

$e^{k\theta}(k^2 + 4k + 3) = 0$

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

$k^2 + 4k = -5$

$k^2 + 4k + \left(\frac{1}{2} \times \frac{4}{1}\right)^2 = -5 + \left(\frac{1}{2} \times \frac{4}{1}\right)^2$

$k^2 + 4k + 4 = -5 + 4$

$(k+2)(k+2) = -1$

$k + 2 = \sqrt{-1}$

$k_1 = -2 + i$ and $k_2 = -2 - i$

$y_n = c_1y_1 + c_2y_2$

$y_1 = e^{k\theta} = e^{(-2+i)x} = e^{-2x} \cdot e^{5x}$

$y_2 = e^{k_2\theta} = e^{(-2-i)x} = e^{-2x} \cdot e^{5x}$

$y_n = c_1e^{-2x} \cdot e^{x} + c_2e^{-2x} \cdot e^{ix}$

$y_n = e^{-2\theta}(c_1\cos\theta + c_2\sin\theta)$

Assume $y_p = A\cos\theta + B\sin\theta$

$y_p' = -A\sin\theta + B\cos\theta$

$y_p'' = -A\cos\theta - B\sin\theta$

$-A\cos\theta - B\sin\theta + 4(-A\sin\theta + B\cos\theta) + 5(A\cos\theta + B\sin\theta) = 6\sin\theta$

$-A\cos\theta - B\sin\theta - 4A\sin\theta + 4B\cos\theta + 5A\cos\theta + 5B\sin\theta = 6\sin\theta$

$(4A-4B)\cos\theta + (4B-4A)\sin\theta = 6\sin\theta$

$(4A+4B)\cos\theta + (4B-4A)\sin\theta = 6\sin\theta$

$4B-4A = 6$

$4A+4B = 0$

$4B-4A = 6$

$4B+4A = 0$

$\frac{8B}{8} = \frac{6}{8}$

$B = 3/4$

$4(3/4) - 4A = 6$

$12/4 - 4A = 6$

$4A = 6 - 12/4$

$A = -3/4$

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

$y = y_n + y_p$

$y = e^{-2\theta}(C_1\cos\theta + C_2\sin\theta) - 3/4\cos\theta + 3/4\sin\theta$

ii) at $\theta = \infty$ and $dy/d\theta = 0$

$\frac{dy}{d\theta} = e^{-2\theta}[-C_1\sin\theta + C_2\sin\theta] + [C_1\cos\theta + C_2\sin\theta)-2e^{-2\theta}$

$+ 3/4\sin\theta + 3/4\cos\theta.$

at $\theta = \infty$ and $dy/d\theta = 0$

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

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

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

$-\tan\theta = 1$

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

$\theta = -45^\circ$

2. $EI\, d^2y/dx^2 = w/2 (L-x)^2$

$EIm^2 = 0$

$m^2 = 0$

$m = \pm 0$

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

$y = A + Bx$

Assume $y_p = Px^2 + Qx^3 + Rx^4$

$y_p' = 2px + 3Qx^2 + 4Rx^3$

$y_p'' = 2p + 6Qx + 12Rx^2$

$EI[2p + 6Qx + 12Rx^2] = \frac{w}{2}[L-x]^2$

$2pEI + 6QEIx + 12REIx^2 = \frac{w}{I}[L^2 - 2Lx + x^2]$

$4pEI + 12QEIx + 24REIx^2 = w[L^2 - 2Lx + x^2]$

$24REL = W$

$R = \frac{W}{24EI}$

$12QEI = -2WL$

$Q \frac{-2WL}{12EL} = -\frac{WL}{6EI}$

$12\ 4PEI = WL^2$

$P = \frac{WL^2}{4EI}$

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

$y = \frac{WL^2x^2}{4EI} - \frac{WLx^2}{6EI} + \frac{Wx^4}{24EI}$

$y = \frac{Wx^2}{24EI}(3x^2 + 48x + 6L^3)$