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Matric:- 16/ENG07/034 Assignment 2

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

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

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

$k^2 + 4k = -5$

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

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

$k + 2 = \pm i$

$k_1 = -2 + i, \quad k_2 = -2 - i$

$y = C_1 e^{(-2+i)\theta} + C_2 e^{(-2-i)\theta}$

$y = C_1 e^{-2\theta + i\theta} + C_2 e^{-2\theta} e^{-i\theta}$

$y = C_1 e^{-2\theta} e^{i\theta} + C_2 e^{-2\theta} e^{-i\theta}$

$y = e^{-2\theta}(C_1 e^{i\theta} + C_2 e^{-i\theta})$

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

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

$y'_p = A\sin\theta + B\cos\theta$

$y''_p = -A\cos\theta - B\sin\theta$

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

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

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

$-4A + 4B = 6$

$4A + 4B = 6$

$-4A$

$8B = 6$

$B = 6/8 = 3/4$

$4A = -4B$

$A = -B$

$A = -3/4$

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

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

Recall steady state equation

$y_p = 0$

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

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

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

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

$\tan\theta = -1$

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

$EIm^2 = 0$

$m^2 = 0$

$m = \pm\sqrt{0}$

$m = \pm 0$

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

$y = A + Bx$

$y_p = y = fx^2 + 6x^3 + 4x^4$

$\frac{dy}{dx} = 2fx + 36x^2 + 12fx^2$

$EI = (2f + 6Gx + 12fx^2) = w/2(L-x)$

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

$4fEI + xEI - 24fEIx^2 = 0$

$w(L^2 - 2Lx + x^2)$

$24fEI = w$

$f = \frac{w}{24EI}$ — ①

$12GEI - 2wL$

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

$4fEI = wL^2$

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

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

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

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

G.E: $y = A + Bx + \frac{w}{24EI}(6l^2x^2 - 4lx^3 + x^4)$

at $y = 0, x = 0, dy/dx =$

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

$A = 0$

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

$0 = \frac{B}{24EI} + \frac{w}{24EI}(12(0) - 12(0) + 4(0))$

$B = 0$

$y_p = \frac{w}{24EI}(6l^2x^2 - 4lx^3 + x^4)$

$y_p = \frac{wx^2}{24EI}(6l^2 - 4lx + x^2)$

$y_p = \frac{wx^2}{24EI}(x^2 - 4lx + 6l^2)$

when $x = l$

$y_p = \frac{wl^2}{24EI}(l^2 - 4l^2 + 6l^2)$

$y_p = \frac{wl^2}{24EI}(3l^2)$

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