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PET. ENG

ENG 381 ASSIGNMENT II

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

Soln

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

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

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

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

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

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

$k + 2 = \pm 1i$

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

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

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

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

$y_h = A^{-2\theta}[A\cos\theta + B\cos\theta)$

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

$y_{p_1} = -A\sin\theta + B\cos\theta$

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

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

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

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

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

$-4A + 4B = 6$

$4A + 4B = 0$

$8B = 6 \quad \therefore B = 6/8 = 3/4$

$4A = -4B$

$A = -B$

$A = -3/4$

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

$y = y_h + y_p$

$y = e^{-2t}[A\cos\theta + B\sin\theta] + 3/4\sin\theta = 3/4\cos\theta$

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Steady state equate

$y = 0$

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

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

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

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

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

$\tan\theta = -1$

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

$EIm^2 = 0$

$m^2 = 0$

$m = \pm\sqrt{0}$

$m = \pm 0$

$y = e^{0x}[A + Bx]$

$y = A + Bx$

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

$dy/dx = 2Fx + 3Gx^2 + 4Hx^3$

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

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

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

$4FEI + 12EIx + 24HEIx^2 = \frac{w}{2}(l^2 - 2lx + x^2)$

$24HEI = w$

$H = \frac{w}{24EI}$ ..... (1)

$12GEI = -2wl$

$G = \frac{-2wl}{12EI} = -\frac{wl}{6EI}$ ..... (2)

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$4FEI = wl^2$

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

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

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

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

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

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

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

$A = 0$

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

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

$B = 0$

$y_p = \frac{w}{24EI}\left[6l^2x^2 - 4lx^3 + x^4\right]$

$y_p = \frac{wx^2}{24EI}\left[6L^2 - 4lx + x^2\right]$

$y_p = \frac{wx^2}{24EI}\left[x^2 - 4lx + 6l^2\right]$

When $x = l$

$y_p = \frac{wl^2}{24EI}\left[L^2 - 4l^2 + 6l^2\right]$, $y_p = \frac{wl^2}{24EI}\left[3l^2\right]$

$\therefore y = \frac{wl^4}{8EI}$