15/ENG04/052

Pam Suleiman

Elect/Elect

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

C.F.

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

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

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

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

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

$= -4 \pm \frac{j2}{2}$

$m = -2 \pm j$

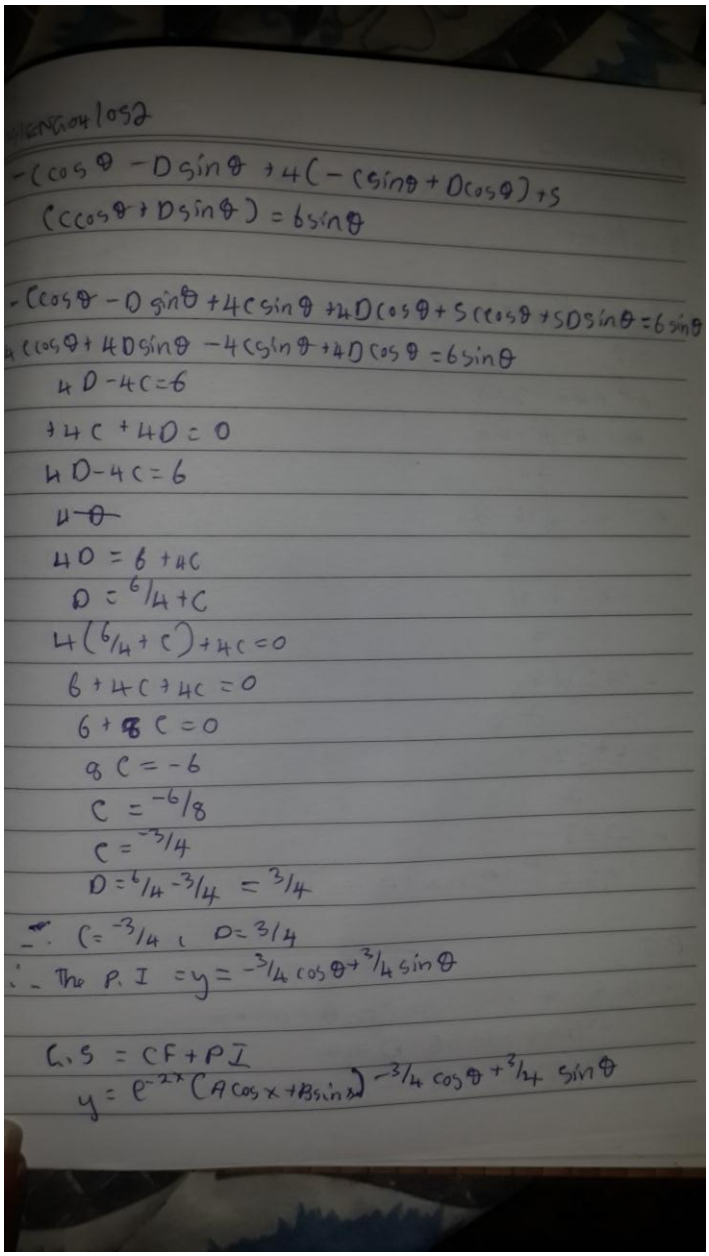
$\therefore y = e^{-2x}(A\cos x + B\sin x)$

P.I

$f(D) = 6\sin\theta \quad \therefore y = C\cos\theta + D\sin\theta$

$dy/dx = -C\sin\theta + D\cos\theta$

$d^2y/dx^2 = -C\cos\theta - D\sin\theta$



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

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

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

$4D - 4C = 6$

$+4C + 4D = 0$

$4D - 4C = 6$

~~4θ~~

$4D = 6 + 4C$

$D = 6/4 + C$

$4(6/4 + C) + 4C = 0$

$6 + 4C + 4C = 0$

$6 + 8C = 0$

$8C = -6$

$C = -6/8$

$C = -3/4$

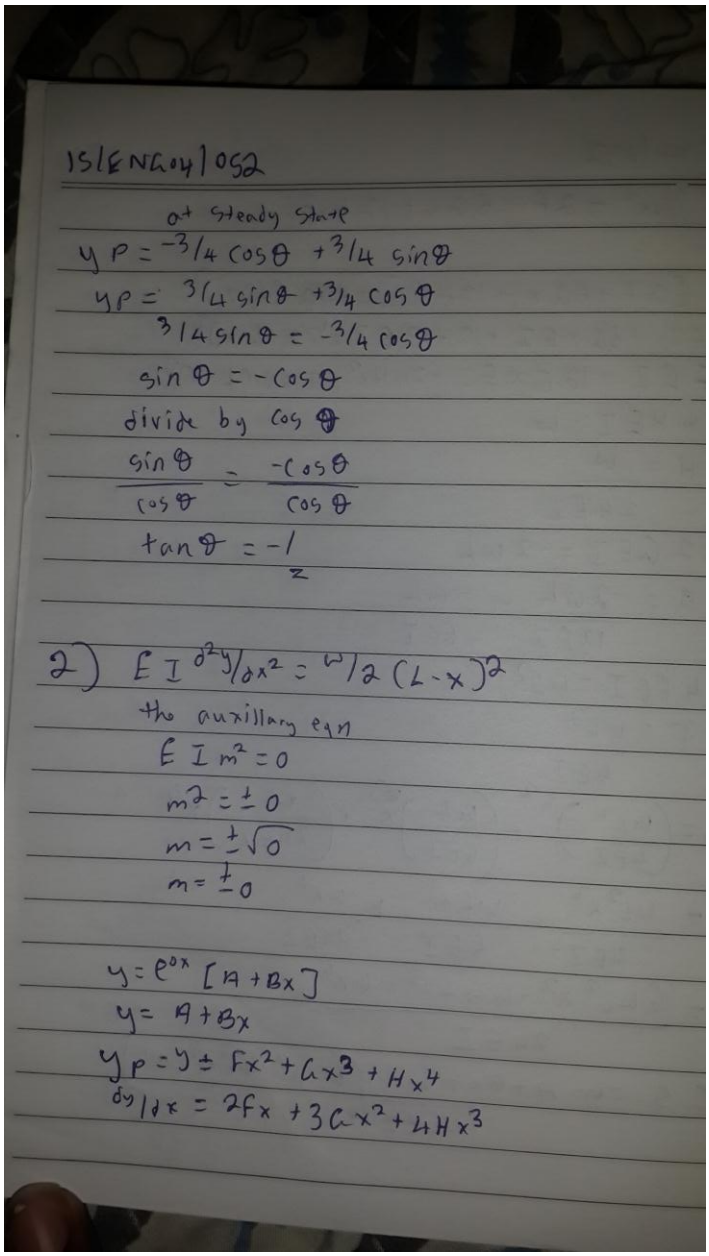
$D = 6/4 - 3/4 = 3/4$

$\therefore C = -3/4$, $D = 3/4$

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

C.S $=$ C.F $+$ P.I

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



1S1ENG04/052

at steady state

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

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

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

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

divide by $\cos\theta$

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

$\tan\theta = -1$

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

the auxillary eqn

$EI\, m^2 = 0$

$m^2 = \pm 0$

$m = \pm\sqrt{0}$

$m = \pm 0$

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

$y = A + Bx$

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

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

B/ENG04/052

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

$$EI[2F + 6Gx + 12Hx^2] = w/2(L-x)^2$$

$$2FEI + 6GxEI + 12Hx^2EI = w/2(L-x)^2$$

$$4FEI + 12GxEI + 24Hx^2EI = w(L-x)^2$$

$$24HEI = w$$

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

$$12GEI = -2wL$$

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

$$4FEI = wL^2$$

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

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

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

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

$$G.S. : y = A + Bx + \frac{w}{24EI}\left(6L^2x^2 - 4Lx^3 + x^4\right)$$

1S1ENG04 1052

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

$$0 = A + B(0) + \frac{w}{24EI}\left[6L^2(0) + 4(0) + 0\right]$$

$$A = 0$$

$$dy/dx = B + \frac{w}{24EI}\left(12L^2x - 12Lx^2 + 4x^3\right)$$

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

$$B = 0$$

$$y_p = \frac{wx^2}{24EI}\left(6L^2x^2 - 4Lx^3 + x^4\right)$$

$$y_p = \frac{wx^2}{24EI}\left(6L^2 - 4xL + x^2\right)$$

$$y_p = \frac{wx^2}{24EI}\left(x^2 - 4xL + 6L^2\right)$$

when $x = L$

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

$$y_p = \frac{wL^2}{24EI}\left(3L^2\right)$$

$$y = \frac{wL^4}{8EI}$$