Name: Jam Terhile Joekin
Dept: Computer Engineering
Matric No: 15/ENG02/032

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

Since it is non-homogenous
$GS = CF + PI$
Solving for CF
$\frac{d^2y}{d\theta^2} + 4\frac{dy}{d\theta} + 5y = 0$

Auxillary equation
$m^2 + 4m + 5 = 0$
$m^2 + 4m = -5$
$m^2 + 4m + 2^2 = -5 + (2)^2$
$(m+2)^2 = -1$
$m + 2 = \pm\sqrt{-1}$
$m + 2 = \pm i$
$m = -2 + i \;\&\; m = -2 - i$
$CF = Ge^{(-2+i)\theta} + G_2e^{(-2-i)\theta}$
$y_n = Ge^{-2\theta+i\theta} + G_2e^{-2\theta-\theta i}$
$y_n = Ge^{-2\theta}.e^{i\theta} + G_2e^{-2\theta}e^{-\theta i}$
$y_n = e^{-2\theta}[Ge^{i\theta} + G_2e^{-\theta i}]$
$y_n = e^{-2\theta}[A\cos\theta + B\sin\theta]$
$y_p = A\cos\theta + B\sin\theta$
$y'_p = -A\sin\theta + B\cos\theta$
$y''_p = -A\cos\theta - B\sin\theta$
$-A\cos\theta - B\sin\theta + 4[-A\sin\theta + B\cos\theta] + 5A\cos\theta + 5B\sin\theta = 6\sin\theta$
$4A\cos\theta + 4B\sin\theta - 4A\sin\theta + 4B\cos\theta = 6\sin\theta$
$4A\cos\theta + 4B\sin\theta - 4A\sin\theta + 4B\cos\theta = 6\sin\theta$
$(-4A + 4B)\sin\theta + (4A + 4B)\cos\theta = 6\sin\theta$
$-4A + 4B = 6$
$4A + 4B = 0$
$8B = 6$
$B = 6/8 = 3/4$

$4A = -4B$

$A = -B$

$A = -3/4$

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

$y = y_n + y_p$

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

Steady state equation

$y'p = 0$

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

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

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

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

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

$\tan\theta = 1$

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

The auxillary equation becomes

$EI m^2 = 0$

$m^2 = 0$

$m = \pm\sqrt{0}$

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

$y = A + Bx$

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

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

$d^2y/dx^2 = 2F + 6Gx + 12Hx^2$

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

$$2FEI + 6GxEI + 12Hx^2EI = \frac{w}{2}(L-x)^2$$

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

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

$$24HEI = w$$

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

$$12GEI = -2wL$$

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

$$4FEI = wL^2$$

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

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

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

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

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

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

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

$$A = 0$$

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

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

$$B = 0$$

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

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

when $x = L$

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

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

$$y = \frac{wL^4}{8EI_2}$$