Name:

HAASTRUP OLUWADOYINSOLA MERCY

15/ENG06/032

MECHANICAL ENGINEERING

\# ASSIGNMENT 2

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

$\frac{d^2y}{d\theta^2} + 4\frac{dy}{d\theta} + 5y = 0$

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

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

$\frac{-4 \pm \sqrt{4^2 - 4(1)(5)}}{2(1)}$

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

$m = -2 \pm i$

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

$\therefore PI = y = C\cos\theta + D\sin\theta$

$\frac{dy}{d\theta} = C\sin\theta + D\sin\theta$

$\frac{d^2y}{d\theta^2} = -C\cos\theta - D\sin\theta$

Subst $dy/d\theta$ & $d^2y/d\theta^2$

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

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

2015/2016 EX

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

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

Comparing Coefficients

for $\cos\theta$

$-C + 4D + 5C = 0$

for $\sin\theta$

$-D - 4C + 5D = 6$

$4D + 4C = 0 \quad \ldots (i)$

$\underline{4D - 4C = 6} \quad \ldots (ii)$

$0 \quad 8C = -6$

$C = -6/8$

$C = -3/4$

$-4D + 4(-3/4) = 0$

$4D + (-3) = 0$

$4D = 3$

$D = 3/4$

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

$y = 3/4(-\cos\theta + \sin\theta)$

Therefore, the general ~~eqn~~ soln then becomes.

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

Neglecting the C.F

model $y = 3/4(-\cos\theta + \sin\theta)$

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

2015/2016

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

$EI\frac{d^2y}{dx^2} = 0$

$EIm^2 = 0$

$m^2 = 0$

$m = \sqrt{0}$

$m = 0$ (twice)

$\therefore \quad y = e^{0x}(A+Bx)$

$y = A+Bx$

CF then becomes $y = (A+Bx)$

$\frac{w}{2}(L-x)^2 = \frac{w}{2}(L^2 - 2Lx + x^2)$

$PI = Cx^4 + Dx^3 + Ex^2$

$y = Cx^4 + Dx^3 + Ex^2$

$\frac{dy}{dx} = 4Cx^3 + 3Dx^2 + 2Ex$

$\frac{d^2y}{dx^2} = 12Cx^2 + 6Dx + 2E$

Subst d^2y/dx^2

$\therefore \quad EI[12Cx^2 + 6Dx + 2F] = w/2(L^2 - 2Lx + x^2)$

Comparing Coefficients.

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

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

Also,

2015/20

$$EI\,6\cancel{D} = \frac{-w2l}{2}$$

$$D = \frac{-wl}{6EI}$$

$$EI\,12Cx^2 = \frac{w}{2}x^2$$

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

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

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

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

The general soln then becomes

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

at $y = 0$ $x = 0$

$$0 = A + 0 + \frac{w}{24EI}(0 - 0 + 0).$$

$$\therefore A = 0$$

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

at $\frac{dy}{dx} = 0$; $x = 0$

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

$\therefore B = 0$

$$y = (0 + 0x) + \frac{w}{24EI}(x^4 - 4lx^3 + 6l^2x^2)$$

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

$\therefore$ If $x = l$

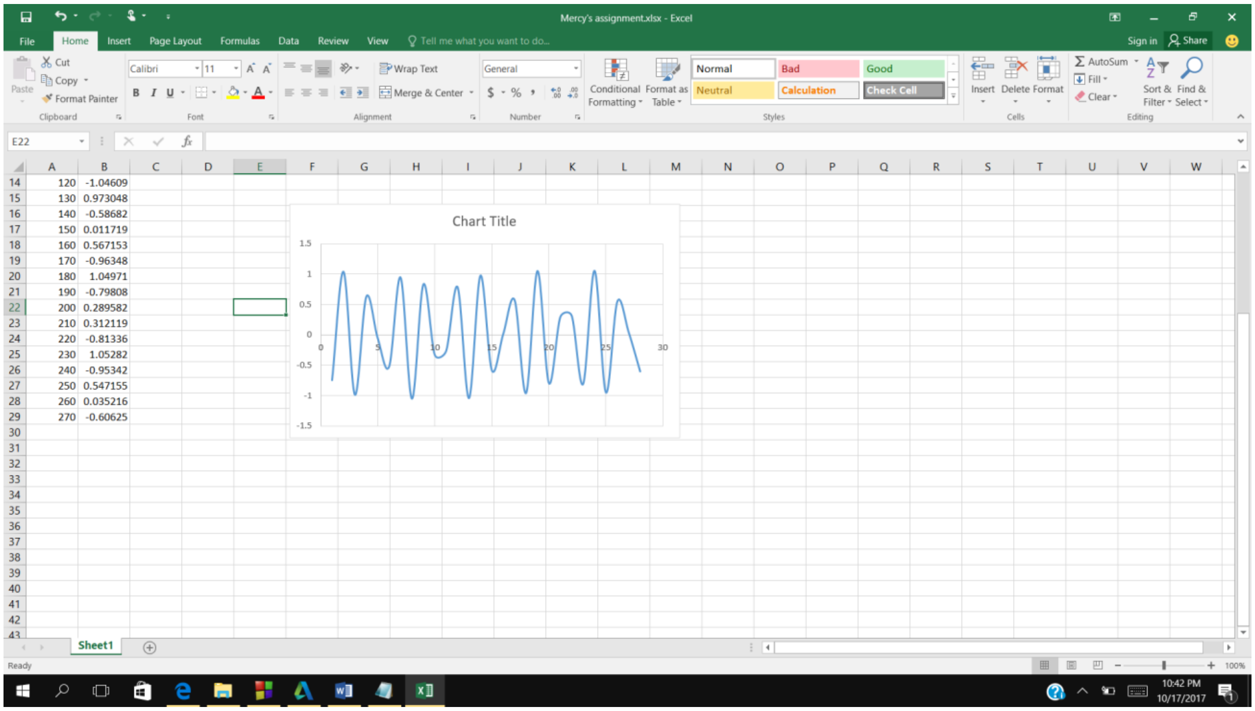
$$y = \frac{w}{24EI}(l^4 - 4l \cdot l^3 + 6l^2 \cdot l^2)$$

$$y = \frac{w}{24EI}(l^4 - 4l^4 + 6l^4)$$

$$y = \frac{w}{24EI}(3l^4)$$

$$y = \frac{3wl^4}{24EI}$$

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



Mercy's assignment.xlsx - Excel
File
Home
Insert
Page Layout
Formulas
Data
Review
View
Tell me what you want to do...
Sign in
Share
E22
14 120 -1.04609
15 130 0.973048
16 140 -0.58682
17 150 0.011719
18 160 0.567153
19 170 -0.96348
20 180 1.04971
21 190 -0.79808
22 200 0.289582
23 210 0.312119
24 220 -0.81336
25 230 1.05282
26 240 -0.95342
27 250 0.547155
28 260 0.035216
29 270 -0.60625
Chart Title
1.5
1
0.5
0
-0.5
-1
-1.5
0
5
10
15
20
25
30
Sheet1
Ready
10:42 PM
10/17/2017