AGBOOLA AMOS . A
15/ENG04/005
Elect/Elect Engr.

ENG 381 Assignment

1) $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 8$

C.F $m^2 - m - 2 = 0$

$(m-2)(m-1) = 0$

$m = 2$ or $m = -1$

$y = Ae^{2x} + Be^{-x}$

P.I $y = C$

$dy/dx = 0$

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

$P.I \Rightarrow 0 - 0 - 2C = 8$

$2C = -8$

$C = -8/2$

$C = -4$

$G.S \Rightarrow C.F + P.I$

$\Rightarrow Ae^{2x} + Be^{-x} - 4$

2) $\frac{d^2y}{dx^2} - 4y = 10e^{3x}$

C.F $m^2 - 4 = 0$

$m^2 = 4$

$m = \sqrt{4}$

$m = \pm 2$

$y = A\cosh 2x + B\sinh 2x$

P.I Assume $y = Ce^{3x}$

$\frac{dy}{dx} = 3Ce^{3x}$

$\frac{d^2y}{dx^2} = 9Ce^{3x}$

$\Rightarrow 9Ce^{3x} - 4(Ce^{3x}) = 10e^{3x}$

$9Ce^{3x} - 4Ce^{3x} = 10e^{3x}$

Divide through by e^{3x}

$9C - 4C = 10$

$5C = 10$

$C = 2$

$G.S \Rightarrow CF + P.I$

$= A\cosh 2x + B\sinh 2x + 2e$

3 $\frac{d^2y}{dx^2}+2\frac{dy}{dx}+y=e^{-2x}$

C.F $m^2+2m+1=0$

$(m+1)(m+1)=0$

$m_1=-1 \quad m_2=-1$

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

P.I Assume $y=Ce^{-2x}$

$\frac{dy}{dx}=-2Ce^{-2x}$

$\frac{d^2y}{dx^2}=4Ce^{-2x}$

$4Ce^{-2x}+2(-2Ce^{-2x})+Ce^{-2x}=e^{-2x}$

$4Ce^{-2x}-4Ce^{-2x}+Ce^{-2x}=e^{-2x}$

$Ce^{-2x}=e^{-2x}$

$C=1$

G.S $\Rightarrow$ C.F + P.I

$\Rightarrow e^{-x}(A+Bx)+e^{-2x}$

4. $\frac{d^2y}{dx^2}+25y=5x^2+x$

C.F $m^2+25=0$

$m^2=-25$

$m=\sqrt{-25}$

$m=\sqrt{-1}\sqrt{25}$

$m=j5$

$y=A\cos 5x+B\sin 5x$

P.I Assume $y=Cx^2+Dx+E$

$\frac{dy}{dx}=2Cx+D$

$\frac{d^2y}{dx^2}=2C$

$= 2C + 25(Cx^2 + Dx + E) = 5x^2 + x$

$= 2C + 25Cx^2 + 25Dx + 25E = 5x^2 + x$

comparing coefficients

$2x = 5$

$C = \frac{1}{5}$

$25D = 1$

$D = 1/25$

$2C + 25E = 0$

$2(1/5) + 25E = 0$

$25E = -2/5$

$E = \frac{-2}{125}$

$G.S \Rightarrow C.F + P.I$

$= A\cos 5x + B\sin 5x + \frac{25x^2 + 5x - 2}{125}$

5 $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} - 8y = 8e^{4x}$

$C.F \quad m^2 - 6m - 8 = 0$

$(m-4)(m-2) = 0$

$m_1 = 4 \quad m_2 = 2$

$y = Ae^{4x} + Be^{2x}$

PI Assume $y = Cxe^{4x}$

$\frac{dy}{dx} = [x \cdot 4e^{4x} + e^{4x}]$

$\frac{d^2y}{dx^2} = 4C[x4e^{4x} + e^{4x}] + 4ce^{4x}$

$= 16Cxe^{4x} + 4ce^{4x} + 4ce^{4x}$

$\Rightarrow 16cxe^{4x} + 8ce^{4x} - 6[4cxe^{4x} + ce^{4x}] + 8cxe^{2x} = 8e^{4x}$

$16cx^{4x} + 8ce^{4x} - 24cxe^{4x} - 6ce^{4x} + 8cxe^{2x} = 8e^{4x}$

$16Cx + 8C - 24Cx - 6C + 8Cx = 8$

$= -8Cx + 2C + 8Cx = 8$

$2C = 8$

$C = 8/2$

$C = 4$

$y = 4xe^{4x}$

$G.S = CF + PI$

$= Ae^{4x} + Be^{2x} + 4xe^{4x}$

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$$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 2e^{-x}$$

given that at $x=0$, $y=1$ and $dy/dx = -2$

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

This is a complex situation

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

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

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

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

$$= -2 \pm j$$

$m_1 = -2+j$, $m_2 = -2-j$.

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

PI Assume $y = ce$

$$\frac{dy}{dx} = -2ce^{-2x}$$

$$\frac{d^2y}{dx^2} = 4ce^{-2x}$$

$4ce^{-2x} + 4(-2ce^{-2x}) + 5(ce^{-2x}) = 2e^{-2x}$

$4ce^{-2x} \cancel{+4} - 8ce^{-2x} + 5ce^{-2x} = 2e^{-2x}$

$4c - 8c + 5c = 2$

$c = 2$

$y = 2e^{-2x}$

GS $\Rightarrow e^{-2x}(A\cos x + B\sin x) + 2e^{-2x}$

at $x=0$, $y=1$

$1 = e^{-2(0)}(A\cos 0 + B\sin 0) + 2e^{-2(0)}$

$1 = 1(A) + 2$

$1 = A + 2$

$A = 1 - 2$

$A = -1$

$dy/dx = e^{-2x}[-A\sin x + B\cos x] + [A\cos x + B\sin x] - 2e^{-2x} + 2e^{-2x}$

$dy/dx = e^{-2x}[-A\sin x + B\cos x] - 2e^{-2x}(A\cos x + B\sin x) - 4e^{-2x}$

at $x = 0$, $dy/dx = -2$

$-2 = e^{-2(0)}[-A\sin 0 + B\cos 0] - 2e^{-2(0)}[A\cos 0 + B\sin 0] - 4e^{-2x}$

$-2 = B - 2A - 4$

$B = -2 - 2 + 4$

$B = 0$

$\therefore PS = e^{-2x}(-\cos x) + 2e^{-2x}$

$= e^{-2x}\cos x + 2e^{-2x}$

$= e^{-2x}(2 - \cos x)$

7) $3\,d^2y/dx^2 - 2\,dy/dx - y = 2x - 3$

CF $3m^2 - 2m - 1 = 0$

$(3m+1)(m-1) = 0$

$m_1 = -1/3$ $m_2 = 1$

$y = Ae^{-1/3x} + Be^{x}$

PI Assume $y = Cx + D$

$dy/dx = C$

$d^2y/dx^2 = 0$

$3(0) + 2(C) - [Cx + D] = 2x - 3$

$0 - 2C - Cx - D = 2x - 3$

x: $-C = 2$

$C = -2$

constants $-2C - D = -3$

$4 - D = -3$

$D = 7$

$\Rightarrow y = -2x + 7$

G.S $\Rightarrow Ae^{-1/3x} + Be^{x} - 2x + 7$