15/ENG04/002

ADESOYE ADEDAMOLA OLUWATOBILOBA

ELECTRICAL ELECTRONICS ENGINEERING

ENG381 ASS

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

$m^2 - m - 2 = 0$

$m^2 - 2m + m - 2 = 0$

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

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

$m_1 = -1, \quad m_2 = 2$

$y = Ae^{m_1 x} + Be^{m_2 x}$

C.F: $y = Ae^{2x} + Be^{-x}$

P.I: $y = C$

$\frac{dy}{dx} = 0$

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

$0 - 0 - 2C = 8$

$-2C = 8$

$C = -4$

The general solution:

G.S = C.F + P.I

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

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

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

$m^2 = 4$

$m = 2$

C.F: $y = A\cosh 2x + B\sinh 2x$

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

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

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

$9Ce^{3x} - 4Ce^{2x} = 10e^{3x}$

$5Ce^{3x} = 10e^{2x}$

$5C = 10$

$C = 2$

$\therefore$ G.S: $y = A\cosh 2x + B\sinh 2x + 2e^{3x}$

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

C.F:

$m^2 + 2m + 1 = 0$

$m^2 + m + m + 1 = 0$

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

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

$m = -1$

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

P.I: $y = ce^{-2x}$

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

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

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

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

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

$c = 1$

$\therefore G.S = y = e^{-x}(A + Bx) + e^{-2x}$

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

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

$m^2 = -25$

$m = \pm j5$

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

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

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

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

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

$2C + 50Cx + 25D = 5x^2 + x$

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

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

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

Comparing both sides

$25C = 5$ ----- ①

$C = 1/5$ --- ①

$25D = 1$

$D = 1/25$ --- ②

$2C + 25E = 0$ --- ③

Subst. ① into ③

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

$2/5 + 25E = 0$

$25E = -2/5$

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

$\therefore G.S = y = A\cos 5x + B\sin 5x + 1/5 x^2 + \frac{1}{25}x - \frac{2}{125}$

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

C.F:

$m^2 - 2m + 1 = 0$

$m^2 - m - m + 1 = 0$

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

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

$m = 1$ twice

C.F: $y = e^x(A + Bx)$

P.I $y = C\cos x + D\sin x$

$\frac{dy}{dx} = -C\sin x + D\cos x$

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

$-C\cos x - D\sin x + 2C\sin x - 2D\cos x + C\cos x + D\sin x = 4\sin x$

$+2C\sin x - 2D\cos x = 4\sin x$

Comparing both sides

$+2C = 4$

$C = 2$

$2D = 0$

$D = 0$

G.S: $y = e^x(A + Bx) + 2\cos x$

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

$(Dm)^2 + 4m + 5 = 0$

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

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

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

$m = -2 \pm j$

$m_1 = -2 + j \quad m_2 = -2 - j$

G.S $y = e^{-2x}(C\cos x + D\sin x)$

P.I: $y = ce^{-2x}$

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

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

$9ce^{-3x} - 12ce^{-3x} + 5ce^{-3x} = 2e^{-3x}$

$2ce^{-3x} = 2e^{-3x}$

$c = 1$

G.S $y = e^{-2x}(C\cos x + D\sin x) + e^{-3x}$

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

ce^{-2x}

$c = 2$

G.S: $y = e^{-2x}(C\cos x + D\sin x) + 2e^{-2x}$

Given $x = 0, y = 1, \frac{dy}{dx} = -2$

$1 = e^0(C\cos 0 + D\sin 0) + 2e^0$

$1 = C + 2$

$C = -1$

$\frac{dy}{dx} = -2e^{-2x}(C\cos x + D\sin x)(-C\sin x + D\cos x)$

when $\frac{dy}{dx} = -2, C = -1, x = 0$

$-2 = -2e^0(-\cos 0 + D\sin 0)(1\sin 0 + D\cos 0)$

$-2 = -2(-1)(D)$

$-2 = 2D$

$D = -1$

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

7.) $3\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - y = 2x - 3$

$\frac{d^2y}{dx^2} - \frac{2}{3}\frac{dy}{dx} - \frac{y}{3} = \frac{2x-1}{3}$

$m^2 - \frac{2}{3}m - \frac{1}{3} = 0$

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

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

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

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

$m_1 = -\frac{1}{3}, \quad m_2 = 1$

C.F: $y = Ae^{-\frac{x}{3}} + Be^{x}$

P.I = $y = Cx + D$

$\frac{dy}{dx} = C$

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

$0 - \frac{2}{3}(C) - \frac{1}{3}(Cx + D) = \frac{2}{3}x - 1$

$-\frac{2}{3}C - \frac{Cx}{3} - \frac{D}{3} = \frac{2}{3}x - 1$

$-\frac{Cx}{3} - \frac{2}{3}C - \frac{D}{3} = \frac{2}{3}x - 1$

Comparing both sides

$-\frac{C}{3} = \frac{2}{3}$

$C = -2$

$-\frac{2}{3}C - \frac{D}{3} = -1$

$\frac{4}{3} + 1 = \frac{D}{3}$

$4 + 3 = D$

$D = 7$

G.S: $y = Ae^{-\frac{x}{3}} + Be^{x} - 2c + 7$

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

$m^2 - 6m + 8 = 0$

$m^2 - 4m - 2m + 8 = 0$

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

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

$m_1 = 2 \quad m_2 = 4$

C.F: $y = Ae^{2x} + Be^{4x}$

P.I = $y = cxe^{4x}$

$\frac{dy}{dx} = 4ce^{4x}$

$\frac{d^2y}{dx^2} = 16ce^{4x}$

$16ce^{4x} - 24ce^{4x} + 8ce^{4x} = 8e^{4x}$

0

P.I: $y = cxe^{4x}$

$\frac{dy}{dx} = 4cxe^{4x}$

$\frac{d^2y}{dx^2} = 4c(4xe^{4x} + e^{4x})$

$4c(4xe^{4x} + e^{4x}) - 6(4cxe^{4x}) + 8(cxe^{4x}) = 8e^{4x}$

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

$4ce^{4x} = 8e^{4x}$

$4c = 8$

$c = 2$

G.S: $y = Ae^{2x} + Be^{4x} + 2xe^{4x}$