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DEPARTMENT: ELECTRICAL/ELECTRONIC ENGINEERING

COURSE: ENG 381

ASSIGNMENT 1

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DEPARTMENT: ELECTRICAL/ELECTRONIC ENGINEERING
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1. $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 8$

$m^2 - m - 2 = 0$

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

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

$y = C$

$dy/dx = 0$

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

$0 - 0 - 2C = 8$

$-2C = 8$

$C = -4$

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

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

$m^2 - 4 = 0$

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

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

$y = Ce^{2x}$

$dy/dx = 2Ce^{2x}$

$d^2y/dx^2 = 4Ce^{2x}$

$4Ce^{2x} - 4(Ce^{2x}) = 10e^{2x}$

$Ce^{2x}(4-4) = 10e^{2x}$

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

$5C = 10$

~~$C = 10$~~ $C = 2$

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

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

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

$m = -2$

$y = e^{-2x}(A + Bx)$

$y = Ce^{-2x}$

$y = Cxe^{-2x}$

$dy/dx = Ce^{-2x} - 2Cxe^{-2x}$

$d^2y/dx^2 = 4Cxe^{-2x} - 4Ce^{-2x}$

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

$4Cxe^{-2x} - 4Ce^{-2x} + 4Ce^{-2x} - 8Cxe^{-2x} + 4Cxe^{-2x} = e^{-2x}$

$4Cx - 4C + 4C - 4Cx + 0x = 1$

$0 - 2C = 1$

$C = -1/2$

$\therefore y = -1/2 xe^{-2x}$

$\therefore y = e^{-2x}(A + Bx) - 1/2 xe^{-2x}$

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

$m^2 + 25 = 0$

$m = \pm 5i$

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

$y = Cx^2 + Dx + E$

$dy/dx = 2Cx + D$

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

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

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

$25Cx^2 = 5x^2$ $2C + 25E = 0$

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

$25Dx = x$ $E = -2/125$

$D = 1/25$

$\therefore y = x^2/5 + x/25 - 2/125$

$\therefore y = A\cos 5x + B\sin 5x + (x^2/5 + x/25 - 2/125)$

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

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

$m = 1$

$y = e^x(A + Bx)$

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

$dy/dx = -(A\sin x + B\cos x)$

$d^2y/dx^2 = -(A\cos x - B\sin x)$

$[-(A\cos x - B\sin x)] - 2(-(A\sin x + B\cos x)) + (A\cos x + B\sin x) = 4\sin x$

$-A\cos x - B\sin x + 2A\sin x - 2B\cos x + A\cos x + B\sin x = 4\sin x$

$-B\sin x + 2A\sin x - 2B\cos x = 4\sin x$

$2A\sin x - 2B\cos x = 4\sin x$

$2A = 4$

$A = 2$

$-2B = 0$

$B = 0$

$\therefore y = 2\cos x$

$\therefore y = e^x(A + Bx) + 2\cos x$

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

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

$m = -2 \pm j$

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

$y = (e$

$dy/dx = -2(e^{-2x}$

$d^2y/dx^2 = 4(e^{-2x}$

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

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

$e^{-2x}[4C - 8C + 5C] = 2e^{-2x}$

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

$C = 2$

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

$\therefore$ GS: $y = e^{-2x}[A\cos x + B\sin x] + 2e^{-2x}$

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

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

$1 = A + 2$

$A = 1 - 2$

$A = -1$

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

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

$-2 = -2B - 4$

$-2B = -2 + 4$

$-2B = 2$

$B = -1$

$y = e^{-2x}(-\cos x$ [illegible]

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

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

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

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

$y = Cx + D$

$dy/dx = C$

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

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

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

$-Cx = 2x$

$\therefore C = -2$

$-2C + D = -3$

$-2(-2) + D = -3$

$4 + D = -3$

$D = -3 - 4$

$D = -7$

PI: $y = -2x - 7$

$\therefore$ GS: $y = Ae^{-x/3} + Be^{x} - 2x - 7$

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

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

$m_1 = 2 \quad m_2 = 4$

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

$y = te^{mx}$

$dy/dx = me^{mx}$

$d^2y/dx^2 = m^2 e^{mx}$

$m^2 e^{mx} - 3(me^{mx}) + 2(e^{mx}) = 2e^{-x}$

$m^2 e^{mx} - 3me^{mx} + 2e^{mx} = 2e^{-x}$

$e^{mx}(m^2 - 3m + 2) = 2e^{-x}$

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

$m = 0$

$\therefore$ G.F $: y = Ae^{mx} + 2e^{-x}$