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

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

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

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

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

$\frac{-4 \pm \sqrt{-1}\cdot\sqrt{4}}{2}$

$\frac{-4 \pm \sqrt{-1} \times 2}{2}$

$-2 \pm j \times 1$

$= -2 \pm j$ $\quad y = e^{-2x}(1\cos x + 0\sin x)$

PI $y = Ce^{-2x}$

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

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

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

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

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

$C = 2$

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

GS $= PI + CF + PI$

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

at $y = 1 \quad x = 0$

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

$1 = C + 2$

$C = 1 - 2$

$C = -1$

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

$-2 = (D + 2) + (-2)(C) - 2e^{-2x}$

$-2 = D - 2C - 2$

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

$-2 = D + 2 - 2$

$-2 = D$

$y = e^{-2x}(-1\cos x - 2\sin x) + 2e^{-2x}$

(B)

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

$3m^2 - 2m - 1$

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

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

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

$m = -\frac{1}{3} \quad m = 1$

CF

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

PS

$y = Cx + D$

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

Guard

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

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

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

$-3C + Cx = 2x$

$-Cx = 2x$

$-C = 2$

$C = -2$

$-2C - D = -3$

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

$4 - D = -3$

$-D = -3 - 4$

$D = 7$

PI

$y = -2x + 7$

GS

$y = Ae^{-1/2x} + Be^{2x} - 2x + 7$

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

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

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

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

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

$m = 2, m = 4$

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

DE

$y = Ce^{4x}$

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

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

$16Ce^{4x} - 6(4Ce^{4x}) + 8(Ce^{4x}) = 8e^{4x}$

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

$y = Cxe^{4x}$

$\frac{dy}{dx} = C_1(4e^{4x}) + Ce^{4x}$

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

$+ 4Ce^{4x}$

$= 16Cxe^{4x} + 8Ce^{4x} + 4Ce^{4x}$

$= 16Cxe^{4x} + 8Ce^{4x}$

$16Cxe^{4x} + 8Ce^{4x}$

$-6(4Cxe^{4x} + Ce^{4x}) +$

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

$16Cxe^{4x} + 8Ce^{4x} - 24Cxe^{4x}$

$-6Ce^{4x} + 8Cxe^{4x} = 8e^{4x}$

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

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

$2C = 8$

$C = 4$

PI

$y = 4xe^{4x}$

GS

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

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

$m^2 + 25 = 0$

$m^2 = -25$

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

$m = \pm i \times 5$

$m = \pm 5i$

C.F

$y = C\cos 5x - D\sin 5x$

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

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

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

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

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

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

$25C = 5$

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

$25D + 2C = 0$

$25D + \frac{2}{5} = 0$

$25D = -\frac{2}{5}$

$D = -\frac{2}{5} \div 25$

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

$25E = -\frac{2}{5}$

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

$y = \frac{1}{5}x^2 - \frac{1}{25}x - \frac{2}{125}$

G.S

$y = C\cos 5x - D\sin 5x + \frac{1}{5}x^2 - \frac{1}{25}x - \frac{2}{125}$

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

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

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

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

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

$m_1 = m_2 = -1$

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

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

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

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

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

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

$-2C = 4$

$C = -2$

$-2D = 0$

$D = 0$

P.I $y = -2\cos x$

G.S

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

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

$m^2 + 25 = 0$

$m^2 = -25$

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

$m = \pm i \times 5$

$m = \pm 5i$

C.F

$y = C\cos 5x - D\sin 5x$

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

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

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

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

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

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

$25C = 5$

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

$25D + 2C = 0$

$25D + \frac{2}{5} = 0$

$25D = -\frac{2}{5}$

$D = -\frac{2}{5} \div 25$

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

$25E = -\frac{2}{5}$

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

$y = \frac{1}{5}x^2 - \frac{1}{25}x - \frac{2}{125}$

G.S

$y = C\cos 5x - D\sin 5x + \frac{1}{5}x^2 - \frac{1}{25}x - \frac{2}{125}$

Ukemhoa [illegible]
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ENG 361
Assignment 1

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

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

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

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

$m_1 = -1$

$m_2 = 2$

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

P.I. $\Rightarrow y = c$

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

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

$= 0 - 0 - 2C = 8$

$-2C = 8$

$C = -4$

$y = -4$

G.S $y = Ae^{-x} + Be^{2x} + (-4)$

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

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

$m^2 - 4 = 0$

$m^2 = 4$

$m = \pm\sqrt{4}$

$m_1 = 2$

$m_2 = -2$

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

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

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

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

$9C - 4C = 10$

$5C = 10$

$C = \frac{10}{5}$

$C = 2$

P.I $= 2Ce^{3x}$

$= 2e^{3x}$

G.S: $Ae^{-2x} + Be^{2x} + 2e^{3x}$

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

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

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

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

$(m+1)(m+1)$

$m_1 = m_2 = -1$

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

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

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

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

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

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

$4C - 2C + C = 0$

$2C + C = 0$

$3C = 0$

$C = 0$