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15/ENG03/002
ENG 381

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

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

$m^2 + m - 2m - 2$

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

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

$m_1 = -x \quad m_2 = 2$

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

$P.I = y = C$

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

$0 - 0 - 2(c) = 8$

$-2c = 8$

$c = 8/-2$

$C = -4$

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

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

$m^2 - 4 = 0$

$m^2 - 2^2 = 0$

$m = \sqrt{2^2}$

$m \pm 2$

$y = [\cosh 2x + D \sinh 2x]$

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

$dy/dx = 3Ce^{-3x}$

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

$= 9Ce^{3x} - 4(Ce^{3x}) = 10C^{3x}$

$9C - 4C = 10$

$5C = 10$

$C = 2$

$y = \cosh 2x + D \sinh 2x + 2e^{3x}$

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

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

$m^2 + m + m + 1$

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

$m + 1 = 0$

$m = -1$

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

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

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

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

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

$4C - 4C + C = 1$

$C = 1$

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

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

$m^2 + 5^2 = 0$

$m = \sqrt{5}^2$

$m \pm 5i$

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

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

$dy = 2Cx + D$ & $\frac{d^2y}{dx^2} = 2C$

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

$= 25C = 5$ — (i)

$2C + 25E = 0$ — (ii)

$25D = 1$ — (iii)

Solving Simultaneously

$C = 1/5$

$D = 1/25$

Sub in eqn (1)

$\frac{2(1/5)}{2} + 25E = 0$

$\frac{1}{5} = -25E$

$E = \frac{1}{5} \div 25$

$E = -1/125$

$y = C\cos 5x + D\sin 5x + \frac{1}{5}x^2 + \frac{1}{25}x - \frac{3}{125}$

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

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

$m^2 - m - m + 1$

$m(m-1) - 1(m-1)$

$m - 1 = 0$

$m = 1$

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

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

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

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

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

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

$C - C - 2D + C = 0 \quad -(1)$

$C - D - 2C + D = 4 \quad -(2)$

$= -2D = 0$

$= D = 0$

$= 2C = 4$

$C = 4/2$

$C = 2$

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

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

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

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

$= \frac{4 \pm \sqrt{4^2 - 4 \times 1 \times 5}}{2 \times 1}$

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

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

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

$= -2 \pm j$

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

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

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

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

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

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

$C = 2$

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

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

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

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

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

$3m - 1 = 0 \quad \& \quad m + 1 =$

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

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

$P.I = y = Cx + D$

$\frac{dy}{dx} = C \quad \& \quad \frac{d^2y}{dx^2} = 0$

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

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

$C = -2$

$-2C + D = -3$

$C = -2$

$-2C + D = -3$

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

$4 + D = -3$

$D = -7$

$y = Ae^{-1/3x} + Be^{x} - 2x - 7$

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

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

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

$m(m-2) - 4(m-2)$

$(m-4)\,\&\,(m-2) = 0$

$m_1 = 2 \;\&\; m_2 = 4$

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

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

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

$\frac{d^2y}{dx^2} = 16Cxe^{4x} + 8Ce^{4x}$

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

$Cxe^{4x} 6Ce^{4x} + 8Cxe^{4x}$

$= 8C4^{x} - 16Cx + 8C - 24x$

$-6c + 8cx = 8$

$2c = 8$

$c = 8/2$

$C = 4$

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