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W/edu/22/036
Computer E/G

Assignment 1.

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

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

$m^2 - m - 2 = 0$

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

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

$\frac{-1 \pm \sqrt{1+8}}{2} = \frac{-1 \pm 3}{2}$

$m_1 = \frac{-1+3}{2} = 1$ or $m_2 = \frac{-1-3}{2} = -2$

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

P.I

$y = C$

$dy/dx = 0 \quad d^2y/dx^2 = 0$

$\therefore -2C = 8$

$C = -4$

$y = -4$

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

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

$\frac{d^2y}{dx^2} - 4y = 0$

$m^2 - 4$

$m = \pm 2$

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

P.I;

$y = Ce^{3x}$

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

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

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

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

$C = 2$

$\therefore y = 2e^{3x}$

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

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

C.F:

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

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

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

$m_1 = m_2 = m = 1$

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

P.I

$y = Ce^{-2x}$

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

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

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

$C = 1$

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

G.S.

$y = e^{-x}(A + Bx) + e^{-3x}$

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

$\frac{d^2y}{dx^2} + 25y = 0$

CF: $m^2 + 25 = 0$

$m^2 = -25$

$m = \sqrt{-25}$

$m = i\sqrt{25}$

$m = \pm j5$

Compare to $\alpha \pm j\beta$

$\alpha = 1$; $\beta = 5$

$y = e^x(A\cos 5x + B\sin 5x)$

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

$\frac{dy}{dx} = 2(x + D$

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

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

$2c + 25(x^2 + 25Dx + 25E = 5x^2 + x$

Compare L.H.S to R.H.S

$25C = 5$ $\quad 25D = 1$ $\quad 2c + 25E = 0$

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

$E = -2/5 \div 25 = -2/125$

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

GS $\Rightarrow$

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

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

CF

$\frac{d^2y}{dx^2} - 2dy/dx + y = 0$

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

$(m-1)^2$

$m_1 = m_2 = m = 1$

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

P.I

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

$dy/dx = -C\sin x + D\cos x$

$d^2y/dx^2 = -C\cos x - D\sin x$

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

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

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

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

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

$= 4\sin x$

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

Compare LHS to RHS

$2C = 4$; $C = 2$

$-2D = 6$; $D = 0$

$\therefore y = 2\cos x$

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

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

C.F.

$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 0$

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

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

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

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

P.I.

$y = Ce^{-2x}$

$dy/dx = -2Ce^{-2x} \quad d^2y/dx^2 = 4e^{-2x}$

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

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

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

$C = 2$

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

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

When $x = 0,\ y = 1$

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

$1 = 1(A) + 2$

$A = 1 - 2 = -1$

$dy/dx = \frac{d(y)}{dx}$

$u = e^{-x} \quad V = A\cos x + B\sin x$

$\frac{du}{dx} = -2e^{-2x} \quad \frac{dv}{dx} = -A\sin x + B\cos x$

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

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

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

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

$-2 = 1(B + A(-2) - A$

$-2 = B - 2A - 4$

$2 = B - 2A$

$B = 2 + 2A$

$A = -1$

$B = 2 + 2(-1)$

$B = 0.$

$\therefore y = e^{-2x}(-\cos x + 0) = e^{-2x}(\cos x)$

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

$3\frac{d^2y}{dx^2} - \frac{dy}{dx} - y = 0$

C.F.

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

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

$m = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3 \times -1)}}{2(3)}$

$= \frac{2 \pm \sqrt{4+12}}{6} = \frac{1}{3} \pm \frac{4}{6}$

$m_1 = \frac{1+2}{3} = 1 \quad m_2 = \frac{1-2}{3} = -\frac{1}{3}$

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

P.I

$y = Cx + D$

$dy/dx = C \qquad d^2y/dx^2 = 0$

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

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

Compare LHS & RHS

$-C = 2 \; ; \; -2C - D = -3$

$C = -2 \; ; \; -2(-2) - D = -3$

$4 - D = -3$

$D = 4 + 3 = 7$

$y = -2x + 7$

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

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

$\frac{d^2y}{dx^2} - 6\,dy/dx + 8y = 0$

C.F

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

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

$= \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1 \times 8)}}{2(1)}$

$= \frac{6 \pm \sqrt{4}}{2} = 3 \pm 1$

$m_1 = 3+1 = 4 \quad m_2 = 3-1 = 2$

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

P.I

$y = Ce^{4x}$

$dy/dx = 4Ce^{4x}$

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

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

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

$0C = 8e^{4x}$

$C = 0$

$y = 0$

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