OBILOM CHIDERA
16/ENG04/068
ELECT/ELECT ENG381

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

$m^2 - m - 2 = 0$

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

$m_1 = 2 \quad m_2 = -1$

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

$y = c$

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

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

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

$2c = 8$

$c = 4$

$y = -4$

G.E $\Rightarrow$ C.F + P.I

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

② $\frac{d^2y}{dx^2} - 4y = 10e^{3x}$

$m^2 - 4 = 0$

$m^2 = 4$

$m = \pm\sqrt{4} = \pm 2$

C.F $\Rightarrow y = C\cosh 2x + D\sinh 2x$

$y = ce^{3x}$

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

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

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

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

$5c = 10$

$c = \frac{10}{5} = 2$

P.I $\rightarrow y = 2e^{3x}$

G.E $= C\cosh 2x + D\sinh 2x + 2e^{3x}$

OBILOMA CHIDERA
16/ENG04/068
ELECT/ELECT

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

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

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

$m_1 = m_2 = -1$

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

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

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

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

$C = 1$

P.I. $y = e^{-2x}$ } $GE = e^{-x}(A + Bx) + e^{-2x}$

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

$m^2 + 25 = 0$

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

$m = \pm j5$

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

$y = Cx^2 + Dx + E$

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

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

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

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

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

$2C + 25E = 0$ ---①

$25C = 5$ ---②

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

$25D = 1$ ---③

$\boxed{D = \frac{1}{25}}$

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

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

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

OBILOM CHIDERA
16/ENG04/068
ELECT/ELEC1

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

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

$(m-1)^2 = 0$

$m_1 = 1, m_2 = 1$

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

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

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

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

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

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

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

$C = 2$

$2D\cos x = 0$

$D = 0$

$y = 2\cos x$.

GE $\Rightarrow e^x(A + Bx) + 2\cos x$

(6) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 2e^{-2x}$ where $x = 0$, $y = 1$ & $\frac{dy}{dx} = -2$.

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

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

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

$y = Ce^{-2x}$

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

$y'' = 4Ce^{-2x}$

OBILOM CHIDERA
16/ENG04/068
ELECT/ELECT

(b) Cont.

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

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

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

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

$$C = 2$$

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

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

When $x = 0$, $y = 1$

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

$$1 = A + 2$$

$$A = 1 - 2$$

$$A = -1$$

When $\frac{dy}{dx} = -2$

$$\frac{dy}{dx} = -2Ae^{-2x}\sin x - 2Be^{-2x}\cos x - 4e^{-2x}$$

$$-2 = -2Ae^{-2(0)}\sin(0) - 2Be^{-2(0)}\cos(0) - 4e^{-2(0)}$$

$$-2 = -2B - 4$$

$$-2B = 2$$

$$B = -1$$

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

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

OBILOM CHIDERA
16/ENG04/068
ELECT/ELECT

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

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

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

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

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

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

$y = Cx + D$
$y' = C$
$y'' = 0$

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

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

$D = 7$

P.I. $y = -2x + 7$

GE $\Rightarrow$ $y = Ae^{x} + Be^{-0.33x} - 2x + 7$

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

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

$m = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{6 \pm \sqrt{36 - 32}}{2}$

$m_1 = 4, \quad m_2 = 2 \Rightarrow y = Ae^{4x} + Be^{2x}$

$y = Cxe^{4x}, \quad y' = 4Cxe^{4x} + Ce^{4x}, \quad y'' = 16Cxe^{4x} + 4Ce^{4x} + 4Ce^{4x}$

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

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

$C(2) = 8$

$C = 4 \Rightarrow y = 4xe^{4x}$

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