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16/ENG03/061
CIVIL ENGINEERING

ASSIGNMENT

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

$m^2 - m - 2 = 0$

$m = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$, $m = \frac{+1 \pm \sqrt{(-1)^2-4(1)(-2)}}{2(1)}$

$m = \frac{1 \pm \sqrt{9}}{2}$ $m_1 = 2$ $m_2 = -1$

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

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

P.I: $y = c$

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

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

$-2c = 8$

$c = -4$

P.I: $y = 4$

G.S = C.F + P.I

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

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

$m^2 - 4 = 0$

$m^2 = 4$

$m_1 = 2$, $m_2 = -2$

C.F: $y = A\cosh 2x + B\sinh 2x$

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

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

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

$9C - 4C = 0$

$5C = 10$ $C = 2e^{3x}$

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

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

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

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

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

$m = -1$ Twice

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

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

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

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

$4C - 4C + C = 1$

$C = 1$

P.I: $y = 1e^{-2x}$

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

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

$m^2 + 25 = 0$

$m^2 = -25$

$m = 5i$

C.F: $y = e^{0x}(A\cos 5x + B\sin 5x)$

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

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

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

$2C + 25E = 0$

$C = 5/25 = 1/5$

$D = 1/25$ $\quad E = -2/5 \times \frac{1}{25}$

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

G.S: $y = e^{0x}(A\cos 5x + B\sin 5x) + 1/5x^2 + 1/25x - \frac{2}{125}$

$y = A\cos 5x + B\sin 5x + (x^2 + 1/5x - 2/25)\ 1/5$

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

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

$(x-1)(x-1)$

$x = 1$ Twice

C.F : $y = e^x(A + Bx)$

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

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

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

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

$-2D = 0$

$2C = 4 \quad C = 2$ P.I : $y = 2\cos x + 0$

G.S : $y = e^x(A + Bx) + 2\cos x$

6) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 2e^{-2x}$ given that $x = 0, y = 1$ and $dy/dx = -2$

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

$m = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$; $m = \frac{-4 \pm \sqrt{16 - 4(1)(5)}}{2(1)}$

$m = \frac{-4 \pm \sqrt{-4}}{2}$, $m = \frac{-4 \pm 2j}{2}$ $m = -2 \pm j$

$\alpha = -2 \quad \beta = 1$

C.F : $y = e^{-2x}(A\cos 1x + B\sin 1x)$

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

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

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

$C = 2$

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

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

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

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

IF $x=0$ $y=1$ and $dy/dx = -2$

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

$1 = 1(A) + 2$

$A = -1$

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

$-2 = 1(B) - 1(A) - 4 \qquad -2 = B - 1 - 4$

$B = 5$

G.S: $y = e^{-2x}(-\cos 2x - 5\sin 2x) + 2e^{-2x}$

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

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

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

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

C.F: $y = Ae^{x} + Be^{-x/3}$

P.I $= y = cx + D$

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

$3(0) - 2(c) - (cx - D) = 2x - 3$

$-2c - cx - D = 2x - 3$

$-cx = 2x, \quad c = -2$

$-2c - D = -3$

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

$4 - D = 3$

$D = 7$

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

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

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

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

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

$m_1 = 4, \quad m_2 = 2$

C.F : $y = Ae^{4x} + Be^{2x}$

P.I : $y = Ce^{4x}$

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

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

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

$0C = 8$

$C = 0$

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