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MATRIC NO: 15/EN04/49

DEPARTMENT: PETROLEUM ENGINEERING

COURSE: ENG 581 (ENGINEERING MATHEMATICS II)

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Q1)

$$d^2y/dx^2 - 4y/dx - 2y = e^{3x}$$

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

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

$$m = 2, m = -1$$

$$y = Ae^{mx} + Be^{nx}$$

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

P.I

$$y = C$$

$$d^2y/dx^2 = 0$$

$$d^2y/dx^2 = 0$$

$$= 0 - 0 - 2C = 8$$

$$C = -8/2$$

$$G.S = C.F + P.I$$

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

NO

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

C.F

$$m^2 - 4 = 0$$

$$m^2 = 4$$

$$m = \pm 2$$

$$m = \pm 2$$

$$y = A \cos 2x + B \sin 2x$$

P.I

$$y = Ce^{3x}$$

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

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

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

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

Divide through by e^{3x}

$$9C - 4C = 10$$

$$5C = 10$$

$$C = 2$$

$$G.S = C.F + P.I$$

$$= A \cos 2x + B \sin 2x + 2e^{3x}$$

NO3)

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

C.F

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

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

$$m_1 = -1, m_2 = -1 \text{ (repeated)}$$

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

P.I

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

$$dy/dx = -2Ce^{-2x}$$

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

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

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

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

$$e^{-2n} + e^{2n}$$

C.C.

General solution

$$e^{-2n} (A + Bn) + e^{2n}$$

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

C.F.

$$m^2 + 25 = 0$$

$$m^2 = -25$$

$$m = \pm 5i$$

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

$$m = 5i$$

$$y = A \cos 5x + B \sin 5x$$

$$= A \cos 5x + B \sin 5x$$

P.2

$$y = Cx^2 + Dx + E$$

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

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

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

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

$$5x^2 + x$$

Comparing coefficient

$$25C = 5$$

$$C = \frac{5}{25} = \frac{1}{5}$$

$$25D = 1$$

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

$$2C + 25E = 0$$

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

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

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

The general solution is

$$A \cos 5x + B \sin 5x + \frac{25x^2 + 5x - 2}{125}$$

NO5)

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

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

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

m = 1 twice

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

P.2

$$y = (\cos x + \sin x)$$

$$\frac{dy}{dx} = (\sin x - \cos x)$$

$$\frac{d^2y}{dx^2} = (\cos x + \sin x)$$

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

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

$$2(\sin x - 2\cos x) = 4\sin x$$

Comparing coefficient

$$2C = 4$$

$$C = \frac{4}{2} = 2$$

$$2D = 0, \quad 0 = 0$$

$$y = 2\cos x + 0\sin x = 2\cos x$$

General solution =

$$e^{3x} (A + Bx) + 2\cos x$$

NO6)

$$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 2e^{-3x}$$

Given that at $x=0, y=1$

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

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

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

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

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

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

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

$$= -2 \pm j$$

$$m_1 = -2 + j \text{ and } m_2 = -2 - j$$

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

P-2

$$y = C e^{-2n}$$

$$dy/dn = -2C e^{-2n}$$

$$d^2y/dn^2 = 4C e^{-2n}$$

$$4C e^{-2n} + 4(-2C e^{-2n}) + 5C e^{-2n} = 2e^{-2n}$$

$$4C e^{-2n} - 8C e^{-2n} + 5C e^{-2n} = 2e^{-2n}$$

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

$$C = 2$$

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

General solution

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

$$\text{at } n=0, y=1$$

NO 7) $5dy/dn - 2dy/dn - y = 2n - 3$

$$= 2n - 3$$

C-2

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

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

$$3m = -1 \text{ or } m = 1$$

$$m = -1/3, m = 1$$

$$y = A e^{-1/3n} + B e^n$$

P-2

$$y = C(n+1)$$

$$dy/dn = C$$

$$d^2y/dn^2 = 0$$

$$5(0) - 2(C) - (Cn+D)^2 = 2n - 3$$

$$0 - 2C - (n+D)^2 = 2n - 3$$

Comparing coefficient

$$n^0 - C = 2$$

$$C = -2$$

$$\text{Constants } [-2C - D = -3]$$

$$4 - D = -3$$

$$-D = -3 - 4$$

$$+D = -7$$

$$D = 7$$

$$y = -2n + 7$$

General solution

$$A e^{-1/3n} + B e^n - 2n + 7$$

NO 8)

$$dy/dn = -6dy/dn + 8y = 8e^{4n}$$

C-F

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

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

$$m = 4; m = 2$$

$$y = A e^{4n} + B e^{2n}$$

P-2

$$y = C n e^{4n}$$

$$dy/dn = [n \cdot 4e^{4n} + e^{4n}] C$$

$$d^2y/dn^2 = 4C [n \cdot 4e^{4n} + e^{4n}] + 4C e^{4n}$$

$$= 16C n e^{4n} + 4C e^{4n} + 4C e^{4n}$$

$$16C n e^{4n} + 8C e^{4n} - 6 [4C n e^{4n} + C e^{4n}] + 8C n e^{2n} = 8e^{4n}$$

$$16C n e^{4n} + 4C e^{4n} + 4C e^{4n}$$

$$- 24C n e^{4n} - 6C e^{4n} + 8C n e^{2n}$$

$$= 8e^{4n}$$

$$16cn + 4c + 4c - 24cn - 6c +$$

$$8cn = 8$$

$$= -8cn + 2c + 8cn = 8$$

$$2c = 8$$

$$c = 8/2$$

$$c = 4$$

$$y = 4e^{4n}$$

General solution

$$Ae^{7n} + Be^{2n} + \underline{\underline{4ne^{4n}}}$$