



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Coimbatore-641035.



UNIT-II ORDINARY DIFFERENTIAL EQUATIONS

SIMULTANEOUS FIRST ORDER LINEAR DIFF. EQUATIONS

Solve the below simultaneous linear differential equations for problem 3.

Prob: 3

$$\frac{dx}{dt} + 2x + 3y = 2e^{2t}$$

$$\frac{dy}{dt} + 3x + 2y = 0$$

$$Dx + 2x + 3y = 2e^{2t}$$

$$Dy + 3x + 2y = 0$$

$$(D+2)x + 3y = 2e^{2t}$$

$$3x + (D+2)y = 0$$

$$0 \rightarrow (D+2) \Rightarrow (D+2)^2 x + 3(D+2)y = 2(D+2)e^{2t}$$

$$② \times ③ \rightarrow 9x + 3(D+2)y = 0$$

$$(D+2)^2 x - 9x = 20(e^{2t} + 4e^{2t})$$

$$(D^2 + 4D + 4 - 9)x = 4e^{2t} + 4e^{2t}$$

$$(D^2 + 4D - 5)x = 8e^{2t}$$

The A.E

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



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$$(m+5)(m-1)=0.$$

$$m=-5, m=1$$

$$C.F = Ae^{-5t} + Be^t.$$

$$P.I = \frac{1}{D^2+4D-5} 8e^{2t}$$

$$= \frac{1}{7} 8e^{2t}.$$

$$P.I = \frac{8}{7} e^{2t}.$$

$$x = C.F + P.I = Ae^{-5t} + Be^t + \frac{8}{7} e^{2t}$$

$$D = \frac{dx}{dt} = -5Ae^{-5t} + Be^t + \frac{16}{7} e^{2t}$$

Sub x and D in eqn ①.

$$[-5Ae^{-5t} + Be^t + \frac{16}{7} e^{2t} + 2] [Ae^{-5t} + Be^t + \frac{8}{7} e^{2t}] + 3y = 2e^{2t}$$

$$-5Ae^{-5t} + Be^t + \frac{16}{7} e^{2t} + 2[Ae^{-5t} + Be^t + \frac{8}{7} e^{2t}] + 3y - 2e^{2t} = 0$$

$$-5Ae^{-5t} + Be^t + \frac{16}{7} e^{2t} + 2Ae^{-5t} + 2Be^t + \frac{16}{7} e^{2t} + 3y - 2e^{2t} = 0$$

$$-3Ae^{-5t} + 3Be^t + \frac{18}{7} e^{2t} + 3y = 0$$

$$3y = 3Ae^{-5t} - 3Be^t - \frac{18}{7} e^{2t}$$

$$y = \frac{3Ae^{-5t}}{3} - \frac{3Be^t}{3} - \frac{18}{7 \times 3} e^{2t}$$

$$y = Ae^{-5t} - Be^t - \frac{6}{7} e^{2t}$$