Sandip Foundation's
Sandip Institute of Technology & Research Centre, Nashik.
S. E.. Mathematics III
UNIT I : Assignment I : Linear Differential Equation
Solve the following differential equations:

1. $\frac{d^3y}{dx^3} + 4 - \frac{dy}{dx} = 2\cosh^2(2x)$

2. $(D^3 - 5D^2 + 8D - 4)y = 2e^x + e^{2x}$

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

4. $(D^2 + 6D + 9)y = 5^x - \log 2.$

5. $\frac{d^3y}{dx^3} + y = \cos^2\frac{x}{2}$

6. $(D^2 - 2D + 4)y = 3x^2 - 5x + 2$

7. $\frac{d^3y}{dx^3} - 2\frac{dy}{dx} - 2y = x^2 + e^{-x} + 1.$

7. $(D^4 - 2D^3 - 3D^2 + 4D + 4)y = x^2 e^x$

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

10. $(D^2 + D + 1)y = x \sin x$

11. $(D - 1)^3 y = e^x + 2^x + 3.$

11. $\frac{d^2y}{dx^2} - y = e^{-x}\sin e^{-x} + \cos e^{-x}$

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

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

11 $x^2\frac{d^2y}{dx^2} - 5x\frac{dy}{dx} + 3y = \frac{\log x}{x^2}$

12.$(5+2x)^2\frac{d^2y}{dx^2} - 6(5+2x)\frac{dy}{dx} + 8y = 5\log(5+2x)$

13. $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \tan x$ (using method of parameters)

14. $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + y = e^{2x}\sec^2 x$ (using method of parameters)

15. $\frac{dx}{dt} + y = \sin t$, $\frac{dy}{dt} + 4x = \cos t.$

16. $\frac{dx}{dt} + 2x - 3y = t$, $\frac{dy}{dt} - 3x + 2y = e^{2t}$

17. $\frac{dx}{y^2} = \frac{dy}{x^2} = \frac{dz}{x^2y^2z^2}$

18. $\frac{dx}{xy} = \frac{dy}{y^2} = \frac{dz}{xyz - 2x^2}$

19. $(D - 1)^2 (D^2 + 1)y = e^x + \sin^2\frac{x}{2}$

20. $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} + 2y = 10\left(x + \frac{1}{x}\right)$

21. $(1 + x)^2\frac{d^2y}{dx^2}(1 + x)\frac{dy}{dx} + y = 4\cos[\log(1 + x)$

22.. $((3x + 2))^2\frac{d^2y}{dx^2} + 3((3x + 2))\frac{dy}{dx} - 36y = 3x^2 + 4x + 1.$

23. $\frac{dx}{x^2 + y^2} = \frac{dy}{2xy} = \frac{dz}{z(x + y)^2}$

24. $\frac{dx}{x(y^2 - z^2)} = \frac{dy}{y(z^2 - x^2)} = \frac{dz}{z(x^2 - y^2)}$

29. The differential equation is $\frac{d^2x}{dt^2} + 2k\frac{dx}{dt} + n^2 x = 0 \; (k < n)$ represent the damped harmonic oscillations of a particle. Solve this equation.

30. A mass of 10 kg is attached to a spring having spring constant 140 N/m. The mass is started in motion from equilibrium position with velocity of 1 m/sec. In the upward direction and with an applied external force of 5 sint. Find the subsequent motion of mass if the force due to air resistance is $9\frac{dx}{dt}$ N. (Hint : $\frac{d^2x}{dt^2} + 9\frac{dx}{dt} + 14x = \frac{1}{2}\sin t$) .

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