

(Pages : 4)

S – 1633

Reg. No. :

Name :

Fifth Semester B.Sc. Degree Examination, December 2023

First Degree Programme Under CBCSS

Mathematics

Core Course

MM 1544 – DIFFERENTIAL EQUATIONS

(2018 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – I

Answer **all** the questions.

1. Define order of an ordinary differential equation.
2. Give an example for an exact differential equation.
3. Integrating factor of $Mdx + Ndy = 0$ is _____.
4. A first-order ordinary differential equation is _____, if it can be brought into the form $y' + p(x)y = r(x)$.
5. Define an autonomous ordinary differential equation.
6. Give an example for homogenous linear order differential equation of second order.
7. Find a general solution of equation $y'' - y = 0$.

P.T.O.

8. Define singular solution of a differential equation.
9. Find the wronskian of e^x and e^{-x} .
10. Verify that the function $y = 2(1 + \cos x)$ is a solution of $y'' + y = 2$.

(10 × 1 = 10 Marks)

SECTION – II

Answer **any eight** questions.

11. Solve $y' = -2xy$, $y(0) = 1.8$.
12. Solve $2xydx + x^2dy = 0$.
13. Verify the differential equation $\cos(x + y)dx + (3y^2 + 2y + \cos(x + y))dy = 0$ is exact or not.
14. Find an equation of a curve with x -intercept 1 and whose tangent line at any point (x, y) has slope xe^y .
15. Find a general solution of $y' - y = 5.2$.
16. Verify by substitution that the functions $y = \cos x$ and $y = \sin x$ are solutions of the differential equation $y'' + y = 0$.
17. Solve $y'' - 4y = 0$.
18. Find a differential equation of the form $y'' + ay' + by = 0$ for which the functions e^{2x} , e^{-2x} form a basis.
19. Solve $x^2y'' - 2y = 0$.
20. Check whether the functions $x + 4$, $-3x - 12$ ($x > 0$) are linearly dependent or not.
21. Find $(D - 3)^2 e^{-x}$.
22. Find a second-order homogenous linear ordinary differential equation for which $y = A \cos 5x + B \sin 5x$ is a general solution.

(8 × 2 = 16 Marks)

SECTION – III

Answer **any six** questions.

23. Solve $2xy \, y' = y^2 - x^2$.
24. Under what conditions for the constants a, b, k, l is $(ax + by) \, dx + (kx + ly) \, dy = 0$ exact? Solve the exact ordinary differential equation.
25. Solve the initial value problem $y' + y \tan x = \sin 2x$, $y(0) = 1$.
26. Find the orthogonal trajectories of family of ellipses $\frac{1}{2}x^2 + y^2 = c$.
27. Show that for a second order homogenous linear differential equation, any linear combination of two solutions on an open interval I is again a solution of the differential equation on I .
28. Solve the initial value problem $y'' - 3y' - 4y = 0$, $y(0) = 2$, $y'(0) = 1$.
29. Find a general solution of $y'' + 5y' + 6y = 2e^{-x}$.
30. Factor $P(D) = D^2 - 3D - 40I$ and solve $P(D)y = 0$.
31. Solve $x^2y'' - 5xy' + 9y = 0$.

(6 × 4 = 24 Marks)

SECTION – IV

Answer **any two** questions.

32. (a) Find an integrating factor and solve the initial value problem $(e^{x+y} + ye^y) + (xe^y - 1)dy = 0$, $y(0) = 1$.
(b) Solve $(-\sin x \tan y + 1)dx + \cos x \sec^2 y \, dy = 0$.
33. (a) Solve $y' + y = -\frac{x}{y}$.
(b) Solve $y' = (y + 4x)^2$.

34. (a) Find a general solution of $y'' + 4y' + 4y = e^{-x} \cos x$.

(b) Find a general solution of $y'' + 3y' + 2y = 12x^2$.

35. (a) Solve $y'' + y = \sec x$.

(b) Solve the non homogenous linear ordinary differential equation by variation of parameters $y'' - 4y' + 5y = e^{2x} \operatorname{cosec} x$.

(2 × 15 = 30 Marks)