

B. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2025**SEMESTER 5 : MATHEMATICS****COURSE : 19U5CRMAT6 : DIFFERENTIAL EQUATIONS***(For Regular 2023 Admission and Supplementary 2022/ 2021/ 2020/ 2019 Admissions)*

Time : Three Hours

Max. Marks: 75

PART A**Answer any 10 (2 marks each)**

1. What is the solution of a linear differential equation if the roots of the auxiliary equation is $2+i, 2-i, 2+i, 2-i$.
2. Form a partial differential equation by eliminating arbitrary constants from $z = ax + by + a^2 + b^2$
3. Eliminate the arbitrary function from the equation $z = x + y + f(xy)$
4. Solve $\frac{d^4y}{dx^4} - 5\frac{d^2y}{dx^2} - 4y = 0$
5. What is regular singular point?
6. Verify that the function $y = \sqrt{2}\cos x + 9\sin x$ is a solution of the homogeneous linear differential equation $y'' + y = 0$
7. Find the integrating factor of linear equations $\frac{dy}{dx} + \left(\frac{2x+1}{x}\right)y = e^{-2x}$.
8. Eliminate a and c from $x^2 + y^2 + (2-c)^2 = a^2$
9. Write the Bessel's equation.
10. What is the transformation that is used to solve Homogeneous differential equation.
11. Find the regular singular point of $x^2(x-2)^2\frac{d^2y}{dx^2} + 2(x-2)\frac{dy}{dx} + (x+1)y = 0$?
12. Check whether the equation $(xy^2 - e^{1/x^3})dx - x^2ydy = 0$ is exact.

(2 x 10 = 20)**PART B****Answer any 5 (5 marks each)**

13. Solve by the method of undetermined coefficients $y'' - 6y' + 8y = 3e^{2x}$
14. Find the general solution of $y'' - 3y' + 2y = 14\sin 2x - 18\cos 2x$
15. Solve $\frac{dx}{x(y^2 + z)} = \frac{dy}{-y(x^2 + z)} = \frac{dz}{z(x^2 - y^2)}$
16. Given that $y = x$ is a solution of $x^2\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 4y = 0$, find a linearly independent solution by reducing the order.
17. Solve $\frac{dx}{mx - ny} = \frac{dy}{nx - lz} = \frac{dz}{ly - mx}$
18. Find the general solution of $y'' + y = 0$ in terms of power series in x .
19. Find the orthogonal trajectories of $y = cx^3$
20. Solve $\tan(\theta)dr + 2r d\theta = 0$

(5 x 5 = 25)

PART C

Answer any 3 (10 marks each)

21. Solve the initial value problem $(6x + 4y + 1)dx + (4x + 2y + 2)dy = 0, y(1/2) = 3$
22. Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 2x^2 + e^x + 2xe^x + 4e^{3x}$.
23. Use the method of Frobenius to find the solution of the differential equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 + \frac{5}{4})y = 0$ in some interval $0 < x < R$
24. (a) Find the integral curves of the equation $\frac{dx}{x+z} = \frac{dy}{y} = \frac{dz}{z+y^2}$
(b) Find the general solution of the differential equation $x^2p + y^2q = (x+y)z$
(10 x 3 = 30)