



K23U 2368

Reg. No. :

Name :

**V Semester B.Sc. Degree (CBCSS – O.B.E. – Regular/Supplementary/
Improvement) Examination, November 2023
(2019 – 2021 Admissions)**

CORE COURSE IN MATHEMATICS

5B08 MAT : Differential Equations and Laplace Transforms

Time : 3 Hours

Max. Marks : 48

PART – A

(Short Answer)

Answer **any four** questions from this Part. **Each** question carries **1** mark. **(4×1=4)**

1. Solve the differential equation $y' = 1 + y^2$.
2. Check whether the equation $-ydx + xdy = 0$ is exact.
3. Give an example of a non-homogeneous differential equation.
4. Solve $y'' - y = 0$.
5. State the linearity property of the Laplace transform.

PART – B

(Short Essay)

Answer **any eight** questions from this Part. **Each** question carries **2** marks. **(8×2=16)**

6. Find the order and degree of the differential equation $\frac{d^2y}{dx^2} + \left[1 + \left(\frac{dy}{dx} \right)^2 \right]^{\frac{3}{2}} = 0$.
7. Prove that e^x is an integrating factor of $\sin y \, dx + \cos y \, dy = 0$ and solve it.



8. Find the orthogonal trajectories of the curve $y = ce^{-x}$.
9. State the existence theorem of first order differential equations.
10. Solve the initial value problem $y'' - y' - 2y = 0$, $y(0) = -4$, $y'(0) = -17$.
11. Check whether the solutions x^2 and $x^2 \ln x$ are linearly independent.
12. Find the Laplace transform of $a + bt + ct^2$.
13. Solve $y'' + 25y = 0$.
14. Find the inverse Laplace transform of $\frac{12}{(s-3)^4}$.
15. Write the standard form of Euler Cauchy equation. Give an example.
16. Solve $2x \tan y \, dx + \sec^2 y \, dy = 0$.

PART - C
(Essay)

Answer **any four** questions from this Part. **Each** question carries **4** marks. **(4×4=16)**

17. Find the general solution of $y' - y = e^{2x}$.
18. Solve $y'' + 2y' + y = x^2$.
19. Let $f(t) = t \sin wt$, find the Laplace transform of $f(t)$.
20. Check for exactness and solve the initial value problem, $ye^x dx + (2y + e^x) dy = 0$, $y(0) = -1$.
21. Solve $y' = (y + 4x)^2$.
22. Solve $(\cot y + x^2) dx = x \csc^2 y dy$.
23. Solve $y'' + y = \sec x$.



PART – D
(Long Essay)

Answer **any two** questions from this Part. **Each** question carries **6** marks. **(2×6=12)**

24. Using Laplace transforms, solve the integral equation, $y(t) = 1 - \int_0^t (t - \tau) y(\tau) d\tau$.

25. Solve $4x^2D^2 + 24xD + 25y = 0$, $y(1) = 2$, $y'(1) = -6$.

26. Solve $y'' + 2y' + 5y = 1.25e^{0.5x} + 40 \cos 4x - 55 \sin 4x$, $y(0) = 0.2$, $y'(0) = 60.1$.

27. Find an integrating factor and solve the initial value problem

$$2\sin(y^2)dx + xycos(y^2)dy = 0, y(2) = \sqrt{\frac{\pi}{2}}.$$

