



K25U 2352

Reg. No. :

Name :

**V Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Regular/Supplementary/
Improvement) Examination, November 2025
(2019 to 2023 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. Is the differential equation $y^2 dx + 2xy dy = 0$ exact ?
2. Solve $\frac{dy}{dx} = 1 + y^2$.
3. Solve $y'' + y' = 0$.
4. Write the characteristic equation of $y'' + 2y' + 10y = 0$.
5. Define the Laplace transform of $f(t)$ for $t > 0$.

**PART – B
(Short Essay)**

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

6. State the existence theorem of first order differential equation.
7. Show that $y = A \sin 5x$ is a solution of the differential equation $\frac{d^2 y}{dx^2} + 25y = 0$.
8. Solve $\frac{dy}{dx} + \sqrt{\frac{1-y^2}{1-x^2}} = 0$.
9. Verify whether the functions $x + 1$ and $x - 1$ are linearly independent.
10. Find a general solution of $y'' - 2y' - 2y = 0$.

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11. Give an example of Bernoulli's differential equation.
12. Write the general form of Euler-Cauchy equation.
13. Find the Wronskian of $e^{-x} \cos x$, $e^{-x} \sin x$.
14. Find $L(\cosh 2t - 1)$.
15. Find $L^{-1}\left(\frac{s+2}{(s+2)^2+9}\right)$.
16. Find the convolution of t and e^t .

**PART – C
(Essay)**

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

17. Find an integrating factor of $(3xy + y^2) + (x^2 + xy) \frac{dy}{dx} = 0$.
18. Solve the equation $x \frac{dy}{dx} + y = x^3 y^6$.
19. Solve the equation $(3x^2 + 4xy) dx + (2x^2 + 2y) dy = 0$.
20. Find the general solution of $xy'' + 2y' = 0$.
21. Solve $(D^2 + 2D + 1)y = e^{2x} + x^2$.
22. Solve the initial value problem using Laplace transform :
 $y'' + y' - 6y = 1$, $y(0) = 0$, $y'(0) = 1$.
23. Find the inverse Laplace transform of $\frac{s^2 - 3s + 4}{s^3}$.

**PART – D
(Long Essay)**

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

24. Solve $\frac{dy}{dx} + \left(\frac{2x+1}{x}\right)y = e^{-2x}$.
25. Solve by the method of Variation of Parameters : $\frac{d^2 y}{dx^2} + y = \tan x$.
26. Solve $\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} - 8y = 4e^{2x} - 21e^{-3x}$.
27. Find $L^{-1}\left[\frac{3s+1}{(s-1)(s^2+1)}\right]$.