



K21U 4553

Reg. No. :

Name :

V Semester B.Sc. Degree CBCSS (OBE) Regular Examination, November 2021

(2019 Admn. Only)

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. **Each** question carries 1 mark.

1. Verify that $y = e^{2x^2}$ is a solution of the ODE $y' - 4xy = 0$.
2. Give an example of a first order nonlinear ODE.
3. Find a basis of solutions of the ODE $y'' - 4y = 0$.
4. What is Euler-Cauchy equations ?
5. State convolution theorem. (4×1=4)

PART – B

(Short Essay)

Answer **any eight** questions. **Each** question carries 2 marks.

6. Solve the initial value problem $y' = 6y$, $y(0) = 2$.
7. Does the initial value problem $xy' = y - 1$ has a unique solution ? Justify.
8. Solve the IVP $y' = -4x/y$, $y(2) = 3$.
9. Find the general solution of $y' + ky = e^{-kx}$.
10. Find the general solution of $4y'' - 25y = 0$.

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11. Factor $P(D) = D^2 - 3D - 40$ and solve $P(D)y = 0$.
12. Find the general solution of $x^2 y'' - 5xy' + 9y = 0$.
13. Find the Wronskian of $\cos 6x$ and $\sin 6x$.
14. Find the inverse transform $f(t)$ of $F(s) = \frac{e^{-s}}{s^2 + 4} + \frac{e^{-2s}}{s^2 + 1} + \frac{e^{-3s}}{(s+2)^2}$.
15. Find the Laplace transform of $t \sin 2t$.
16. Find the inverse transform of $\frac{1}{s(s^2 + 9)}$. (8x2=16)

PART - C

(Essay)

Answer **any four** questions. **Each** question carries **4** marks.

17. Solve the IVP $e^{2x}(2\cos y \, dx - \sin y \, dy) = 0$, $y(0) = 0$.
18. Find the general solution of $y' = 1/(6e^y - 2x)$.
19. Solve $y'' + y' = 0$ by reducing it to first order.
20. Solve the IVP $y'' + y' - 6y = 0$, $y(0) = 10$, $y'(0) = 0$.
21. Solve the nonhomogeneous ODE $y'' + y = \sec x$.
22. Find the Laplace transform of the function $f(t) = \begin{cases} 2, & \text{if } 0 < t < 1 \\ \frac{1}{2}t^2, & \text{if } 1 < t < \frac{1}{2}\pi \\ \cos t, & \text{if } t > \frac{1}{2}\pi. \end{cases}$
23. Solve the IVP $y'' + 3y' + 2y = \delta(t - 1)$, $y(0) = 0$, $y'(0) = 0$ by Laplace transform. (4x4=16)



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PART - D
(Long Essay)

Answer **any two** questions. **Each** question carries **6** marks.

24. Solve $2xyy' = y^2 - x^2$ by reducing it to variable separable form.
25. Solve the IVP $(e^{x+y} + ye^y) dx + (xe^y - 1) dy = 0$, $y(0) = -1$.
26. Solve the initial value problem $y'' - 6y' + 9y = e^{3x}$, $y(0) = 1$, $y'(0) = 1$.
27. Solve the integral equation $y(t) - \int_0^t (1 + \tau) y(\tau) d\tau = 1 - \sinh t$ by Laplace Transform.

(2×6=12)