K24U 2753

Reg. No. : .....

Name : .....

V Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, November 2024
(2019 to 2022 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. Define an ordinary differential equation.
2. For what values of the constant m will $y = e^{mx}$ be the solution of $y'' - 3y' - 10y = 0$.
3. Write the characteristic equation of $3\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^3} = x^2$.
4. Write the integrating factor of $Mdx + Ndy = 0$.
5. Find the inverse Laplace transform of $\frac{1}{s^2+9}$.

PART – B
(Short Essay)

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

6. Solve $y' + (x+2)y^2 = 0$.
7. Find the order and degree of $x^2\frac{d^3y}{dx^3} + 12x\left(\frac{dy}{dx}\right)^{\frac{1}{2}} = 6$.

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8. Solve $\frac{dy}{dx} = xy + x$.
9. Find the Wronskian of cosx and sinx.
10. State the uniqueness theorem of first order differential equation.
11. Find the basis of the solution of the equation $\frac{d^2y}{dx^2} + y = 0$.
12. Find the general solution of $\frac{d^2y}{dx^2} - 4y = 0$.
13. Find the Wronskian of e^x and e^{-x}.
14. Find $L^{-1}\left[\frac{1}{(s+1)(s+2)}\right]$.
15. Find the convolution of t and e^{-t}.
16. Evaluate $L^{-1}\left[\frac{2}{(s+4)^3}\right]$.

PART – C
(Essay)

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

17. Solve $2xyy' = y^2 - x^2$.
18. Find the orthogonal trajectories of the family $x^2 - y^2 = c$.
19. Solve $\frac{d^2y}{dx^2} - 13\frac{dy}{dx} + 12y = e^{-2x}$.
20. Solve $\frac{d^2y}{dx^2} + 25y = 2\sin 5x$.

21. Solve $\frac{d^2y}{dx^2} - y = 3 + 2x^2$.
22. Find the Laplace transform of the integral $\int_0^t te^{-4t}\sin 3tdt$.
23. Find the Laplace transform of the function f(t) = t; if $t \geq 2$ and 0, if $t < 2$.

PART – D
(Long Essay)

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

24. Solve the initial value problem $\left(y + \sqrt{x^2+y^2}\right)dx - xdy = 0, y(1) = 0$.
25. Check the exactness and solve $(2xy^2 + y)dx + (2y^3 - x)dy = 0$.
26. Solve $y'' - 3y' + 2y = 2x^2 + e^x + 2xe^x + 4e^{3x}$.
27. If L[f(t)] = F(s), then show that $L[f(t-a)\,u(t-a)] = e^{-as}F(s)$.