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 $3\dfrac{d^3y}{dx^3} + 2\dfrac{d^2y}{dx^3} = x^2$.

4. Write the integrating factor of $Mdx + Ndy = 0$.

5. Find the inverse Laplace transform of $\dfrac{1}{s^2 + 9}$.

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 $x^2\dfrac{d^3y}{dx^3} + 12x\left(\dfrac{dy}{dx}\right)^{\frac{1}{2}} = 6$.

P.T.O.

8. Solve $\dfrac{dy}{dx} = xy + x$.

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 $\dfrac{d^2y}{dx^2} + y = 0$.

12. Find the general solution of $\dfrac{d^2y}{dx^2} - 4y = 0$.

13. Find the Wronskian of e^x and e^{-x}.

14. Find $L^{-1}\left[\dfrac{1}{(s+1)(s+2)}\right]$.

15. Find the convolution of t and e^{-t}.

16. Evaluate $L^{-1}\left[\dfrac{2}{(s+4)^3}\right]$.

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 $\dfrac{d^2y}{dx^2} - 13\dfrac{dy}{dx} + 12y = e^{-2x}$.

20. Solve $\dfrac{d^2y}{dx^2} + 25y = 2\sin 5x$.

21. Solve $\dfrac{d^2y}{dx^2} - y = 3 + 2x^2$.

22. Find the Laplace transform of the integral $\displaystyle\int_0^t te^{-4t}\sin 3t\, dt$.

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 $\left(y + \sqrt{x^2 + y^2}\right)dx - x\,dy = 0$, $y(1) = 0$.

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 $L[f(t - a)\, u(t - a)] = e^{-as}F(s)$.