



K25U 1409

Reg. No. :

Name :

**Second Semester B.Sc. (Hon's) Mathematics Degree (C.B.C.S.S. – OBE –
Supplementary/Improvement) Examination, April 2025
(2021 to 2023 Admissions)
Core Course
2B08BMH : ORDINARY DIFFERENTIAL EQUATIONS**

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **any 4** questions. **Each** question carries **1** mark :

1. What is the order and degree of the differential equation $\frac{d^3y}{dx^3} + \sqrt{1 + \left(\frac{dy}{dx}\right)^2} = 0$?
2. What is the general form of the homogeneous linear differential equation of the second order ?
3. State uniqueness theorem of solution of the initial value problem $y' = f(x, y)$, $y(x_0) = y_0$.
4. Find the Wronskian of the bases $1, e^x$.
5. Solve $y'' - 4y' + 4y = 0$. (4×1=4)

SECTION – B

Answer **any 6** out of 9 questions. **Each** question carries **2** marks :

6. Solve $x^2y'' - 20y = 0$.
7. Solve $xdy - ydx = x\sqrt{x^2 - y^2}dx$.
8. Are the functions $x^2, x^2 \ln x$ ($x \geq 1$) linearly independent or dependent on the given interval ?
9. Explain the Euler's method for finding the solution of differential equations.

P.T.O.

K25U 1409

-2-



10. Find a second order homogeneous linear differential equation for which the functions x^5 and x^{-5} are solutions.
11. Solve the initial value problem, $\frac{dy}{dx} = \sqrt[3]{x}, y(1) = 2$.
12. Solve the initial value problem, $\frac{dy}{dx} = -4xy^2, y(0) = 1$.
13. Find the orthogonal trajectories of the curve $y = cx^2$, where c is arbitrary.
14. Solve the differential equation $y''' - 2y'' - y' + 2y = 0$. (6×2=12)

SECTION – C

Answer **any 8** out of 12 questions. **Each** question carries **4** marks :

15. Solve the initial value problem $y' + y \tan x = \sin 2x; y(0) = 1$.
16. Find the orthogonal trajectories of $x^2 + y^2 = 2cx$.
17. Solve $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} = x + 11$.
18. Solve the initial value problem, $y'' + y' - 6y = 0, y(0) = 10, y'(0) = 0$.
19. Solve $y_1' = y_2 + e^{3t}$
 $y_2' = y_1 - 3e^{3t}$.
20. Solve $y' = x + y^2$ subject to the condition $y = 1$ when $x = 0$.
21. Solve $(y - x^3) dx + (x + y^3) dy = 0$.
22. Find a basis of solution for the second order homogeneous linear equation $x^2y'' - xy' + y = 0$ for positive x .
23. Solve $xy' = y^2 + y$.
24. Solve $xy' = 2y + x^3e^x$.
25. From the Taylor series for $y(x)$, find $y(0.1)$ correct to four decimal places if $y(x)$ satisfies $y' = x - y^2$ and $y(0) = 1$.
26. Solve $(3D^2 + D - 14)y = 13e^{2x}$. (8×4=32)



-3-

K25U 1409

SECTION – D

Answer **any 2** out of 4 questions. **Each** question carries **6** marks :

27. Given $\frac{dy}{dx} = 1 + y^2$ where $y(0) = 0$, find $y(0.2)$, $y(0.4)$ and $y(0.6)$.
28. At time $t = 0$, a tank contains 4 lb of salt dissolved in 100 gal of water. Suppose that brine containing 2 lb of salt per gallon of brine is allowed to enter the tank at a rate of 5 gal/min, and that the mixed solution is drained from the tank at the same rate. Find the amount of salt in the tank after 10 minutes.
29. a) Prove that the system of confocal conics $\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1, \lambda$ being the parameter is self orthogonal.
b) Solve $(D^2 - 4D + 4)y = e^{2x}$.
30. a) Solve $yy'' = 2y'^2$.
b) Solve $(xy^3 + y) dx + 2(x^2y^2 + x + y^4) dy = 0$. (2×6=12)