# K24U 1718

Reg. No. : ..................................

Name : ..................................

**Second Semester B.Sc. (Hon's) Mathematics Degree (CBCSS – OBE – Regular/Supplementary/Improvement) Examination, April 2024**
**(2021 Admission Onwards)**
**Core Course**
**2B08BMH : ORDINARY DIFFERENTIAL EQUATIONS**

Time : 3 Hours                                        Max. Marks : 60

SECTION – A

Answer **any 4** questions. **Each** question carries **1** mark. **(4×1=4)**

1. What is the degree of the differential equation $\frac{d^3y}{dx^3}-\left(1+\left(\frac{dy}{dx}\right)^2\right)^{\frac{3}{2}}=0$ ?
2. What is the general form of the linear differential equation ?
3. State linearity principle.
4. Apply the operator $D^2 + 3D$ to the function $e^{-x} + e^{3x}$.
5. Solve $y'' - 5y' + 6y = 0$.

SECTION – B

Answer **any 6** out of 9 questions. **Each** question carries **2** marks. **(6×2=12)**

6. Solve $(x^2D^2 + D)y = 0$.
7. Solve $ydx - xdy + 3x^2ye^{x^3}\, dx = 0$.
8. Solve the boundary value problem $y'' + y = 0$, $y(0) = 3$, $y(\pi) = -3$.
9. Explain the modified Euler's method for finding the solution of differential equations.
10. Find a second order homogeneous linear differential equation for which the functions $x^2$ and $x^{\frac{1}{2}}$ are solutions.

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11. Find an equation of the curve which satisfies the condition that at each point (x, y) on the curve the slope is $2x + 1$ and the curve passes through the point $(-3, 0)$.
12. Solve the differential equation $\frac{dy}{dx}-y=e^{2x}$.
13. Prove that the difference of two solutions of the non-homogeneous equation $y'' + p(x)y' + q(x)y = r(x)$ on some open interval I is a solution of the homogeneous equation $y'' + p(x)y' + q(x)y = 0$ on I.
14. Solve $y^{IV} - 16y = 0$.

SECTION – C

Answer **any 8** out of 12 questions. **Each** question carries **4** marks. **(8×4=32)**

15. Solve the Bernoulli's equation $y' - Ay = -By^2$.
16. Find the orthogonal trajectories of the family of circles $x^2 + y^2 + 2\lambda y + c = 2$, $\lambda$ being the parameter.
17. Find the particular integral of $(D - 3)^2y = xe^{-2x}$.
18. Solve $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+y = \sin(\log x^2)$.
19. Solve $y_1' = y_2 + e^{3t}$
    $y_2' = y_1 - 3e^{3t}$.
20. Solve $y' = -y$ with the condition $y(0) = 1$ by Euler's method.
21. Solve $4y'' - 4y' - 3y = 0$, $y(-2) = e$, $y'(-2) = \frac{-e}{2}$.
22. Solve $\frac{dy}{dx}=\frac{y\cos x+\sin y+y}{\sin x+x\cos y+x}=0$.
23. Find the electrostatic potential $V = V(r)$ between two concentric spheres of radii $r_1 = 4$cm and $r_2 = 8$cm kept at potential $V_1 = 110$ volts and $V_2 = 0$ respectively. $V_r$ is the solution of $rV'' + 2V' = 0$, where $V'=\frac{dV}{dr}$.



24. Solve $(2x - 4y + 5)y' + x - 2y + 3 = 0$.
25. Solve $y' = (y - 2)\cot x$.
26. Use Picard's method to find a series solution of $\frac{dy}{dx} = 1 + xy$, $y(0) = 1$.

SECTION – D

Answer **any 2** out of 4 questions. **Each** question carries **6** marks. **(2×6=12)**

27. Using Taylor's series, find y(0.1), y(0.2) and y(0.3), given that $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$.
28. Solve $(x^2 + x)y'' + (2 - x^2)y' - (2 + x)y = x(x + 1)^2$.
29. a) Solve $(D^3 + D^2 + D + 1)y = x^2$.
    b) Solve $\frac{d^2y}{dx^2} + y = \tan x$ by the method of variation of parameters.
30. a) Solve $(xy^2 + 2x^2y^3)dx + (x^2y - x^3y^2)dy = 0$.
    b) Reduce to the first order and solve the equation $y'' = y'$.

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