K23U 2025

Reg. No. : ……………………………

Name : …………………………………

II Semester B.Sc. Hon's (Mathematics) Degree (C.B.C.S.S. – O.B.E. – Regular/Supplementary/Improvement) Examination, April 2023
(2021 and 2022 Admission)
2B08BMH : ORDINARY DIFFERENTIAL EQUATIONS

Time : 3 Hours Max. Marks : 60

SECTION – A

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

1. When is an equation of the form $M(x, y)dx + N(x, y)dy = 0$ said to be exact ?
2. What is the Wronskian of the functions x and xe^x ?
3. Express in mathematical form a general n-th order differential equation in the dependent variable y and the independent variable x.
4. Write the general solution of $\frac{d^ny}{dx^n} = 0$.
5. Find the value of k and m if $y = e^{kx}$ and $y = e^{-x}$ are two independent solutions of $y'' + 4y' + 3my = 0$. **(4×1=4)**

SECTION – B

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

6. Solve : $\frac{dy}{dx} = (x+1)e^{-x}y^2$.
7. Use Euler's method to find y(0.8) from $2y' = (x + 1)y$, $y(0) = 2$.
8. Solve : $y'' - y = 0$.
9. Find the orthogonal trajectories to the circles $x^2 + y^2 = c^2$.
10. Solve : $y'' - 2y' + 2y = 0$ where y is a function of t.

P.T.O.

11. Find an integrating factor for the equation : $e^x \cos y dx - e^x \sin y dy = 0$.
12. Solve : $\frac{d^3y}{dx^3} + 8y = 0$.
13. Find the general solution of the differential equation $\frac{d^3y}{dt^3} = 1$.
14. Using Runge-Kutta method of order 2 find y(1.1) from the problem : $y' = y + t^2$, $y = 1$ when $t = 1$. **(6×2=12)**

SECTION – C

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

15. Test for exactness and solve : $\cos(x + y)dx + (3y^2 + 2y + \cos(x + y))dy = 0$.
16. Show that for the one parameter family of ellipses $\frac{x^2}{2} + y^2 = c$, the orthogonal trajectories are a one parameter family of parabolas.
17. Solve : $2xyy' = y^2 - x^2$.
18. Solve the Verhulst equation : $y' = Ay - By^2$.
19. Show that for the equation $y'' + p(x)y' + q(x)y = 0$, linear combination of two solutions is again a solution.
20. Find y(0.5) by solving $y' = x - y$, $y(0) = 1$ using Euler's modified method.
21. Using the method of variation of parameters solve : $y'' - 2y' + y = e^x \sin x$.
22. Find a general solution for the system of differential equations :
 $y_1' = y_2 + t$
 $y_2' = y_1 - 3t$

23. Find a basis of solutions of the ODE : $(x^2 - x)y'' - xy' + y = 0$ if one of the solutions is given as $y_1 = x$. Show that they are actually linearly independent solutions.
24. Using Taylor series method find y(0.1) from $y' = 1 + xy$, $y(0) = 1$.
25. Under what conditions for the constants a, b, k, l is $(ax + by)dx + (kx + ly)dy = 0$ exact ? Solve the exact ODE in those cases.
26. Find y(1) if y(t) satisfies $\frac{d^3y}{dt^3} - 8y = 1$, where it is given that $y(0) = y'(0) = y''(0) = 0$. **(8×4=32)**

SECTION – D

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

27. a) Solve the initial value problem : $(e^{x+y} + ye^y)dx + (xe^y - 1)dy = 0$; $y(0) = -1$.
 b) Solve for $y_1(t)$ and $y_2(t)$ from the equations :
 $y_1' = 10y_1 - 6y_2 + 10(1 - t - t^2)$
 $y_2' = 6y_1 - 10y_2 + 2(2 - 5t - 3t^2)$
28. Find y(0.4) by solving $y' = x - 2y$, $y(0) = 1$ using Runge-Kutta method of order 4. Compute the error by finding the actual solution using some other method.
29. a) Use Picards method to find y(1.1) from the initial value problem : $\frac{dy}{dx} = xy$, $y(1) = 1$.
 b) Solve : $y'' - 5y' + 6y = 3e^{2t} + \sin(2t)$ using method of undetermined coefficients.
30. Solve : $x^2y'' + 3xy' + y = 0$, $y(1) = 3.6$, $y'(1) = 0.4$. **(2×6=12)**

____