

Reg. No. :

Name :

**Third Semester B.Sc. Honours in Mathematics Degree
(CBCSS – Supplementary/Improvement) Examination, November 2022
(2017 – 2020 Admissions)
BHM 303 : ORDINARY DIFFERENTIAL EQUATIONS**

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **any 4** questions out of 5 questions. **Each** question carries 1 mark.

1. What do you mean by order of a differential equation ?
2. What do you mean by exact first order differential equation ?
3. If y_1 and y_2 are two solutions of an ordinary differential equation, find their Wronskian.
4. Give an example for a non-homogeneous linear system of ordinary differential equations.
5. What do you mean by initial value problem ? (4×1=4)

SECTION – B

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

6. Solve the differential equation $y' = 1 + y^2$.
7. Solve $y' + y \tan x = \sin 2x$.
8. Solve the differential equation $y'' - y = 0$.
9. Find the Wronskian of the solutions of the differential equation $y'' - 2y' + y = 0$.
10. Solve the differential equation $x^2y'' + 1.5xy' - 0.5y = 0$.

P.T.O.

11. Solve the differential equation $y'' + 16y' = 0$.
12. Convert the differential equation $2y'' - 3y' - 2y = 0$ into a system of first order differential equations.
13. Find the error in Runge-Kutta second order formula.
14. Using Euler's method, find the value of $y(0.1)$, given that $y' = 1 - y$, $y(0) = 0$. (6×2=12)

SECTION – C

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

15. Solve the differential equation $2xyy' = y^2 - x^2$.
16. Find a suitable integrating factor for the differential equation $-y dx + x dy = 0$ to convert the equation into exact form and hence solve it.
17. What do you mean by orthogonal trajectories of a given family of curves ? What are the steps to find the orthogonal trajectories of a family of curves ?
18. Solve the initial value problem $y'' + y = 0$, $y(0) = 3.0$, $y'(0) = -0.5$.
19. Solve the differential equation $y'' + y' + 0.25y = 0$, $y(0) = 3.0$, $y'(0) = -3.5$.
20. Using the method of variation of parameters, solve the differential equation $y'' + y = \sec x$.
21. Solve $x^2y'' - xy' + y = \log x$.
22. Solve the differential equation $y''' - 3y'' + 3y' - y = e^x - x - 1$.
23. State and prove superposition principle of solutions of the homogeneous linear system of differential equations $y' = Ay$.
24. Using Taylor series method find the value of $y(0.1)$ correct to four decimal places, given that $\frac{dy}{dx} = 1 + xy$, $y(0) = 2$.
25. Using Picard's method, solve the equation $y' = y$ subject to the condition $y(0) = 1$ (conduct 2 iterations).
26. Using the modified Euler's method, determine the value of y when $x = 0.1$, given that $y(0) = 2$ and $y' = 1 + xy$. (8×4=32)

SECTION – D

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

27. A tank contains 1000 gal of water in which 200 lb of salt are dissolved. Fifty gallons of brine, each containing $(1 + \text{cost})$ lb of dissolved salt, run into the tank per minute. The mixture, kept uniform by stirring, runs out at the same rate. Find the amount of salt $y(t)$ in the tank at any time t .
28. Solve the initial value problem $y'' + 2y' + 0.75y = 2 \cos x - 0.25 \sin x + 0.09x$, $y(0) = 2.78$, $y'(0) = -0.43$.
29. Solve the initial value problem $y'''' + 3y'' + 3y' + y = 30e^{-x}$, $y(0) = 3$, $y'(0) = -3$, $y''(0) = -47$.
30. Using Runge-Kutta Fourth order formula, find the values of $y(0.2)$ and $y(0.4)$ correct to four decimal places, given that $\frac{dy}{dx} = 1 + y^2$, $y(0) = 0$. (2×6=12)