K24U 0732

Reg. No. : ....

Name : ....

IV Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Regular/Supplementary/ Improvement) Examination, April 2024
(2019 to 2022 Admissions)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
4C04 MAT-CH : Mathematics for Chemistry – IV

Time : 3 Hours Max. Marks : 40

PART – A

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

1. Write the standard form of a Two-dimensional Laplace Equation.
2. Differentiate between linear and non-linear PDE.
3. Write general formula for numerical integration.
4. Define cyclic group.
5. Define symmetric operation. **(4×1=4)**

PART – B

Answer **any seven** questions. **Each** question carries **2** marks.

6. Identify the type of following Quasi-linear PDE
   a) $2xyU_{xy} + xU_y + yU_x = 0$
   b) $U_{xx} + U_{xy} + 5U_{yy} + 6U_x = 0$.
7. Find the characteristics of $3U_{xx} + 10U_{xy} + 3U_{yy} = 0$.
8. Give one dimensional heat equation with boundary conditions. Give solution of the problem by Fourier Series.
9. Find the deflection of vibrating string of unit length having fixed ends with initial velocity zero and deflection $f(x) = k(\sin x - \sin 2x)$.

P.T.O.

10. Find the function U(x, t) satisfies the initial value problem.

$$\frac{\partial^2 U}{\partial t^2} = \frac{\partial^2 U}{\partial x^2}, x \in \mathbb{R}, t > 0, \ U(x,0) = x, \ U_t(x,0) = 0.$$

11. Evaluate $\int_0^6 xe^{0.5x}dx$ using the trapezoidal rule with n = 3 to 3 decimal places.
12. Solve the initial-value problem $y' = y - x$, $y(0) = \frac{1}{2}$ using modified Euler's method with h = 0.1 to obtain an approximation to y(1).
13. Solve the initial-value problem $y' = -y$, $y(0) = 1$ using Euler's method with h = 0.01 to obtain an approximation to y(0.04).
14. Let G be a group with $(ab)^2 = a^2b^2$ for every a, b in G. Show that G is abelian.
15. Show that the three reflection of NH_3 constitute a class. **(7×2=14)**

PART – C

Answer **any four** questions. **Each** question carries **3** marks.

16. Solve using the method of separation of variables
$$\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0.$$
17. Give the condition when Quasi-linear equation
$AU_{xx} + BU_{xy} + CU_{yy} = F(x, y, u, u_x, u_y)$ is
i) Hyperbolic ii) Elliptic iii) Parabolic.
18. Approximate $\int_0^1 \sqrt{1+x^3}\,dx$ using the Trapezoidal rule with n = 5 to 3 decimal places.
19. Solve the differential equation $y' = x + y$ with conditions $y(0) = 1$ by Taylor series method. Hence find the value of y at x = 0.1 and x = 0.2.
20. List the five type of symmetry elements of molecule.
21. Prove that in any abelian group each element is in a class by itself.
22. Give multiplication table of a group of order 3. **(4×3=12)**

PART – D

Answer **any two** questions. **Each** question carries **5** marks.

23. Solve the one dimensional wave equation, $U_{tt} = c^2U_{xx}$, satisfying $U(0, t) = U(l, t) = 0 \ \forall t$ and initial deflection is given by

$$f(x) = \begin{cases} \sin\left(\frac{\pi x}{c}\right) & 0 \le x \le c \\ 0 & \text{otherwise} \end{cases} \quad \text{and } U_t(x, 0) = 0.$$

24. Find the first four terms of the Taylor expansion of the solution of $y' = x + y^2$, $y(0) = 1$ about $x_0 = 0$.
25. Given that $\frac{dy}{dx} = y - x$ where $y(0) = 2$, find y(0.1) and y(0.4) correct to four decimal places, using Runge-Kutta second order formula. Take h = 0.1.
26. From the group multiplication table for water molecule by verifying the properties of a group. **(2×5=10)**