K25U 0832

Reg. No. : .....

Name : .....

IV Semester B.Sc. Degree (C.B.C.S.S.-OBE – Regular/Supplementary/ Improvement) Examination, April 2025
(2019 to 2023 Admissions)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
4C04 MAT-CH : Mathematics for Chemistry – IV

Time : 3 Hours Max. Marks : 40

SECTION – A

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

1. Find the order of the partial differential equation $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial u}{\partial x}$.
2. Give an example of a non-linear PDE.
3. State the Trapezoidal rule for Numerical Integration.
4. Does the set of integers, $0, +1, \pm 2, \ldots$ under ordinary addition is a cyclic group ? Justify your answer.
5. Give an example of a group of order 2.

SECTION – B

Answer **any seven** questions from the following. **Each** question carries **2** marks. **(7×2=14)**

6. Solve $u_{xx} = u$ like an ODE.
7. Show that $u = e^{-t} \sin x$ is a solution of the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$.
8. What you mean by a mixed PDE ? Give an example.
9. Find the type of the PDE $u_{xx} + 2u_{xy} + u_{yy} = 0$.

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10. How does the frequency of the fundamental mode of the vibrating string depend on the length of the string ? Explain.
11. What you mean by the term symmetric elements ? Explain.
12. With the usual notations, show that $S_6^2 = C_3$.
13. Show that H_2O belongs to the group of order 4.
14. If A is the conjugate of B and B is the conjugate of C, then show that A, B and C are mutually conjugate.
15. What you mean by the term center of inversion ? Explain.

SECTION – C

Answer **any four** questions. **Each** question carries **3** marks. **(4×3=12)**

16. Solve the wave equation $u_{tt} - c^2 u_{xx} = 0$.
17. If u_1 and u_2 are solutions of $u_t = c^2 u_{xx}$ in some region R. Prove that $u = c_1 u_1 + c_2 u_2$ is also a solution of the above partial differential equation.
18. Let G be a group and A, B $\in$ G. Prove that $(AB)^{-1} = B^{-1}A^{-1}$.
19. Use Modified Euler's method to solve $\frac{dy}{dx} = -y$ for $x = 0.6$ and $h = 0.2$ with the boundary condition $y = 1$ when $x = 0$.
20. Use Euler's method to approximate y when $x = 0.1$ given that $\frac{dy}{dx} = \frac{y - x}{y + x}$ with $y = 1$ for $x = 0$ (Take $h = 0.02$).
21. Apply Simpson's one third rule to evaluate $\int_1^5 \frac{1}{1+x^2} dx$ with $h = 1$.
22. Evaluate $\int_0^6 \frac{1}{1+x} dx$ using Trapezoidal rule.

SECTION – D

Answer **any two** questions. **Each** question carries **5** marks. **(2×5=10)**

23. Transform to normal form, and solve the partial differential equation $u_{xx} - 4u_{xy} + 5u_{yy} = 0$.
24. Use Runge-Kutta method to find y, when $x = 0.1$, $x = 0.2$, $h = 0.1$, given that $y = 1$ when $x = 0$ and $\frac{dy}{dx} = x + y$.
25. Use Taylor series method to find y for $x = 0.1$ correct to four decimal places, if y satisfies $\frac{dy}{dx} = x - y^2$ with $y_0 = 1$, $x_0 = 0$.
26. List the groups which are subgroups of D_{2h}.