Roll No. | | | | | | | | | | | | | **Total No. of Pages: 02**

Total No. of Questions: 11

Master of Science (Chemistry) (Sem. – 1)

NUMERICAL METHODS FOR CHEMISTS

Subject Code: CHL406B-18

M Code: 75119

Date of Examination : 23-01-23

Time: 3 Hrs. **Max. Marks: 50**

INSTRUCTIONS TO CANDIDATES:

1. **SECTION-A is COMPULSORY consisting of FIVE questions carrying TWO marks each.**
2. **SECTION-B contains EIGHT questions carrying FOUR marks each and students have to attempt any SIX questions.**
3. **SECTION-C is COMPULSORY consisting of TWO questions with internal choice carrying EIGHT marks each.**

SECTION-A

1. Write briefly:

   a) Compute $\begin{bmatrix} 2 & -3 \\ 4 & -2 \end{bmatrix} - X = \begin{bmatrix} -3 & 4 \\ 5 & -1 \end{bmatrix}$

   b) Define Continuity.

   c) What is Geometrical meaning of Differential equation?

   d) Two dice are thrown simultaneously, find the probability of getting six as a product.

   e) Give an example of two square matrices of order 2×2 so that $(A+B)^2 = A^2 + 2AB + B^2$

SECTION-B

2. If $A = \begin{bmatrix} 1 & 2 & 5 \\ 1 & -1 & -1 \\ 2 & 3 & -1 \end{bmatrix}$, find A^{-1}

3. If $z = x^2 \tan^{-1} \frac{y}{x} - y^2 \tan^{-1} \frac{x}{y}$, prove that $\frac{\partial^2 z}{\partial x \, \partial y} = \frac{x^2 - y^2}{x^2 + y^2}, \quad x \neq 0, y \neq 0$

4. Solve $\left(y + \frac{y^3}{3} + \frac{x^2}{2}\right) dx + \frac{1}{4}(x + xy^2) dy = 0, x > 0$

5. If events A and B are two independent events such that $P(A) = 0.2, P(A \cup B) = 0.6$, then find $P(B)$.

6. Expand $\begin{vmatrix} 3 & -5 & 4 \\ 7 & 6 & 1 \\ 1 & 2 & 3 \end{vmatrix}$.

7. Evaluate $\int \frac{\sin 4x}{\cos 2x} dx$.

8. Find solution in series about $x = 0$

$$(1 - x^2)\frac{d^2y}{dx^2} + 2y = 0$$

9. Prove that ${}^{n}P_r = {}^{(n-1)}P_r + r.\ {}^{(n-1)}P_{r-1}$

SECTION-C

10. a) If $z = \tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$, prove that $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = \sin 2z$.

b) If $A = \begin{bmatrix} 2 & 1 & 3 \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{bmatrix}$ then Verify that $A(\text{ Adj.A }) = (\text{ Adj.A })A = |A|I_3$

OR

a) Check that the matrix $A = \frac{1}{6}\begin{bmatrix} 1 & -2 & 1 \\ -2 & 4 & -2 \\ 1 & -2 & 1 \end{bmatrix}$ is an idempotent matrix.

b) Let $f(x,y) = \left\{\frac{xy}{x^2+y^2}, \text{ if } (x,y) \neq (0,0)\right\}, f(0,0) = 0$, prove that f_x, f_y both exist at $(0,0)$.

11. a) Solve $(2x^2y^2 + y)dx - (x^3y - 3x)dy = 0$

b) Calculate Arithmetic mean from the following data using step-Deviation Method 25,35,40,50,55,60,65,75,85,90

OR

a) By the method of least squares, find a straight line that best fits the following data.

X:	10	12	13	17	18
Y:	5	6	7	9	13

b) Solve $(D^4 - D^2)y = 2$.

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.