Roll No. | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 15

M.Sc. (Chemistry) (2018 & onwards) (Sem.–1)

NUMERICAL METHODS FOR CHEMISTS

Subject Code : CHL406B-18

M.Code : 75119

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 will comprise of two compulsory questions with INTERNAL CHOICE in both these questions. Each question carries EIGHT marks.

SECTION-A

1. Compute the sum $\begin{bmatrix} 2 & 1 & 4 & 3 \\ 3 & 5 & 1 & 2 \end{bmatrix} + \begin{bmatrix} \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \end{bmatrix}$.

2. Define function.

3. Define exact differential equation.

4. In a throw of two coins, find the probability of getting both heads or both tails.

5. Find the value of x such that $[1\ 1\ x] \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 1 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = [0]$.

SECTION-B

6. If $A = \begin{bmatrix} 5 & 6 & 4 \\ 7 & 4 & 3 \\ 2 & 1 & 6 \end{bmatrix}$, find A^{-1}

7. If $z = \frac{x^2 + y^2}{x + y}$, prove that $\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = 4\left(1 - \frac{\partial z}{\partial x}\right)$

8. Solve $(x^2 + y^2 + 2x)\,dx + 2y\,dy = 0$.

9. If events A and B are two independent events such that P (A) = 0.2, P (AUB) = 0.6, then find P (B).

10. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ then prove that $A^2 - 4A - 5I = 0$.

11. Evaluate $\int x^2 \sin x^3\,dx$

12. Solve $y = x\frac{dy}{dx} + a\left(y^2 + \frac{dy}{dx}\right)$.

13. If $\frac{n!}{2!(n-2)!} : \frac{n!}{4!(n-4)!} = 2 : 1$ find n .

SECTION-C

14. a) If z is a function of x and y, prove that if $x = e^u + e^{-v}$, $y = e^{-u} - e^v$, then

$$\frac{\partial z}{\partial u} = \frac{\partial z}{\partial v}\left(x\frac{\partial z}{\partial x} - y\frac{\partial z}{\partial y}\right)$$

b) Prove that $\begin{vmatrix} b^2 + c^2 & ab & ac \\ ab & c^2 + a^2 & bc \\ ca & cb & a^2 + b^2 \end{vmatrix} = 4a^2b^2c^2$

OR

a) If A = $\begin{bmatrix} 1 & 1 \\ 2 & 1 \end{bmatrix}$, B = $\begin{bmatrix} x & 1 \\ y & 1 \end{bmatrix}$ and $(A + B)^2 = A^2 + B^2$, find x & y.

b) Discuss the continuity of the function (f x, y) defined by :

$$f(x,y) = \begin{cases} x\, y \sin\left(\frac{1}{x}\right), & \text{if } x \neq 0, \\ 0, & \text{if } x = 0 \end{cases} \quad f(0, y) = 0$$

15. a) Solve $(y^4 + 2y)\,dx + (xy^3 + 2y^4 - 4x)\,dy = 0$.

b) Calculate Arithmetic mean from the following data using step-Deviation method.

30, 40, 50, 55, 60, 70, 80, 90, 100

OR

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

X :	1	2	3	4	5
Y :	14	27	40	55	68

b) Solve $(D^3 + 1)\, y = 3 + e^{-x}$.

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