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Total No. of Pages : 02

Total No. of Questions : 19

PIT M.Sc (Chemistry) (Sem.-1)

MATHEMATICS

Subject Code : CHL-405M

Paper ID : [51207]

Time : 3 Hrs.

Max. Marks : 70

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains SIX questions carrying FIVE marks each and students have to attempt ALL questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A**Answer briefly :**

1. Find $\text{div } \vec{f}$ and $\text{curl } \vec{f}$ where $\vec{f} = xy^2\hat{i} + 2x^2yz\hat{j} - 3yz^2\hat{k}$.
2. If $\vec{A} = 3t^2\hat{i} + 2t\hat{j} - t^3\hat{k}$, $\vec{B} = 5t^2\hat{j} + t\hat{k}$. Find $\vec{A} \cdot \vec{B}$.
3. Define Hermitian matrix.
4. Calculate the value of Bohr radius.
5. Evaluate $\int \frac{1}{e^x - 1} dx$
6. If $u = f\left(\frac{y}{x}\right)$, show $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 0$.
7. Solve $\frac{dy}{dx} + 3x^2y^2 = 0$, $y(1) = \frac{1}{2}$.
8. If A and B are two events such that
$$P(A) = 0.3, P(B) = 0.4, P(A \cup B) = 0.5.$$
 Find $P(A \cap B)$.
9. What are spherical Harmonics of $Y_{11}(\theta, \phi)$.
10. What do you mean by root mean square error?

SECTION-B

11. Show that $i \times (a \times i) + j \times (a \times j) + k \times (a \times k) = 2a$

12. Show that the equations $x + y + z = 6$

$$x + 2y + 3z = 14$$

$$x + 4y + 7z = 30$$

are consistent and solve them.

13. Find the differential equation for bimolecular reaction $A + B \rightarrow C$ where a and b are original concentrations of A and B respectively. Also solve the differential equation.

14. Solve $\int \frac{x}{(x+2)(3-2x)} dx$

15. Find the Fourier series expression for $f(x) = x^3$ for $-\pi < x < \pi$

16. How many diagonals are there in a polygon of n sides?

SECTION-C

17. Find eigen value and eigen vector of $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

18. State and prove Baye's theorem.

19. Trace the curve $y^2(2a - x) = x^3$.