



**II Semester M.Sc. Degree Examination, July 2017**  
**(CBCS Scheme)**  
**CHEMISTRY**  
**C – 205 (SC) : Mathematics for Chemists**

Time : 3 Hours

Max. Marks : 70

**Instruction :** Answer question no. 1 and **any five** of the remaining.

1. Answer **any ten** of the following : **(2×10=20)**

a) If  $\vec{u} = (1, -1, 0)$  and  $\vec{v} = (-1, 2, 1)$ , then find  $\vec{u} \cdot \vec{v}$  and  $\vec{u} \times \vec{v}$ .

b) If the vectors  $\vec{a} = (1, k, 2)$  and  $\vec{b} = (-1, 2, 3)$  are orthogonal, find k.

c) Find the determinant of matrix  $\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 1 \\ 1 & -1 & 0 \end{bmatrix}$ .

d) Find AB, if  $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$  and  $B = \begin{bmatrix} -1 & 1 \\ 2 & 3 \end{bmatrix}$ .

e) Find the  $n^{\text{th}}$  derivative of  $y = \cos(ax + b)$ .

f) Evaluate  $\int \sec^2(ax + b) dx$ .

g) If  $s = 3t^2 - 5t + 6$ , then find velocity and acceleration at  $t = -1$ .

h) Find the critical points of the function  $f(x) = x^3 + 2x^2 + 5$ .

i) Form the differential equation for the function  $y = e^{ax}$ .

j) Solve the differential equation  $x \frac{dy}{dx} + y = 0$ .

k) If  $u = x^2 - y^2 + x - y$ , show that  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ .

l) Three coins are tossed simultaneously, find the sample space.



2. a) Find the inverse of a matrix  $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 3 & 1 \\ -1 & 2 & 1 \end{bmatrix}$ .
- b) Solve by matrix method :
- $$x + y + z = 6$$
- $$2x - y + z = 3$$
- $$x - y + 2z = 5. \quad (5+5=10)$$
3. a) Find the area of the triangle with vertices P(2, 1, 3), Q(1, -2, 1) and R(-1, 2, 1).
- b) Find the volume determined by  $u = i + j - 2k$ ,  $v = 2i - j + 3k$  and  $w = i + j - 2k$ .  
(5+5=10)
4. a) Find the  $n^{\text{th}}$  derivative of  $y = e^{ax} \sin (bx + c)$ .
- b) If  $y = x^n \log x$ , prove that  $y_{n+1} = \frac{n!}{x}$ . (5+5=10)
5. a) Find the maximum and minimum values of the function  
 $f(x, y) = x^3 + 3x^2y + 3xy^2 - 4y^3 + 4$ .
- b) If  $u = \log\left(\frac{x^2 + y^2}{x + y}\right)$ , show that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 1$ . (5+5=10)
6. a) Evaluate :
- i)  $\int \frac{8 + 3t}{10t^2 + 13t - 1} dt$       ii)  $\int \frac{9}{x^2 + 4x + 5} dx$
- b) Find the area bounded by  $x = a \cos t$  and  $y = b \sin t$  ( $0 \leq t \leq 2\pi$ ). (5+5=10)
7. a) Solve  $\sec^2 x \tan y dx + \sec^2 y \tan x dy = 0$ .
- b) Solve  $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)/dy = 0$  (5+5=10)
8. a) Find the Fourier series of the function  $f(x) = x^3 - x$  ( $-\pi < x < \pi$ ).
- b) Fit a straight line for the following data.
- |            |   |   |   |   |   |          |
|------------|---|---|---|---|---|----------|
| <b>x :</b> | 1 | 2 | 3 | 4 | 5 |          |
| <b>y :</b> | 8 | 6 | 5 | 3 | 1 | (5+5=10) |