



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^{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^{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.
- | | | | | | | |
|------------|---|---|---|---|---|----------|
| x : | 1 | 2 | 3 | 4 | 5 | |
| y : | 8 | 6 | 5 | 3 | 1 | (5+5=10) |