PG – 202

II Semester M.Sc. Degree Examination, June 2016
(CBCS)
CHEMISTRY
C – 205 (SC) : Mathematics for Chemistry

Time : 3 Hours Max. Marks : 70

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

1. Answer **any ten** of the following :

a) If u = (–1, 3, 1) and v = (4, 7, 0), then find the components of 2u + 3v.

b) Find the inverse of the matrix $A = \begin{bmatrix} 1 & -2 \\ -3 & 8 \end{bmatrix}$.

c) Find the product AB of the matrices $A = \begin{bmatrix} 2 & 3 \\ -1 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 9 \\ 3 & 2 \end{bmatrix}$ and verify $(AB)^t = B^t A^t$, where A^t denote the transpose of A.

d) Find the n^{th} derivative of y = sin (ax + b).

e) Evaluate $\int 5 \sec^2 (5t + 1)\, dt$.

f) Find the integral $\int x \sin x\, dx$.

g) Find the critical points of the function $f(x) = x^4 - 4x^3 + 10$.

h) Solve the differential equation $y' = e^{3x - 2y}$.

i) Solve $y' + y \cot x = \cos x$.

j) If $u = x^3 - y^3 + x - y$, show that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u^2}{\partial y^2} = 6 (x - y)$.

k) Two coins are tossed twice. Find the sample space.

l) Evaluate $\int_1^2 (x^3 + x^2)\, dx$.

P.T.O.

2. a) Find the inverse of the matrix $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & -1 \end{bmatrix}$.

   b) Solve :

   $8x - 7y + 10z = 15$

   $2x + 3y + 8z = 7$

   $-4x + 5y - 2z = -9$

   by Cramer's rule. **(5+5)**

3. a) Find the area of the triangle with vertices P (1, –1, 0), Q (2, 1, –1) and R (–1, 1, 2).

   b) Find the volume of the parallelopiped determined by

   $u = i + 2j - k$

   $v = -2i + 3k$

   and $w = 7j - 4k$. **(5+5)**

4. a) Find the n^{th} derivative of $y = e^{ax} \cos(bx + c)$.

   b) If $y_n = D^n (x^n \log x)$, then prove that $y_n = ny_{n-1} + (n - 1)!$. **(4+6)**

5. a) Find the maximum and minimum values of the function

   $f(x, y) = x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$.

   b) Solve : $(y^3 - 3x^2y)dx - (x^3 - 3xy^2)dy = 0$. **(5+5)**

6. a) Evaluate :

   i) $\int \frac{8 - 3t}{10t^2 + 13t - 3} dt$

   ii) $\int \frac{4}{x^2 + 5x - 14} dx$.

   b) Find the area bounded by the ellipse $x = a(\cos t)$, $y = b \sin t$, $(0 \le t \le 2\pi)$. **(5+5)**

7. a) Solve :

   i) $xy\frac{dy}{dx} = 1 + x + y + xy$

   ii) $(2x + y + 1)\,dx + (x + 2y + 1)\,dy = 0$.

   b) Solve :

   i) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 0$

   ii) $\frac{d^2x}{dt^2} - 3\frac{dx}{dt} + 2x = 0$. **(5+5)**

8. a) Find the Fourier series of the function $f(x) = x^2$ $(-\pi < x < \pi)$.

   b) Fit a straight line through the data :

x	:	1	2	3	4	5
y	:	14	13	9	5	2

(5+5)