PG – 361

II Semester M.Sc. Examination, June 2015
(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 : **(2×10=20)**

   a) Prove that the triangle whose vertices are 2i + 4j – k, 4i + 5j + k, 3i + 6j – 3k is an isosceles right angled triangle.

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

   c) If $A = \begin{bmatrix} -2 \\ 4 \\ 5 \end{bmatrix}$, $B = [1 \ \ 3 \ \ -6]$ verify that $(AB)' = B'A'$.

   d) Find the n^{th} derivative of $y = e^{ax}$.

   e) Show that $f(x, y) = x^3 + y^3 - 3xy + 1$ is minimum at the point (1, 1).

   f) Find $\int x \cos x \, dx$.

   g) Solve $\sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0$.

   h) Solve the equation $y'' - 6y' + 13y = 0$.

   i) A die is thrown. If E is the event 'the number appearing is a multiple of 3' and F be the event 'the number appearing is even' then find whether E and F are independent.

   j) Evaluate $\int x \cos x \, dx$.

   k) Evaluate $\int \frac{dx}{(x+1)(x+2)}$.

   l) If $z = x^2y^2 + 3xy$, find $\frac{\partial^2 z}{\partial x^2}$ and $\frac{\partial^2 z}{\partial y^2}$.

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

b) Solve : $x + y + z = 11$

$2x - 6y - z = 0$

$3x + 4y + 2z = 0$

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

3. a) Given that $\vec{a} = 2i + 3j + 6k, b = 3i - 6j + 2k, c = 6i + 2j - 3k$. Show that $a \times b = 7c$. Show also that a, b, c are each of modulus 7 and are mutually perpendicular.

b) Find the volume of parallelepiped whose edges are represented by

$\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}, \vec{b} = \hat{i} + 2\hat{j} - \hat{k}, \vec{c} = 3\hat{i} - \hat{j} + 2\hat{k}$. **(5+5)**

4. a) Find the derivative of the following :

i) $y = \cos(ax + b)$

ii) $y = \frac{1}{3x + 2}$.

b) If $y = x^n \log x$. Show that $y_{n+1} = \frac{n!}{x}$. **(5+5)**

5. a) Find the maximum and minimum values of $f(x, y) = x^2y^2 - 5x^2 - 8xy - 5y^2$

b) Write the general solution of the differential equation : $\frac{dy}{dx} = \frac{x+1}{2-y}, y \neq 2$. **(7+3)**

6. a) Find $\int \frac{x^2}{(x^2 + 1)(x^2 + 4)} dx$.

b) Evaluate i) $\int x e^x dx$ ii) $\int \frac{x \sin^{-1} x}{\sqrt{1 - x^2}} dx$. **(5+5)**

7. a) Solve $\frac{dy}{dx} = \sin(x+y) + \cos(x+y)$.

b) Solve $\frac{dy}{dx} = \frac{x+y-1}{x-y+1}$. **(5+5)**

8. a) Solve $\frac{d^2y}{dx^2} - 18\frac{dy}{dx} + 81y = 0$.

b) Find the Fourier series of the function f(x) = | x | in $-\pi < x < \pi$. Hence deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$ **(4+6)**
