Sr.No. 7031

Exam.Code: 210402
Subject Code : 4251

M.Sc. Chemistry - 2nd Sem.

(2519)

Paper: XIII Mathematics for Chemists

Time allowed: 2 hrs. **Max. Marks : 25**

Note:- Attempt **five** questions selecting atleast one question from each Section (A-D). The **Fifth** question can be attempted from any section. All carry equal marks.

Section A

Q.1(a). Prove that $(\cos x - \cos y)^2 + (\sin x - \sin y)^2 = 4sin^2\left(\frac{x-y}{2}\right)$.

Q. 1(b). If A+ B = 45°. Show that $(1 + \tan A)(1 + \tan B) = 2$.

Q.2(a). Prove that $x + \frac{1}{x} = 2cos\theta,\ then\ x^3 + \frac{1}{x^3} = 2cos3\theta$.

Q.2(b). Find x from the equation

Sec (90° -A) + x sin A tan(90° -A) = cos(90° -A)

Section B

Q.3(a). Use Cayley Hamilton Theorem to find the inverse of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$$

Q.3(b). If $3A - B = \begin{bmatrix} 5 & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 3 \\ 2 & 5 \end{bmatrix}$, find the matrix A.

Q.4(a). Prove that $\begin{vmatrix} x+1 & 2 & 3 \\ 1 & x+2 & 3 \\ 1 & 2 & x+3 \end{vmatrix} = x^2(x+6)$.

Q.4(b). For what value of x, the matrix $\begin{bmatrix} 1+x & 7 \\ 3-x & 8 \end{bmatrix}$ is a singular matrix

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Section C

Q.5(a). If $y = sin^{-1}\left[\frac{2x}{1+x^2}\right] + sec^{-1}\left[\frac{1+x^2}{1-x^2}\right]$, prove that $\frac{dy}{dx} = \frac{4}{1+x^2}$.

Q.5(b). Differentiate $\log[(x+2)(x^3-x)]$, w.r.t. x.

Q.6(a). Differentiate $x^{\cos x} + (\cos x)^{\sin x}$ w.r.t. x.

Q.6(b). If $y = log\left(x - \sqrt{x^2 - a^2}\right)$, prove that $\frac{dy}{dx} = -\frac{1}{\sqrt{x^2-a^2}}$.

Section D

Q.7(a). If $U_n = \int_0^{\frac{\pi}{4}} tan^n x\, dx$, prove that $U_n + U_{n-1} = \frac{1}{n-1}$, where n being a positive integer >1. Hence evaluate U_5.

Q.7(b). Evaluate $\int e^{3\log x}(x^4+1)^{-1}\, dx$.

Q.8(a). Evaluate $\int \frac{2x}{(x^2-1)(x^2-3)} dx$.

Q.8(b). Evaluate $\int \frac{(x^2+8)^2}{x^4} dx$.

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