K16U 1223

Reg. No. : .....

Name : .....

II Semester B.Sc. Degree (CCSS – Reg./Supple./Improv.) Examination, May 2016
COMPLEMENTARY COURSE IN MATHEMATICS
2C02 MAT-CH : Mathematics for Chemistry – II
(2014 Adm. Onwards)

Time : 3 Hours Max. Marks : 40

SECTION – A

All the **first 4** questions are **compulsory**. They carry **1** mark **each** :

1. Evaluate $\int_0^{\pi/2} \sin^{10} x dx$.
2. Define the null space of a matrix.
3. Find the rank of the matrix $\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$.
4. State the Cayley-Hamilton theorem. **(4×1=4)**

SECTION – B

Answer **any 7** questions from among the questions **5** to **13**. They carry **2** marks **each**.

5. Evaluate $\int_0^{\pi/4} (\cos 2\theta)^{3/2} \cos\theta d\theta$.
6. Find the area bounded by the ellipse $x^2/a^2 + y^2/b^2 = 1$.
7. Find the length of the curve $y = \log\{(e^x - 1)/(e^x + 1)\}$ from $x = 1$ to $x = 2$.
8. Find the volume of the solid obtained by revolving one arc of the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 + \cos\theta)$.

P.T.O.

9. Evaluate $\iint xy\ (x+y)\,dxdy$ over the area between $y = x^2$ and $y = x$.

10. Give any two elementary row operations for matrices.

11. Show that the diagonal elements of a skew symmetric matrix are all zero.

12. Do there exist Skew-symmetric orthogonal 3×3 matrices ? Justify.

13. If $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$, use Cayley Hamilton theorem to show that $A^3 = 4A^2 - 5A$. **(7×2=14)**

SECTION – C

Answer **any 4** questions from among the questions **14** to **19**. They carry **3** marks **each**.

14. If $I_n = \int_0^a (a^2 - x^2)^n\,dx$ and $I_0 = a$ prove that $I_n = \frac{2na^2}{2n+1} I_{n-1}$.

15. Find the surface of the solid generated by the revolution of the lemniscate.
$r^2 = a^2\cos 2\theta$ about the initial line.

16. Find by double integration, the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$.

17. Solve by Gauss elimination method :
$4y + 4z = 24$
$3x - 11y - 2z = -6$
$6x - 17y + z = 18$.

18. Find the inverse of $\begin{bmatrix} -1 & 1 & 2 \\ 3 & -1 & 1 \\ -1 & 3 & 4 \end{bmatrix}$.

19. Find eigenvectors of the matrix $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$. **(4×3=12)**

SECTION – D

Answer **any 2** questions from among the questions **20** to **23**. They carry **5** marks **each**.

20. Find the area between the ellipses $x^2 + 2y^2 = a^2$ and $2x^2 + y^2 = a^2$.

21. Show that $\int_0^1 \left[\int_0^1 \frac{x-y}{(x+y)^2}\,dy \right] dx \neq \int_0^1 \left[\int_0^1 \frac{x-y}{(x+y)^2}\,dx \right] dy$.

22. Solve by Cramer's rule :
$3y + 4z = 14.8$
$4x + 2y - z = -6.3$
$x - y + 5z = 13.5$.

23. Find an eigen basis and diagonalize;

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

(2×5=10)