K18U 0503

Reg. No. : ....

Name : ....

II Semester B.Sc. Degree (C.B.C.S.S. – Reg./Supple./Improv.)
Examination, May 2018
COMPLEMENTARY COURSE IN MATHEMATICS
2C02 MAT-CH : Mathematics for Chemistry II
(2014 Admn. Onwards)

Time : 3 Hours

Max. Marks : 40

SECTION – A

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

1. Write down the value of $\int_0^{\pi/2} \cos^8 x \, dx$.

2. What is the area bounded by the ellipse $x^2/a^2 + y^2/b^2 = 1$?

3. Evaluate $\int_0^1 \int_0^1 (x^2 + y^2) \, dx \, dy$.

4. State the Cayley-Hamilton theorem.

$(1 \times 4 = 4)$

SECTION – B

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

5. Find the value of $\int_0^3 \sqrt{\left(\dfrac{x^3}{3-x}\right)} \, dx$.

6. Find the volume of the solid generated by rotating completely about x–axis the area enclosed between $y^2 = x^3 + 5x$ and the lines x = 2 and x = 4.

P.T.O.

7. Find the surface generated by the revolution of an arc of the catenary $y = c \cosh \dfrac{x}{c}$ about the axis of x.

8. Evaluate $\iint_A xy \, dx \, dy$ over the positive quadrant of the circle $x^2 + y^2 = a^2$.

9. Give examples of (i) symmetric and (ii) skew-symmetric matrices.

10. Solve the following system :

   $2x - y + 3z = -1$

   $-4x + 2y - 6z = 2$

11. If $A = \begin{bmatrix} 1 & 3 \\ 2 & 6 \end{bmatrix}$, find A^2 using Cayley-Hamilton theorem.

12. Consider the matrix $A = \begin{bmatrix} -1 & 3 & -1 & 1 \\ -3 & 5 & 1 & -1 \\ 10 & -10 & -10 & 14 \\ 4 & -4 & -4 & 8 \end{bmatrix}$. If one eigenvector is

   $v = \begin{bmatrix} 1 & 1 & 0 & 0 \end{bmatrix}^T$, find its eigenvalue λ.

13. Do there exist nonsingular skew-symmetric $n \times n$ matrices with odd n ? Justify.

   (2×7=14)

SECTION – C

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

14. Obtain the intrinsic equation of the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 - \cos\theta)$, the fixed point being the origin.

15. Find the whole length of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$.

16. Evaluate $\int_0^4 \int_0^{2\sqrt{z}} \int_0^{\sqrt{4z-x^2}} dz \, dx \, dy$.

17. Find the rank and a basis for the row space and for the column space of the matrix, $\begin{bmatrix} 0 & 0 & -7 & 1 \\ 0 & 0 & 5 & 0 \\ -7 & 5 & 0 & 2 \\ 1 & 0 & 2 & 0 \end{bmatrix}$.

18. Use Crammers rule to solve :

   $3x_1 + 4x_2 - 3x_3 = 5$

   $3x_1 - 2x_2 + 4x_3 = 7$

   $3x_1 + 2x_2 - x_3 = 3$.

19. Find the spectrum of the matrix $\begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$.

   (3×4=12)

SECTION – D

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

20. Find the area common to the circle $r = a\sqrt{2}$ and $r = 2a\cos\theta$.

21. Find the surface of the solid generated by revolution of the curve $x^2 + 4y^2 = 16$ about the $x - $ axis.

22. Find the inverse of the matrix $\begin{bmatrix} 1 & 2 & 5 \\ 0 & -1 & 2 \\ 2 & 4 & 11 \end{bmatrix}$, by Gauss-Jordan elimination.

23. Diagonalize the matrix $\begin{bmatrix} 7.3 & 0.2 & -3.7 \\ -11.5 & 1.0 & 5.5 \\ 17.7 & 1.8 & -9.3 \end{bmatrix}$.

   (5×2=10)