K22U 1064

Reg. No. : ....

Name : ....

II Semester B.Sc. Degree (C.B.C.S.S. – Supplementary) Examination, April 2022
(2016-2018 Admissions)
COMPLEMENTARY COURSE IN MATHEMATICS
2C02 MAT – CS : Mathematics for Computer Science – II

Time : 3 Hours Max. Marks : 40

SECTION – A

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

1. Give the reduction formula for $\int \sin^n x \, dx$.
2. What is the area of the surface of the solid obtained on revolving about x-axis, the arc of the curve $y = f(x)$ intercepted between $x = a$ and $x = b$?
3. If 1, 2 are the eigenvalues of matrix A, then what are the eigenvalues of A^T ?
4. What are the possible values of determinant of an orthogonal matrix ?

SECTION – B

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

5. Evaluate $\int_0^{\pi/4} (\cos 2\theta)^{3/2} \cos \theta \, d\theta$.
6. Find the volume of the solid obtained by revolving one arc of the cycloid $x = a(\theta + \sin \theta)$, $y = a(1 + \cos \theta)$ about the x-axis.
7. Find the area of a loop of the curve $r^2 = a^2 \cos 2\theta$.
8. Write the matrix $\begin{pmatrix} 4 & 3 \\ 0 & 4 \end{pmatrix}$ as a sum of a symmetric matrix R and a skew symmetric matrix S.

P.T.O.

9. For 2×2 matrices A, B, if $AB = I$, is it necessary that $BA = I$? If yes, give reason. If no, give an example.

10. Are the vectors $(-4, 2, 6)$ and $(2, -1, -3)$ linearly independent ? Why?

11. Prove that the eigenvalues of a 3×3 diagonal matrix are the same as its diagonal entries.

12. If $A = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$, show that 1 is an eigenvalue of A by giving an eigenvector.

13. Is $A = \begin{pmatrix} 1 & 0 \\ 0 & 2 \end{pmatrix}$ orthogonal ? Why ?

SECTION – C

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

14. Find the perimeter of the loop of the curve $9ay^2 = (x - 2a)(x - 5a)^2$.

15. If $\phi(n) = \int_0^{\pi/4} \tan^n x\,dx$, show that $\phi(n) + \phi(n-2) = \frac{1}{n-1}$. Deduce the value of $\phi(5)$.

16. Evaluate $\int_0^{\pi} \int_0^{a\theta} r^3 d\theta\, dr$.

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

18. For a 3×3 matrix A prove that $A + A^T$ is skew-symmetric without using the properties of transposes.

19. Prove that the eigenvalues of a 3×3 upper triangular matrix are the same as its main diagonal elements.

SECTION – D

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

20. Show that the area common to the ellipses $a^2x^2 + b^2y^2 = 1$ and $b^2x^2 + a^2y^2 = 1$ where $0 < a < b < 1$ is $\frac{4}{ab}\tan^{-1}\frac{a}{b}$.

21. Evaluate $\iiint_V (2x + y)\, dxdydz$, where V is the closed region bounded by the cylinder $z = 4 - x^2$ and the planes $x = 0$, $y = 0$, $y = 2$, $z = 0$.

22. Consider the system

    $x + 2y + 3z = 1$

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

    $4x - 6y + az = 2$

    Using row reduction, find for which value of a the system has a unique solution ? For which value of a the system has no solution ?

23. Find the eigenvalues and eigenvectors of the matrix $\begin{pmatrix} -3 & 2 \\ 2 & 0 \end{pmatrix}$.