K19U 0270

Reg. No. : ....

Name : ....

II Semester B.Sc. Degree (CBCSS – Reg./Supple./Improv.) Examination, April 2019
(2014 Admission Onwards)
COMPLEMENTARY COURSE IN MATHEMATICS
2C02 MAT-BCA : Mathematics for BCA-II

Time : 3 Hours Max. Marks : 40

SECTION – A

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

1. Give example of a lower triangular matrix that is not upper triangular.

2. Draw the graph with adjacency matrix $\begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$.

3. Prove or disprove : There exists a graph with vertex degrees 3, 3, 3, 1.

4. What is a cubic graph ?

SECTION – B

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

5. Obtain the intrinsic equation of the catenary $y = a \cosh(x/a)$, taking the vertex (0, a) as the fixed point.

6. Find the perimeter of the cardioide $r = a(1 - \cos \theta)$.

7. Solve the following system or indicate the nonexistence of solutions.
$2x + y - 3z = 8$
$5x + 2z = 3$
$8x - y + 7z = 0$

P.T.O.

8. Is the set of vectors [1, 1, 0], [1, 0, 0] and [1, 1, 1], linearly independent ? Justify.

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

10. 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 $v = [1\ 1\ 0\ 0]^T$, find its eigenvalue λ.

11. Let A be an idempotent matrix, meaning $A^2 = A$. Show that $\lambda = 0$ or $\lambda = 1$ are the only possible eigenvalues of A.

12. Does there exist a graph with four edges and four vertices which have degrees 1, 2, 3, 4 ? If yes, draw such a graph, otherwise state why ?

13. Prove that no simple graph with two or three vertices is self-complementary.

SECTION – C

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

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

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

16. Find the rank and a basis for the row space and for the column space of the matrix, $\begin{bmatrix} 8 & 2 & 5 \\ 16 & 6 & 29 \\ 4 & 0 & -7 \end{bmatrix}$

17. Use Cayley-Hamilton theorem to find the inverse of the matrix

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

18. Determine the eigenvalues and eigenvectors of $\begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$.

19. Let G be a simple graph with n vertices and m edges. Show that if $m > \binom{n-1}{2}$, then G is connected.

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. Solve by Cramer's rule :

$w + 2x - 3z = 30$

$4x - 5y + 2z = 13$

$2w + 8x - 4y + z = 42$

$3w + y - 5z = 35$

22. Diagonalize the following matrix, if possible.

$$A = \begin{bmatrix} 1 & -1 & -1 \\ 1 & 3 & 1 \\ -3 & 1 & -1 \end{bmatrix}.$$

23. Show that a self-complementary graph must have 4k or 4k + 1 vertices for some integer k.