

QP CODE: 22001704



Reg No

Name

2202
C3

M Sc DEGREE (CSS) EXAMINATION, JULY 2022

First Semester

M.Sc. Artificial Intelligence

CORE - AI010104 - MATHEMATICAL FOUNDATIONS OF AI

2019 ADMISSION ONWARDS

B932ABAF

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

Answer any **eight** questions.

Weight 1 each.

1. What you mean by scalar matrix?
2. How do you know two vectors are linearly independent?
3. For what c are $3x+z = 5$ and $8x-y+cz = 9$ are orthogonal
4. Define Affine spaces
5. Define identity matrix. Give an example for order 2 and order 3 identity matrix
6. Define Echelon Form of a matrix. Give an example
7. Find $\partial z/\partial x$ and $\partial z/\partial y$
 $x^3z^2 - 5xy^5z = x^2 + y^3$
8. Define principal component analysis
9. What is a Taylor series and a Taylor polynomial
10. Let $z = (4x + 9)(8x + 5)$. Find $\partial z/\partial x$

(8×1=8 weightage)

Part B (Short Essay/Problems)

Answer any **six** questions.

Weight 2 each.

11. Given $\mathbf{v} = \mathbf{i} - 2\mathbf{j} + 2\mathbf{k}$ and $\mathbf{u} = 4\mathbf{i} - 3\mathbf{k}$ find
 - i. the component of \mathbf{v} in the direction of \mathbf{u} ,
 - ii. the projection of \mathbf{v} in the direction of \mathbf{u} ,
 - iii the resolution of \mathbf{v} into components parallel and perpendicular to \mathbf{u}





12. Prove that the set of all ordered n-tuples of the elements of any field F is a vector space over F

13. Prove that $A^3 - 4A^2 - 3A + 11I = 0$ where $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 0 & -1 \\ 1 & 2 & 3 \end{bmatrix}$

14. If $A = \begin{bmatrix} 1 & 2 & -1 \\ 3 & 0 & 2 \\ 4 & 5 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$, verify that $(AB)^T = B^T A^T$

15. What is differentiation. Write the derivatives of trigonometric functions

16. Reduce the dimension

x	4	8	13	17
y	11	4	5	14

17. Use steepest descent method to minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ Starting from point $x_1 = (0, 0)$

18. Find the extrema of $F(x, y) = x^2 y - \ln(x)$ subject to $0 = g(x, y) := 8x + 3y$.

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight **5** each.

19.

1. Solve the following equations by matrix inversion

$$2x + y + 2z = 0$$

$$2x - y + z = 10$$

$$x + 3y - z = 5$$

20. Express the vector $u = (-4, 2, -5, -2)$ as a linear combination of the vectors

$$\{(1, -4, 1, 2), (4, -8, 4, 4), (-4, 4, -5, -3), (2, -2, 3, 2)\}$$

21.

Find the characteristic equation of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$

22. Define Jacobian Find the Jacobian of $x = (u + v)/2, y = (u - v)/2$

(2×5=10 weightage)

