

QP CODE: 22001704



Reg No

Name

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## 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.

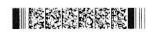
Weight 2 each.

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 v in the direction of 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 
$$A^3 + 4A^2 + 3A + 111 = 0$$
 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 |    | 8 | 13 | 17 |  |
|---|----|---|----|----|--|
| у | 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  $F(x, y) = x 2y - \ln(x)$  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

$$2x+y+2z=0$$
  
 $2x-y+z=10$ 

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)