Reg. No....................................... Name 26U4219

BA, BSc, BCOM DEGREE END SEMESTER EXAMINATION - MARCH 2026

UGP (HONS.) SEMESTER 4 : DISCIPLINE SPECIFIC COURSE

COURSE: 24UMATDSC212 - MATHEMATICS FOR DATA SCIENCE

(For Regular 2024 Admission)

Time : 2 hours Max. Marks : 70

(Non-programmable scientific calculators are allowed)

PART A

(Each question carries 2 marks, a maximum of 10 marks can score from this part)

1. a) Define characteristic equation of a matrix. R, CO1

   b) State Cayley Hamilton theorem.

2. If the trace and determinant of a 2×2 matrix are 9 and 14. Find the Eigen values. A, CO1
3. Define slack and surplus variable in linear programming problem. R, CO2
4. Explain the non –negativity condition in linear programming problem. U, CO2
5. Find the value of the function $f(x, y, z) = \sqrt{100 - x^2 - y^2 + z^2}$ at the point A, CO3

   a) (2,3,7)

   b) $\left(5, -3, \frac{1}{5}\right)$.

6. Find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{dy}$ of $f(x, y) = 2xy + y^2$. A, CO4
7. State Lagrange's multiplier method in one constraint. R, CO4
8. Find $\int_2^4 \int_1^3 x^2 y \, dydx$. A, CO4

PART B

(Each question carries 5 marks, a maximum of 30 marks can score from this part)

9. Find the Eigen values and Eigen vectors of $A = \begin{bmatrix} 4 & -1 \\ 2 & 1 \end{bmatrix}$. An, CO1
10. Interpret the applications of Eigen values in Data Science. U, CO1
11. This pandemic, Kiran learned to bake while home quarantine. He also realized that he will able to make ₹60 profit per tray of banana muffins, ₹120 profit per tray of blueberry muffins. He needs 2 cups of milk and 3 cups of flour to bake banana muffins and baking a tray of blueberry, 4 cups of milk and 3 cups of flour. He has 60 cups of milk and 50 cups of flour. Find the number of trays of each muffin must be baked to maximize profit. A, CO2
12. Find the first iteration table of the simplex method for the given LPP: An, CO2

    Maximize $Z = 2x_1 + x_2$

    Subject to $x_1 - x_2 \leq 10, 2x_1 - x_2 \leq 10, x_1, x_2 \geq 0$.

13. Find the domain and range of the following functions: An, CO3

    a) $f(x, y, z) = x^2 + y^2 + z^2$.

    b) $g(x, y, z) = x \, logyz$.

14. Show that $f(x, y) = \begin{cases} \frac{2xy}{x^2+y^2} & , (x, y) \neq (0,0) \\ 0 & , (x, y) = (0,0) \end{cases}$ An, CO4

    is continuous at every point except at origin.

15. Find the gradient vector of the following functions: A, CO4

    a) $f(x, y, z) = x^3 + \sqrt{y} + \sin z$

    b) $f(x, y, z) = x \log yz$

16. Find the point $P(x, y, z)$ closest to the origin on the plane $2x + y - z - 5 = 0$. An, CO4

PART C

(Each question carries 15 marks, a maximum of 30 marks can be score from this part)

17. Find the singular value decomposition of the matrix $A = \begin{bmatrix} 1 & 1 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}$. An, CO1

18. Solve the given LPP using simplex method: An, CO2

Maximize $Z = 3x_1 + 5x_2 + 4x_3$

subject to the constraints: $2x_1 + 3x_2 \leq 8, 2x_2 + 5x_3 \leq 10, 3x_1 + 2x_2 + 4x_3 \leq 15,$

$x_1, x_2, x_3 \geq 0.$

19. Find the level curves of the following functions: U, CO3

a) $z = f(x, y) = 100 - x^2 - y^2$

b) $z = f(x, y) = x^2 + y^2$

20. Find the volume of the wedge like solid that lies beneath the surface $z = 16 - x^2 - y^2$ and above the region R bounded by the curve $y = 2\sqrt{x}$, the line $y = 4x - 2$, and the x-axis. An, CO4