



Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY  
B.Tech Degree S1(S) Examinations May 2026 (2024 Scheme)

Course Code: GAMAT101

Course Name: MATHEMATICS FOR INFORMATION SCIENCE-1

Max. Marks: 60

Duration: 2 hours 30 minutes

## PART A

*(Answer all questions. Each question carries 3 marks)*

- |   |  | CO  | Marks |
|---|--|-----|-------|
| 1 | Evaluate $\lim_{x \rightarrow 0} \frac{\sqrt{x^2+100}-10}{x^2}$  | CO1 | (3)   |
| 2 | A weight hanging from a spring is stretched down 5 units beyond its rest position and released at time $t = 0$ to bob up and down. Its position at any later time $t$ is $s = 5 \cos t$ . What are its velocity and acceleration at time $t$ ? | CO1 | (3)   |
| 3 | Show that $f(x, y) = \begin{cases} \frac{2xy}{x^2+y^2}, & (x, y) \neq (0,0) \\ 0, & (x, y) = (0,0) \end{cases}$ is continuous at every point except at the origin.   | CO2 | (3)   |
| 4 | If $f(x, y) = \sqrt{2x + 3y - 1}$ find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ at $(-2,3)$ .   | CO2 | (3)   |
| 5 | Find the derivative of $f(x, y) = xe^y + \cos(xy)$ at the point $(2,0)$ in the direction of $\vec{v} = 3i - 4j$  | CO3 | (3)   |
| 6 | Find the critical points of the function $f(x, y) = x^3 + 3xy + y^3$ .   | CO3 | (3)   |
| 7 | Find the local extreme values of $f(x, y) = 49 - x^2 - y^2$ on the line $x + 3y = 10$ using Lagrange's multiplier method.  | CO4 | (3)   |
| 8 | Form the LPP : Foods A and B have 600 and 500 calories contain 15gm and 30 gm of protein and cost \$ 1.80 and \$ 2.10 per unit respectively. Find the minimum cost diet of atleast 3900 calories containing atleast 150gm of protein.          | CO4 | (3)   |

## PART B

*(Answer any one full question from each module, each question carries 9 marks)*

## Module -1

- 9 a) Find the equation of tangent line and normal line to the curve  $x^3 + y^3 - 9xy = 0$  at  $(2,4)$ . CO1 (5)

- b) A body moves on a coordinate plane whose position is  $s = 2t^2 - 5t + 2$ ;  $0 \leq t \leq 3$ . Find the body's speed and acceleration at the end points of the interval. CO1 (4)
- 10 a) Find the derivative of the function  $f(x) = 4 - x^2$  using limit definition of derivative. Hence find  $f'(-3)$  and  $f'(1)$ . CO1 (4)
- b) Determine the concavity of  $f(x) = e^{-x^2}$ . CO1 (5)

## Module -2

- 11 a) Find and sketch the level curves  $f(x, y) = c$  where  $f(x, y) = x + y - 1$ ;  $c = -3, 0$ . CO2 (3)
- b) If  $f(x, y) = x \cos y + ye^x$  find  $\frac{\partial^2 f}{\partial x^2}$ ,  $\frac{\partial^2 f}{\partial x \partial y}$ ,  $\frac{\partial^2 f}{\partial y \partial x}$ ,  $\frac{\partial^2 f}{\partial y^2}$  CO2 (6)
- 12 a) Assume that  $w = f(ts^2, \frac{s}{t})$ ,  $\frac{\partial f}{\partial x}(x, y) = xy$ ,  $\frac{\partial f}{\partial y}(x, y) = \frac{x^2}{2}$ . Find  $\frac{\partial w}{\partial t}$  and  $\frac{\partial w}{\partial s}$  by chain rule. CO2 (6)
- b) Find  $\frac{\partial f}{\partial x}$ ,  $\frac{\partial f}{\partial y}$  and  $\frac{\partial f}{\partial z}$  of the function  $f(x, y, z) = yz \ln(xy)$ . CO2 (3)

## Module -3

- 13 a) If  $w = \ln(x^2 + y^2 + z^2)$ ,  $x = ue^v \sin u$ ,  $y = ue^v \cos u$ ,  $z = ue^v$ ;  $(u, v) = (-2, 0)$ , find  $\frac{\partial w}{\partial u}$  by chain rule. CO3 (5)
- b) Find the local extreme values of  $f(x, y) = 3y^2 - 2y^3 - 3x^2 + 6xy$ . CO3 (4)
- 14 a) Find the directions in which the function  $f(x, y) = x^2 + xy + y^2$  increases and decreases rapidly at  $(-1, 1)$ . CO3 (3)
- b) Find the absolute extrema of  $f(x, y) = 2x^2 - 4x + y^2 - 4y + 1$  on the closed triangular plane bounded by the lines  $x = 0$ ,  $y = 2$ ,  $y = 2x$  in the first quadrant. CO3 (6)

## Module -4

- 15 a) By Lagrange's multiplier method find the maximum and minimum values of the function  $f(x, y) = 3x + 4y$  on the circle  $x^2 + y^2 = 1$ . CO4 (5)
- b) Determine the minimum of  $f(x) = x_1^2 + 3x_2^2$  starting from  $(x_0, y_0) = (6, 3)$  by the method of steepest descent in three iterations. CO4 (4)

- 16 a) Maximise  $f(x, y, z) = x^2 + 2y - z^2$  subject to the constraints CO4 (5)  
 $2x - y = 0, y + z = 0$  by Lagrange's multiplier method.

- b) Solve the following LPP graphically : CO4 (4)

Maximise  $z = 40x_1 + 88x_2$  subject to

$$2x_1 + 8x_2 \leq 60$$

$$5x_1 + 2x_2 \leq 60$$

$$x_1 \geq 0, x_2 \geq 0$$

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