A

Pages: 3

03GAMAT101122404

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S1 (R,S) Examination December 2025 (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 $\lim_{x\to 0} \frac{x}{3-\sqrt{x+9}}$.	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 cost . What are its velocity and acceleration at time t ?	CO1	(3)
3	Verify $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$ for $u = tan^{-1}(\frac{x}{y})$	CO2	(3)
4	If $z = x^2y,\ x = t^2,\ y = t^3$, find $\frac{dz}{dt}$ using chain rule.	CO2	(3)
5	Prove that $\nabla(fg) = f\nabla g + g\nabla f$	CO3	(3)
6	Find the directions in which the function $f(x,y) = x^2 + xy + y^2$ increases and decreases rapidly at $(-1,1)$.	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	Explain the general form of LPP	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)	Check the continuity of the function $f(x) = \begin{cases} 3x+2, & x \le 1 \\ x^2+1, & x > 1 \end{cases}$ at x = 1.	CO 1	(2)

c) Find the linearization of $f(x) = cosx$ at $x = \frac{\pi}{2}$. CO1 (2)

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) Find the inflection points of $f(x) = x^3 - 3x + 1$ and the intervals on which it is concave up and concave down. 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 $f(x, y) = x\,cosy + ye^x$ 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) Express $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial \theta}$ in terms of r and θ , where

$$w = 4\,e^x\,lny, \qquad x = \ln(rcos\theta) \quad and \quad y = r\,sin\theta.$$

CO2 (6)

b) Show that the function $f(x, y) = \frac{xy^3}{x^2 + y^6}$ has no limit as $(x, y) \to (0,0)$ CO2 (3)

Module -3

13 a) Let f be a differentiable function of 3 variables and suppose that $w = f(x - y, y - z, z - x)$. Show that $\frac{\partial w}{\partial x} + \frac{\partial w}{\partial y} + \frac{\partial w}{\partial z} = 0$. 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 directional derivative at (1, -1) of $g(x, y) = \frac{x-y}{xy+2}$ in the direction of $\vec{v} = 12\vec{\imath} + 5\vec{\jmath}$. CO3 (4)

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 (5)

Module -4

15 a) A firm manufacturers two types of products P_1 and P_2 and sells them on a profit of Rs 3 on type P_1 and Rs 4 on type P_2. Each product is processed on two machines A & B. Type P_1 requires 2 minutes of processing time on A and 1 minute on B; type P_2 requires 3 minutes on A and 2 minutes on B. The machine A is available for not more than 450 minutes while machine B is

available for 720 minutes during any working day. Formulate the problem as on LPP. CO4 (3)

b) Find the extreme values of $f(x, y, z) = x^2 + y^2 + z^2$ subject to the constraints $x + y + z = 1, and\ x - y = 0$. CO4 (6)

16 a) Minimise the quadratic function $f(x, y) = 3x^2 + 4y^2$ starting from the point $(x_0, y_0) = (1,1)$ using the method of steepest descent with a fixed step size $\alpha = 0.01$. Iterate 3 steps CO4 (4)

b) Solve the LPP

Minimize Z= 5x + 3y CO4 (5)

Subject to $2x + y \geq 10$,

$x + 3y \geq 15$,

$x \leq 10$,

$y \leq 8$,

$x, y \geq 0$

***