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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S1 (S) Examination May 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 $\lim_{x\to 1}\frac{x-1}{\sqrt{x+3}-2}$	CO1	(3)
2	Find the derivative of the function $f(x)=\frac{\ln x}{x^3}$ $at\ x=1$.	CO1	(3)
3	Find the domain and range of the function $f(x,y)=\frac{1}{\sqrt{16-x^2-y^2}}$	CO2	(3)
4	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)
5	Prove that $\nabla(fg)=f\nabla g+g\nabla f$	CO3	(3)
6	Find the critical points of the function $f(x,y)=x^3+3xy+y^3$.	CO3	(3)
7	Find the maximum and minimum values of the function $f(x,y)=3x+4y$ on the circle $x^2+y^2=1$	CO4	(3)
8	Solve the following LPP graphically: Maximise $z=3x+2y$ subject to $x+2y\le 10,\ 3x+y\le 15\ and\ x,y\ge 0$	CO4	(3)

PART B

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

Module -1

			CO	Marks
9	a)	Find the first and second derivatives of the function $y=\frac{(x+1)(x^2+x+1)}{x^3}$	CO1	(4)
	b)	Show that the point (2,4) lies on the curve $x^3+y^3-9xy=0$. Then find the tangent and normal to the curve there.	CO1	(5)
10	a)	Find the linearisation of $f(x)=x+\frac{1}{x}$ at $x=1$	CO1	(2)

b) Determine the concavity of the function $f(x) = x^3 - 3x^2 + 2$ and find the points of inflexion. CO1 (4)

c) Using implicit differentiation Find $\frac{dy}{dx}$ in $x^2 + xy + y^2 = 1.2$ CO1 (3)

Module -2

11 a) 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 (5)

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 (4)

12 a) Express $\frac{\partial w}{\partial r}$ and $\frac{\partial w}{\partial \theta}$ in terms of $r\ and\ \theta$, where CO2 (5)

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

b) Find the partial derivatives of $f(x,y) = x^3y + 2xy^3$ and verify mixed derivative theorem. CO2 (4)

Module -3

13 a) Locate the relative extrema and saddle point of $f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$. CO3 (5)

b) Find the absolute maximum and minimum values of the function $f(x, y) = 2x^2 - 4x + y^2 - 4y + 1$ on the closed triangular plane bounded by the lines $x = 0, y = 2, and\ y = 2x$ in the first quadrant. CO3 (4)

14 a) Find the directional derivative of $f(x, y) = xe^y$ in the direction of the vector $\hat{\imath} - \hat{\jmath}$. CO3 (4)

b) Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ at (0,0,0,) if $x^3 + z^2 + y\,e^{xz} + z\,cosy = 0$ CO3 (5)

Module -4

15 a) Solve the following LPP graphically: Minimise $z = 20x + 10y$ Subject to the constraints CO4 (5)

$x + 2y \leq 40,\ \ 3x + y \geq 30,\ \ 4x + 3y \geq 60,$

$and\ \ x \geq 0\,, y \geq 0$

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 (4)

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 (5)

b) A firm manufactures 3 products A, B and C. The profits are Rs. 3, Rs. 2 and Rs. 4 respectively. The firm has two machines M_1 and M_2 and below is the required capacity processing time in minutes for each machine on each product. CO4 (4)

Machine	Product		
	A	B	C
M_1	4	3	5
M_2	2	2	4

Machines M_1 and M_2 have 2000 and 2500 machine minutes respectively. The firm must manufacture 100 A's, 200 B's and 50 C's but not more than 150 A's. Formulate an LPP to maximise the profit.

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