Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester B.Tech Degree Regular Examination December 2024 (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

		CO	Marks
1	At what points are the function $g(x) = \begin{cases} \frac{x^2-x-6}{x-3}, & x \neq 3 \\ 5\ ; & x = 3 \end{cases}$ continuous.	CO1	3
2	Find the first and second derivatives of $\frac{x^3+7}{x}$.	CO1	3
3	Find $\lim\limits_{(x,y)\to(0,0)} \frac{1-\cos(xy)}{xy}$	CO2	3
4	Show that $w_{xy} = w_{yx}$ where $w = e^x + x\ lny + y\ lnx$.	CO2	3
5	What are the directions of zero change in $f(x,y) = \frac{x^2}{2} + \frac{y^2}{2}$ at $(1,1)$	CO3	3
6	Find the critical points of the function $f(x,y) = 5xy - 7x^2 + 3x - 6y + 2$.	CO3	3
7	Find the extreme points of $f(x,y) = xy$ subject to the constraints $x + y = 16$	CO4	3
8	Form the LPP by maximising the profit: DC Drug company produces two types of liquid pain killer, N(normal) and S(super). Each bottle of N requires 2 units of drug A, 1 unit of drug B and 1 unit of drug C. Each bottle of S requires 1 unit of A, 1 unit of B, 3 units of C. The company is able to produce each week only 1400 units of A, 800 units of B and 1800 units of C. The profit per bottle of N and S is $11 and $15 respectively.	CO4	3

PART B

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

Module -1

9 a) Find $\lim\limits_{x \to 0} \dfrac{\frac{1}{x-1} + \frac{1}{x+1}}{x}$ CO1   3

   b) Find the linearization of $f(x) = cosx$ at $x = \dfrac{\pi}{2}$.   CO1   3

   c) Determine the concavity of $f(x) = x^3 - 6x^2 + 9x + 1$.   CO1   3

10 a) Show that $y = |x|$ is differentiable on $(-\infty, 0)$ and $(0, \infty)$, but has no   CO1   6
       derivative at $x = 0$.

    b) The area A of a circle is related to its diameter D by the equation $A = \dfrac{\pi}{4}D^2$.   CO1   3
       How fast does the area change with respect to the diameter when diameter
       is 10m.

Module -2

11 a) Find $\dfrac{\partial^2 w}{\partial y \partial x}$ if $w = xy + \dfrac{e^y}{y^2+1}$ CO2   3

    b) Find the limit of the function $\lim\limits_{(x,y)\to(0,0)} \dfrac{x^2 - xy}{\sqrt{x} - \sqrt{y}}$.   CO2   3

    c) Find $\dfrac{\partial f}{\partial x}, \dfrac{\partial f}{\partial y}$ and $\dfrac{\partial f}{\partial z}$ for the function $f(x, y, z) = e^{\frac{x}{y}} + e^{\frac{z}{y}}$ CO2   3

12 a) Find the domain and range of the function $g(x, y) = \ln(x^2+y^2)$ CO2   3

    b) If $w = e^{x^2 y}, x = \sqrt{uv}, y = \dfrac{1}{v}$, find $\dfrac{\partial w}{\partial u}$ and $\dfrac{\partial w}{\partial v}$ at $(2,2)$ using chain rule.   CO2   6

Module -3

13 a) If $w = f(x - y, y - z, z - x)$, show that $\dfrac{\partial w}{\partial x} + \dfrac{\partial w}{\partial y} + \dfrac{\partial w}{\partial z} = 0$.   CO3   5

    b) Find the directional derivative at $(1,-1)$ of $g(x, y) = \dfrac{x-y}{xy+2}$ in the direction   CO3   4
       of $\vec{v} = 12\vec{i} + 5\vec{j}$.

14 a) Find the local extrema of $f(x, y) = 10xye^{-(x^2+y^2)}$ CO3   6

b) Find the gradient of $f(x, y) = x^2 - xy + y^2 - y$ at $(1, -1)$ CO3   3

Module -4

15   a)   Find the point $P(x, y, z)$ on the plane $2x + y - z - 5 = 0$ that is close to the origin.   CO4   6

     b)   Minimise the function $f(x, y) = x^2 + y^2$ with starting point $(1,1)$ with step size, $\alpha = 0.1$ in two iterations by the method of steepest descent.   CO4   3

16   a)   Find the largest and smallest values the function $f(x, y) = xy$ takes on the ellipse $\frac{x^2}{8} + \frac{y^2}{2} = 1$ by Lagrange's multiplier method.   CO4   5

     b)   Solve the following LPP graphically: CO4   4

     Maximise $z = 6x_1 + 11 x_2$ subject to

$$2x_1 + x_2 \leq 104$$
$$x_1 + 2x_2 \leq 76$$
$$x_1 \geq 0, x_2 \geq 0$$

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