National University of Computer and Emerging Sciences 0412

Lahore Campus

Multivariable Calculus (MT1008)

Date: 25th Feb 2025

Sessional-I

Course Instructor(s)

Dr. Mazhar Hussain, Dr. Akhlaq Ahmad, Dr. Hina Firdous, Dr. Sidra Afzal, Tasaduque Hussain, Muhammad Yaseen.

Total Time (Hrs.):	1
Total Marks:	55
Total Questions:	2

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Attempt all the questions.

***CLO*#1. Defining Functions of Several Variables, Computing Partial Derivatives, Directional and Gradient Vectors.**

1 (a). Find and sketch the domain of f. Then find an equation for the level curves of the function passing through the given point

identify and sketch LC

$$f(x,y) = \sqrt{x^2 - y}$$

Also, determined if the domain is bounded or unbounded, and decide if open region or closed region.

(b). Check whether the given function has a limit or not as (x,y) approaches (0,0),

$$f(x,y) = \frac{2x^2y}{x^4 + y^2}$$

(c). Show that for a function $f(x,y)$ and a positive number ϵ given below there exist a $\delta > 0$ such that for all (x,y), $|f(x,y) - f(0,0)| < \epsilon$ whenever $0 < \sqrt{x^2 + y^2} < \delta$

$$f(x,y) = \frac{x+y}{2 + \cos x} \quad , \quad \epsilon = 0.02$$

(d). Does there exist a direction u in which the rate of change of the temperature function $T(x,y,z) = x^4y - 3xy^2z + e^{xyz}$ (temperature in degree Celsius, distance in meter) at $P(1,-1,0)$ equals $-5.74^o\ C/m$? If not, provide reasons for your answers. [10+10+10+10]

***CLO*#2. Evaluation of Multiple Integrals in Different Coordinate Systems and Their Applications to Work, Circulation, Flux, Green's Theorem, and Stokes' Theorem.**

2. Sketch the region of integration and evaluate the integral

$$\iint_R xy\, dA$$

Where R is the region bounded by the lines $y = x, y = 2x,$ and $x + y = 2$. [15]