UNIVERSITY OF CENTRAL PUNJAB LAHORE
Assignment 3
CLO Mapping: CLO2

Course Code	MAT243	Semester	Fall 2025
Course Title	Multivariable Calculus		
Resource Person	Ms. Seema Mazhar		
Assignment Given Date	22-12-2025	Submission Date	30-12-2025
Total Marks	20		

Version	Name of student	Complete Registration no.	Section	Total marks

Submission Instructions *(Please follow strictly)*

- **It is COMPULSORY to attach this page as the title page of your assignment. Failure to do so will lead to 2 marks deduction and 1 mark deduction foreach missed detail here.**
- **Work should be done on A4 papers or Assignment Sheets in a neat way with complete computational steps.**
- **This is an INDIVIDUAL assignment so mention all detail as asked.**
- **Version 2 will be done by students whose roll number ends in odd digits (1,3,5,7) and Version 1 will be done by students whose roll number ends in even digits (2,4,6,8,0)**
- **2 marks will be deducted per day delay of Late submission. Assignment will not be accepted after 2 days of deadline.**
- **All students' plagiarized assignments will be awarded deduction of 2 marks for each match.**
- **All AI matched and plagiarized assignments will be awarded ZERO marks.**

I declare that I have prepared the assignment according to above guidelines, and I shall be responsible for any deduction of marks as per rubrics of the instructions.

Student signature: _____

Q1. (2+2+3+3=10 marks) Find f_{xyzy} of the function

$$f(x, y, z) = 4yz^2 \ln\left(\frac{xz}{8y}\right) + 3\sin(zx^2 - y^2)$$

Q2. (4+4+2=10 marks):

Mega Hub Corp is optimizing its automated distribution center. The **Throughput Index (T)** represents the number of packages processed per hour. This index depends on the **conveyor belt speed (x)** in meters per minute and the **robotic arm frequency (y),** in cycles per minute. The engineering team has refined the model to account for startup costs and system synchronization:

$$T(x, y) = x^3 + y^3 - 45x^2 - 75y^2 + 600x + 1800y + 1000$$

1. Find **all** distinct operational configurations and identify which configuration yields the **optimum** Throughput index. **Give reasons for your selection.**
2. **Determine and describe** the optimum Throughput index.

Version 2

Q1. (3+4+4=10 marks) Find f_{xyz} of the function

$$f(x,y) = 4\frac{yz}{x}\cos\left(\frac{3x}{yz}\right)$$

Q2 (4+4+2=10 marks):

Delwright Logistics is optimizing the battery efficiency of its delivery drones. The **Efficiency Index (E)** of a drone's flight depends on two primary operational variables the **payload weight (x)**, measured in kilograms and cruising altitude (y), measured in hundreds of meters. Based on test flights, the efficiency function is modeled by:

$$E(x,y) = 12xy - x^3 - 4y^2 - 16y + 145$$

where E represents the flight time in minutes.

 To ensure consistent performance across the fleet, the engineering team needs to identify the suitable metrics of this function. These metrics will help determine where the system reaches peak performance and where it becomes inefficient.

1. **Find** the **optimum value** of the *operational variables*?
2. **Determine** the **optimum value** of the *efficiency index*? What do you infer from this answer?