FACULTY OF ENGINEERING SCIENCES AND TECHNOLOGY

Department: **Computer Science**   Program: **BS**

Multivariable Calculus

Announced date: 01-09-24   Due Date: 08-09-24   Total Marks =   05

Assignment 2			
Mapped CLO	**SDG**	**Knowledge Profile**	**Complex Problem Solving Mapped**
CLO 2	4 & 9	WK2 (Mathematics)	GA – 2 (Knowledge for Solving Computing Problems)

Problem Statement:

Question # 01(Directional Derivative)

a) find the directional derivative $f_{\vec{u}}\,(1,2)$ for the function f with $\vec{u} = (3\vec{i} - 4\vec{j})/5$.

$$i. \;. f(x,y) = sin(2x - y) \qquad ii. f(x,y) = xy + y^3$$

b) If $f(x,y) = x^2 y$ and $\vec{v} = 4\vec{i} - 3\vec{j}$, find the directional derivative at the point (2, 6) in the direction of $\vec{v}$.

Question # 02(Chain Rule)

a) Find dz/dt using the chain rule.

1. $z = (x + y)e^y, \quad x = 2t,\; y = 1 - t^2$
2. $z = ln(x^2 + y^2), \quad x = 1/t,\; y = \sqrt{t}$
3. $z = sin\left(\frac{x}{y}\right), \quad x = 2t,\; y = 1 - t^2$

b) Use the chain rule to find dz/dt, and check the result by expressing z as a function of t and differentiating directly.

$$z = y^3 x^3, \qquad x = t^3, \qquad y = t^2$$

Question # 03(Second Derivative Test)

a) Find the critical points and classify them as local maxima, local minima, saddle points, or none.

1. $f(x,y) = x^3 + y^3 - 3x^2 - 3y + 10$

2. $f(x,y) = x^2 y + 2y^2 - 2xy + 6$

Question # 04(Implicit Differentiation)

a) Find the differentiation($\frac{dy}{dx}$ o$\frac{dz}{dx}, \frac{dz}{dy}$) for the following functions.

1. $y^2 + x^3 - y^3 + 6 = 3y$ 2. $x^2 + y^2 + z^2 + \sin(xy) = 0$.

Question # 05(Differential)

b) An unevenly heated plate has a temperature $T(x,y)$ in ∘C at the point (x, y). If $T(2,1) = 135$, and $Tx(2,1) = 16$, and $Ty(2,1) = -15$, estimate the temperature at the point $(2.04, 0.97)$.

c) 26. A right circular cylinder has a radius of 50 cm and a height of 100 cm. Use differentials to estimate the cylinder's volume change if its height and radius increase by 1 cm.