GALGOTIAS UNIVERSITY

ADMISSION NUMBER

School of Basic Sciences

Bachelor of Science Honours in Mathematics
Mid Term Examination - Nov 2023

Duration : 90 Minutes
Max Marks : 50

Sem III - C1UC301T - Multivariable Calculus and Partial Differential equations

General Instructions
Answer to the specific question asked
Draw neat, labelled diagrams wherever necessary
Approved data hand books are allowed subject to verification by the Invigilator

1) Find the gradient of the scalar field $f(x,y) = y^2 - 4xy$ at the point (1,2). K2 (2)

2) Find the value of $\frac{\partial z}{\partial x}$ at the point (1, 1, 1) if the equation $xy + z^3x - 2yz = 0$ defines z as a function of the two independent variables x and y. K1 (3)

3) Find the second-order partial derivative $\frac{\partial^2 f}{\partial x^2}, \frac{\partial^2 f}{\partial y^2}$ of the function $f(x,y) = sin(xy)$. K2 (4)

4) Find $\int \int_R xcos(xy)dA$ where $R: 0 \leq x \leq \frac{\pi}{2}, 0 \leq y \leq 1$. K2 (6)

5) Find the points of discontinuity of the function $f(x,y) = \begin{cases} \frac{3x^2y}{x^4+y^4}, (x,y) \neq (0,0) \\ 0, (x,y) = (0,0) \end{cases}$. K3 (6)

6) Show that the vector field $F = 2x(y^2 + z^3)i + 2x^2yj + 3z^2x^2k$ is conservative. Find its potential function. K3 (9)

7) Apply Lagrange Multiplier method to find the maximum and minimum values of $f(x,y) = xy$ on the curve $3x^2 + y^2 = 6$. K4 (8)

8) Analyse the critical points of the function $f(x,y) = 8x^3 - 24xy + y^3$ and use second derivative test to classify each point as one where a saddle, local minimum or local maximum occurs. K4 (12)

OR

Analyse the critical points of the function $f(x,y) = 10xye^{-(x^2+y^2)}$ and use second derivative test to classify each point as one where a saddle, local minimum or local maximum occurs. K4 (12)