

Reg. No.:



Y7963

Name:

University of Kerala

Fourth Semester FYUGP Degree Examination, May 2026

Discipline Specific Core Course

MATHEMATICS

UK4DSCMAT201 - Partial Differentiation and Introduction to Abstract Algebra

Academic Level: 200-299

2024 Admission

Time: 1 Hour 30 Minutes(90 Mins.)

Max. Marks: 42

Part A. 6 Marks.Time:6 Minutes.(Cognitive Level:Remember(RE)/Understand(UN)) Objective Type. 1 Mark Each.Answer all questions

Qn No.	Question	CL	CO
1	Define a transposition.	RE	1
2	State the condition under which a function of two variables is differentiable at a point in terms of its first-order partial derivatives.	RE	1
3	Find all cosets of the subgroup $2\mathbb{Z}$ of the group $\mathbb{Z}$.	UN	4
4	State true or false: Every cyclic group is abelian.	UN	4
5	The natural domain of $f(x, y, z) = \sqrt{1 - x^2 - y^2 - z^2}$ is	UN	2
6	Find the gradient of $f(x, y) = 5x^2 + y^4$ at $(4, 2)$.	UN	2

Part B. 8 Marks.Time:24 Minutes.(Cognitive Level:Understand(UN)/Apply(AP))Short Answer. 2 marks each.Answer all questions

Qn No.	Question	CL	CO
7	Prove that every cyclic group is abelian.	UN	4
8	Let $\phi : G \rightarrow G'$ be a group homomorphism. Show that if e is the identity element in G then $\phi(e)$ is the identity element e' in G' .	UN	4
9	Find the slope of the sphere $x^2 + y^2 + z^2 = 1$ in the y -direction at the points $(2/3, 1/3, 2/3)$ and $(2/3, 1/3, -2/3)$.	AP	2
10	Find the equation for the tangent plane and parametric equation for the normal line to the surface $z = x^2y$ at the point $(2, 1, 4)$.	AP	2

Qn No.	Question	CL	CO
11	A) Prove that a subgroup of a cyclic group is cyclic. OR B) Prove that $\langle U, \cdot \rangle$ is an abelian group where $U = \{z \in \mathbb{C} : z = 1\}$.	AP	4, 4
12	A) (i) Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$, $z = e^{xy} \sin 5y^2$. (ii) Show that the function $u(x, t) = e^{-t} \sin(x/c)$ is a solution of the heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. OR B) (i) Let $e^{xy} + ye^y = 1$. Find $\frac{dy}{dx}$. (ii) Let f be a differentiable function of three variables and suppose that $w = f(x - y, y - z, z - x)$. Show that $\frac{\partial w}{\partial x} + \frac{\partial w}{\partial y} + \frac{\partial w}{\partial z} = 0$.	AN	2, 2
13	A) Let $\phi : \mathbb{R} \rightarrow \mathbb{R}^+$ be defined by $\phi(x) = 2^x$. Prove that ϕ is a homomorphism and also find its kernel. OR B) Find all cosets of the subgroup $\langle 3 \rangle$ in $\mathbb{Z}_{18}$. Write the index of $\langle 3 \rangle$ in $\mathbb{Z}_{18}$.	EV	4, 4
14	A) A heat seeking particle is located at the point $(2, 3)$ on a flat metal plate whose temperature at a point (x, y) is $T(x, y) = 10 - 8x^2 - 2y^2$. Find an equation of the trajectory of the particle if it moves continuously in the direction of maximum temperature increase.	CR	2, 2

Qn No.	Question	CL	CO
	OR B) Find the absolute maximum and absolute minimum values of $f(x, y) = 3xy - 6x - 3y + 7$ on the closed triangular region R with vertices $(0, 0)$, $(3, 0)$ and $(0, 5)$.		