

Reg. No.: .....



Name: .....

University of Kerala

W7041

Third Semester FYUGP Degree Examination, November 2025

Discipline Specific Core Course

MATHEMATICS

UK3DSCMAT208-Geometry, Multivariate and Vector Calculus

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	Write the standard equation of the parabola in polar co-ordinates.	RE	1
2	Write relation ship between polar co- ordinates $(r, \theta)$ and rectangular coordinates $(x, y)$ .	RE	1
3	If the position vector of a moving particle at time $t$ is $r(t) = 2\cos t i + 2\sin t j$ then instantaneous velocity is ... .	UN	1
4	Find $r(t)$ , given $r'(t) = 2t i + 3t^2 j$ .	UN	1
5	Let $f(x, y) = xe^{-y} + 5y$ . Find the slope of the surface $z = f(x, y)$ in the $y$ direction at the point $(4, 0)$ .	UN	3
6	Find $\int_{-2}^0 \int_0^2 (x^2 + y^2) dx dy$	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	Find $z_x(1, 2)$ , $z_y(1, 2)$ for the function $z = \sqrt{(x^2 + y^2)}$	UN	3
8	Find the unit tangent vector to the graph $r(t) = t^2 i + t^3 j$ at the point $t = 2$	UN	3
9	Sketch the graph of $r = \theta(\theta \geq 0)$ in polar coordinates by plotting points.	AP	1
10	Let $f(x, y) = x^2 y + 5y^3$ . Find the slope of the surface $z = f(x, y)$ in the $y$ -direction at the point $(1, -2)$ .	AP	2

Qn.No.	Question	CL	CO
11	<p>A)</p> <p>Find the volume of the solid bounded by the cylinder <math>x^2 + y^2 = 4</math> and the planes <math>y + z = 4</math> and <math>z = 0</math>.</p> <p>OR</p> <p>B)</p> <p>a) Find the arc length of the cardioid <math>r = 1 + \cos\theta</math>.</p> <p>b) Find the unit tangent and unit normal vector to the graph of <math>r(t) = t^2\hat{i} + t^3\hat{j}</math> at the point where <math>t = 2</math>.</p>	AP	4
12	<p>A)</p> <p>Find the points on the cardioid <math>r = 1 - \cos\theta</math> at which there is a horizontal tangent line, a vertical tangent line, or a singular point.</p> <p>OR</p> <p>B)</p> <p>Describe the graph of the equation <math>x^2 - 4y^2 + 2x + 8y - 7 = 0</math></p>	AN	1
13	<p>A)</p> <p>The circle of radius <math>a</math> with counterclockwise orientation and centered at the origin can be represented by the vector-valued function <math>r = acosti + asintj</math> (<math>0 \leq t \leq 2\pi</math>). Parametrize this circle by arc length and find <math>T(s)</math> and <math>N(s)</math>.</p> <p>OR</p> <p>B)</p> <p>Find the arc length parametrization of the circular helix <math>r = costi + sintj + tk</math> that has reference point <math>r(0) = (1, 0, 0)</math> and the same orientation as the given helix.</p>	EV	1
14	<p>A)</p> <p>Evaluate <math>\iint (2x - y^2) dA</math> over the triangular region <math>R</math> enclosed between the lines <math>y = -x + 1</math>, <math>y = x + 1</math> and <math>y = 3</math>.</p>	CR	4

Qn.No.	Question	CL	CO
	<p>OR</p> <p>B)</p> <p>Use double integration to find the volume of the solid bounded above by the paraboloid <math>z = 9x^2 + y^2</math>, below by the plane <math>z = 0</math>, and laterally by the planes <math>x = 0</math>, <math>y = 0</math>, <math>x = 3</math>, and <math>y = 2</math>.</p>		