

Reg. No.:



Name:

University of Kerala

U8944

Second Semester FYUGP Degree Examination, April 2025

Discipline Specific Core Course

MATHEMATICS

UK2DSCMAT101 - Integration and Multivariate Calculus

Academic Level: 100-199

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	If f and g are continuous functions on the interval $[a, b]$, and if $f(x) \geq g(x)$ for all x in $[a, b]$, then the area of the region bounded above by $y = f(x)$ below by $y = g(x)$, on the left by the line $x = a$, and on the right by the line $x = b$ is	RE	1
2	Give an example of a function having two variables.	RE	1
3	Let $f(x, y, z) = x + xyz$. The value of $f(xy, y/x, xz)$ is ...	UN	3
4	Find f_y where $f(x, y) = xy^2 + \sin x$.	UN	1
5	Write the integral expression for the area of the region bounded between the curves $y = 20 - 3x^2$ and $y = 3\sqrt{x}$ and bounded on the sides by $x = 0$ and $x = 2$.	UN	2
6	Find $\overline{r'(t)}$ where $\overline{r(t)} = (4 + 5t)i + (t - t^2)j$	UN	1

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	Show that the volume of a sphere of radius r is $\frac{4}{3}\pi r^3$.	UN	1
8	Evaluate $\int \frac{3x^2}{x^3 + 5} dx$.	UN	1
9	Let $f(x, y) = \sqrt{3x + 2y}$. Find the slope of the surface $z = f(x, y)$ in the x-direction at the point $(2, 5)$.	AP	2
10	Find the arc length of the curve $y = 3x^{\frac{3}{2}} - 1$ from $x = 0$ to $x = 1$.	AP	3

Qn No.	Question	CL	CO

Part C. 28 Marks. Time: 60 Minutes (Cognitive Level: Apply (AP)/Analyse (AN)/Evaluate (EV)/Create (CR)) Long Answer. 7 marks each. Answer all 4 Questions choosing among options * within each question

Qn No.	Question	CL	CO
11	A) Find the absolute maximum and minimum values of $f(x, y) = 3xy - 6x - 3y + 7$ on the closed triangular region R with vertices $(0, 0)$, $(3, 0)$, and $(0, 5)$. OR B) Find the unit tangent vector $\mathbf{T}(t)$ and unit normal vector $\mathbf{N}(t)$ to the graph of $\mathbf{r}(t) = \cos t \mathbf{i} + \sin t \mathbf{j} + \mathbf{k}$ at the point where $t = \frac{\pi}{4}$.	AP	3, 2
12	A) Find relative extrema and saddle points, if any, of the function $f(x, y) = 2xy - x^3 - y^3$. OR B) a) Let $\vec{r}(t) = \cos t \mathbf{i} + \sin t \mathbf{j} + \mathbf{k}$. Find $\lim_{t \rightarrow 0} (\vec{r}(t) \cdot \vec{r}'(t))$. b) When we say a vector valued function $\vec{r}(t)$ is continuous at a point t_0 in its domain. Also determine whether the functions $\vec{r}_1(t) = t^2 \mathbf{i} + \frac{1}{t} \mathbf{j} + t \mathbf{k}$ and $\vec{r}_2(t) = (3 \sin t) \mathbf{i} - 2t \mathbf{k}$ continuous at $t = 0$.	AN	3, 3
13	A) (a) Evaluate $\int \frac{1}{1+\sin x} dx$. (b) Find the area under the curve $y = \frac{1}{(3x+1)^2}$ over the interval $[0, 1]$. OR B) a) Evaluate $\int \cos^3 x dx$ and $\int \cot x dx$. b) Evaluate $\int t^4 \sqrt{3-5t^5} dt$. c) Evaluate $\int_0^{\ln 3} e^x (1+e^x)^{\frac{1}{2}} dx$.	EV	2, 2
14	A)	CR	3, 3

Qn No.	Question	CL	CO
	Let $T = x^2y - xy^3 + 2$, $x = r \cos \theta$, $y = r \sin \theta$. Use appropriate form of chain rule to find $\frac{\partial T}{\partial x}$ and $\frac{\partial T}{\partial \theta}$. . OR B) (a) Find the volume of the solid generated when the region between the graphs of the equations $f(x) = \frac{1}{2+x^2}$ and $g(x) = x$ over the interval $[0, 2]$ is revolved about the x-axis. (b) Find the area of the region bounded above by $y = x + 6$, bounded below by $y = x^2$, and bounded on the sides by the lines $x = 0$ and $x = 2$.		