

Reg. No.:



Name:

Y8671

University of Kerala

Second Semester FYUGP Degree Examination, June 2026

Discipline Specific Core Course

MATHEMATICS**UK2DSCMAT101 - Integration and Multivariate Calculus**

Academic Level: 100-199

2024 Admission onwards

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	Evaluate $\int_0^{\frac{\pi}{2}} \sin \frac{x}{2} dx$	RE	1
3	If $f(x, y) = x^3y + e^{xy^2}$, find $f_x(x, y)$.	UN	3
4	Find $\int_0^1 (2t \mathbf{i} + t^2 \mathbf{j} + \sin \pi t \mathbf{k}) dt$.	UN	1
5	Let S be a solid bounded by two parallel planes perpendicular to the x -axis at $x = a$ and $x = b$. If, for each x in $[a, b]$, the cross-sectional area of S perpendicular to the x -axis is $A(x)$, then the volume of the solid is ...	UN	1
6	Tangent vector to the graph of $\mathbf{r}(t) = 4 \mathbf{i} - \cos t \mathbf{j}$ at $t = \pi/2$ is ...	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	Find the domain of $\mathbf{r}(t) = \ln t - 1 \mathbf{i} + e^t \mathbf{j} + \sqrt{t} \mathbf{k}$.	UN	1
8	Find the rate of change of $z = \frac{1}{x + y}$ with respect to x at the point $(-2, 4)$ with y held fixed.	UN	3
9	Find the area enclosed between the curves $y = x^2$ and $y = \sqrt{x}$.	AP	1
10	Evaluate the integral $\int_1^5 \frac{1}{\sqrt{2x-1}} dx$.	AP	1

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) (a) Solve the initial value problem $\frac{dy}{dx} = \sec^2 x - \sin x$, $y\left(\frac{\pi}{4}\right) = \frac{1}{2}$.(b) Find the area under the curve $y = \frac{1}{(3x+2)^2}$ over the interval $[0, 1]$. OR B)	AP	2, 2

Qn No.	Question	CL	CO
	(i) Solve $\int_0^{\ln 3} e^x (1 + e^x)^{\frac{1}{2}} dx$ (ii) Solve $\int_1^3 (2x - 1)^3 dx$.		
12	A) A rectangular box open at the top is to have volume 32 cubic feet. Find its dimensions if the total surface area is minimum. OR B) Find the absolute maximum and minimum of $f(x, y) = 3xy - 6x - 3y + 7$ on the closed triangular region R with vertices (0,0), (3,0) and (0,5).	AN	3, 3
13	A) (a) Find the t -intercept of the line in 2-space that is represented by the vector equation $\vec{r}(t) = (3 + 2t)\mathbf{i} + 5t\mathbf{j}$. (b) Find the parametric equation of the line tangent to the graph of $\vec{r}(t) = 2\cos \pi t \mathbf{i} + 2\sin \pi t \mathbf{j} + 3t\mathbf{k}$ at $t = 1/3$. 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 $t = \frac{\pi}{4}$.	EV	3, 3
14	A) (a) Find the area of the region enclosed by the curves $y = 5x - x^2$ and $y = x$. (b) Find the volume of the solid that is obtained when the region under the curve $y = \sqrt{x}$ over the interval $[1, 4]$ is revolved about the x -axis. OR B) (a) Find the area of the region enclosed by the parabolas $y = x^2$ and $y = 2x - x^2$. (b) Find the volume of the solid obtained by rotating the region bounded by $y = x^3$, $y = 8$, and $x = 0$ about the y -axis.	CR	2, 2