

Reg. No.:



Name:

University of Kerala

U8946

Second Semester FYUGP Degree Examination, April 2025

Discipline Specific Core Course

MATHEMATICS

UK2DSCMAT103 - Integral Calculus and Vectors

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 $\mathbf{u}$ and $\mathbf{v}$ are vectors in 3-Space then $\mathbf{u} \cdot (\mathbf{v} \times \mathbf{u}) = \dots$	RE	3
2	Define normalized vector	RE	3
3	If $\mathbf{v} = \langle 1, -2, 2 \rangle$ find $\ -3\mathbf{v} \ $	UN	3
4	Find the distance d between the points $(1, 2, 6)$ and $(-1, 4, -5)$.	UN	1
5	If $\mathbf{u}$ and $\mathbf{v}$ are vectors in 3 space then $\mathbf{v} \cdot (\mathbf{u} \times \mathbf{v}) = \dots$	UN	4
6	Write the formula for $\int \cos^n x dx$.	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	Using reduction formula find $\int \tan x dx$.	UN	2
8	Find the unit vector that has opposite direction as $\mathbf{v} = 2\mathbf{i} + 2\mathbf{j} + 1\mathbf{k}$.	UN	3
9	Find $\int t^4 \sqrt[3]{3 - 5t^5} dt$.	AP	1
10	Find the vector of length 5 that makes an angle of 120° with the positive x -axis.	AP	3

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) Evaluate the integral $\int_0^1 \frac{x^3}{\sqrt{x^2 + 1}} dx$ using (a) integration by parts	AP	2, 4

Qn No.	Question	CL	CO
	(b) the substitution $u = \sqrt{x^2 + 1}$. OR B) (i) Find the vector of length 2 that makes an angle of $\frac{\pi}{4}$ with the positive x-axis. (ii) Find the angle that the vector $v = -\sqrt{2}\mathbf{i} + \mathbf{j}$ makes with the positive x-axis. (iii) Find the norms of $\mathbf{v} = \langle 5, -3 \rangle$, $10\mathbf{v}$, and $\mathbf{w} = \langle 2, 3, 6 \rangle$.		
12	A) (i) Find two unit vectors that are normal to the plane determined by the points $A(0, -2, 1)$, $B(1, -1, -2)$, and $C(-1, 1, 0)$. (ii) Let $\mathbf{v} = \langle 2, 3 \rangle$ and $\mathbf{e}_1 = \left\langle \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle$. Find the scalar and vector components of $\mathbf{v}$ along $\mathbf{e}_1$. OR B) (i) Find the direction cosines of the vector $\mathbf{v} = 2\mathbf{i} - 4\mathbf{j} + 4\mathbf{k}$, and approximate the direction angles to the nearest degree. (ii) Find the orthogonal projection of $\mathbf{v} = \mathbf{i} + \mathbf{j} + \mathbf{k}$ on $\mathbf{b} = 2\mathbf{i} + 2\mathbf{j}$, and then find the vector component of $\mathbf{v}$ orthogonal to $\mathbf{b}$.	AN	3, 3
13	A) (i) Evaluate $\int_0^{10} \sqrt{10x - x^2} dx$. (ii) Evaluate $\int_{\pi/3}^{\pi/2} \sin \theta \sqrt{1 - 4 \cos^2 \theta} d\theta$. OR B) 1. Evaluate $\int \sin^4 x \cos^5 x dx$. 2. Evaluate $\int \sin 7x \cos 3x dx$.	EV	1, 2
14	A) Let $\mathbf{v} = \langle 2, 5 \rangle$, $\mathbf{e}_1 = \left\langle \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle$ and $\mathbf{e}_2 = \left\langle -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle$. Find the scalar components of $\mathbf{v}$ along $\mathbf{e}_1$ and $\mathbf{e}_2$ and the vector components of $\mathbf{v}$ along $\mathbf{e}_1$ and $\mathbf{e}_2$. OR B) Create a vector-valued function $\mathbf{r}(\mathbf{t})$ that describes the motion of an object moving in a circular helix, the curve that wraps around a right circular cylinder of radius a centered on the z-axis. Draw the picture. Can you deduce the parametric equations of the circle from this ?	CR	3, 3