

Reg. No.:



W6765

Name:

University of Kerala

Third Semester FYUGP Degree Examination, November 2025

Discipline Specific Core Course

MATHEMATICS

UK3DSCMAT200-Integral Calculus and Foundations of 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	A solid S is generated by revolving the region enclosed by the line $y = 2x + 1$ and the curve $y = x^2 + 1$ about the x-axis.. An integral expression for the volume of S is.....	RE	1
2	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 write down the formula for 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 $x = b$.	RE	1
3	Find $r'(t)$, where $r(t) = 6i - (\sin t)j$	UN	4
4	An object moves $5ft$ along a line while subjected to a constant force of $100lb$ in its direction of motion. Then W is _____	UN	2
5	Write the general equation of a plane.	UN	3
6	Find the point of intersection for the circle $x^2 + y^2 = 4$ and the line $y = x + 2$.	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	Use cylindrical shells to find the volume of the solid generated when the region enclosed between $y^2 = x, y = 1, x = 0$ about the x-axis.	UN	1
8	Show that the planes $x + 2y - 2z = 3$ and $2x + 4y - 4z = 7$ are parallel. Find the distance between these planes.	UN	4

Qn.No.	Question	CL	CO
9	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 $x = 2$.	AP	2
10	Find an equation of the plane passing through the point $(3, -1, 7)$ and perpendicular to the vector $\mathbf{n} = \langle 4, 2, -5 \rangle$	AP	4

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	<p>A)</p> <p>(a) 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.</p> <p>(b) Use cylindrical shells to find the volume of the solid generated when the region R in the first quadrant enclosed between $y = x$ and $y = x^2$ is revolved about the y-axis</p> <p>OR</p> <p>B)</p> <p>Derive the formula for the volume of a right pyramid whose altitude is h and whose base is a square with sides of length a.</p>	AP	2
12	<p>A)</p> <p>Find an equation of the plane through the points $P_1(1, 2, -1)$, $P_2(2, 3, 1)$, and $P_3(3, -1, 2)$.</p> <p>OR</p> <p>B)</p>	AN	3

Qn.No.	Question	CL	CO
	Prove that $\frac{d}{dt}[r_1(t) \times r_2(t)] = r_1(t) \times \frac{dr_2}{dt} + \frac{dr_1}{dt} \times r_2$		
13	<p>A)</p> <p>(a) Derive the formula for the volume of a sphere of radius r.</p> <p>(b) Use cylindrical shells to find the volume of the solid generated when the region R in the first quadrant enclosed between $y=x$ and $y=x^2$ is revolved about the y-axis</p> <p>OR</p> <p>B)</p> <p>A force of $F = 3i - j + 2k$ lb is applied to a point that moves on a line from $(-1, 1, 2)$ to $(3, 0, -2)$</p> <p>(a) Find the displacement vector</p> <p>(b) Determine the angle between the force vector and the displacement vector</p> <p>(c) Find the norms of the force vector and the displacement vector</p> <p>(d) Evaluate the work done by using the results of part(b) and part(c)</p>	EV	3
14	<p>A)</p> <p>(a) Find the arc length of the curve $y = 3x^{3/2} - 1$ from $x = 0$ to $x = 1$.</p> <p>(b) Let S denote the area of the surface generated by rotating the line segment joining $(3,1)$ and $(6,2)$ about the x-axis.</p> <p>(i) write an integral expression to find S</p> <p>(ii) Find the value of the integral in part(i)</p> <p>OR</p> <p>B)</p> <p>Show that the lines are skew</p> <p>L1: $x=1+4t, y=5-4t, z=-1+5t$</p> <p>L2 : $x=2+8t, y=4-3t, z=5+t$.</p> <p>Also find the distance between them.</p>	CR	1

Qn.No.	Question	CL	CO