

Reg. No.:



Name:

W7034

University of Kerala

Third Semester FYUGP Degree Examination, November 2025

Discipline Specific Core Course

MATHEMATICS

UK3DSCMAT201-Differential Equations, Multiple Integrals 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	Define divergence of a vector field	RE	1
2	Give an example of a Differential Equation of order 2.	RE	2
3	Find the Wronskian of $\cos \omega x$ and $\sin \omega x$	UN	1
4	Express the double integral $\int \int_R x^2 y \, dx \, dy$ over the region $R = \{(x, y) : -1 \leq x \leq 2, 0 \leq y \leq 3\}$ as an iterated integral.	UN	1
5	The Integrating Factor of $y' + y = e^x$ is-----	UN	2
6	Find the gradient field of $\phi(x, y) = x + y$.	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	Prove that the line integral $\int_{(0,0)}^{(3,2)} 3x^2 e^y dx + x^3 e^y dy$ is independent of path joining $(0, 0)$ and $(3, 2)$.	UN	1
8	Find the general solution of $y'' - 6y' - 7y = 0$	UN	2
9	Solve the initial value problem $y' = 3y, y(0) = 1$.	AP	3

Qn.No.	Question	CL	CO
10	Evaluate $\int \int y^2 x dA$ over the rectangle $R = \{(x, y): -3 \leq x \leq 2; 0 \leq y \leq 1\}$.	AP	2

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) Using Green's theorem, evaluate the line integral $\int_C (xy + y^2)dx + x^2 dy$ where C is bounded by $y = x$ and $y = x^2$ and positively oriented. OR B) Evaluate the integral $\int_0^4 \int_{\sqrt{y}}^2 e^{x^3} dx dy$ by first reversing the order of integration.	AP	1
12	A) (a) Solve the initial value problem $y'' + y' - 2y = 0, y(0) = 4, y'(0) = -5$ (b) Solve $y'' + 4y = e^{3x}$. OR B) a) Solve the differential equation $x^2 \frac{dy}{dx} - 3xy = x^2$ b) Solve $y'' + y' - 2y = \sin x$.	AN	2
13	A) i)Find the divergence and curl of $\vec{F}(x, y, z) = x^2 y \hat{i} + 2y^3 z \hat{j} + 3z \hat{k}$ ii)Evaluate $\int_C 2xy dx + (x^2 + y^2) dy$ along the circular arc C given by $x = \cos t, y = \sin t, 0 \leq t \leq \frac{\pi}{2}$ OR B)	EV	3

Qn.No.	Question	CL	CO
	Find the volume of the tetrahedron bounded by the coordinate planes and the plane $3x + 2y + 4z = 12$		
14	A) Using double integration find the area enclosed between the curves $y^2 = 9 - x$ and $y^2 = 9 - 9x$. OR B) A large tank initially contains 1000 gallons of water in which 100 lb of salt is dissolved. Brine containing 5 lb of salt per gallon is pumped into the tank at a rate of 10 gal/min. The mixture is kept uniform by stirring and is pumped out at a rate of 10 gal/min. Let $y(t)$ denote the amount of salt (in lb) in the tank at time t (in minutes). First, set up the first-order differential equation that models the rate of change of the amount of salt, $\frac{dy}{dt}$. Then, solve this differential equation to find the amount of salt $y(t)$ in the tank at any time t.	CR	3