SUKKUR IBA UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

1. General Information

Course Number	MTS-112
Credit Hours	4+0 (Theory Credit Hour = 3, Lab Credit Hour = 0)
Prerequisite	Calculus
Course Coordinator	Not specified

2. Course Objective

Course Objective	In this course, we will cover differential, integral, and vector calculus for functions with more than one variable. A wide range of mathematical tools and methods are used extensively in physics, engineering, economics, and computer graphics. Multivariate Calculus is used in machine learning to explain how variables are related to each other. In cases where you have a lot of features and a lot of data, Multivariate Calculus becomes useful. For this reason, machine-learning models require knowledge of multivariate calculus. Multivariate calculus can help in understanding the behavior of a model, by analyzing the derivatives and gradients. It can also help in optimizing the model's parameters to get the best performance. Lastly, it can be used to solve complex problems involving multiple variables.

3. Course Contents

Session No.	Date / Week	Topic	Assignments/ Quizzes	Suggested Readings
01	Week 01	Review of Basic Derivative & Integration Rules	Solving Examples and Practice	
2-3	Week 2-3	**Parametric and Polar Curves** 1. Parametric equations 2. Polar coordinates 3. Calculus in polar coordinates		
4-6	Week 4-6	**Vectors and Vector-Valued Functions** 1. Vectors in the plane 2. Vectors in three dimensions 3. Dot products 4. Cross products 5. Lines and curves in space 6. Calculus of vector-valued functions 7. Motion in space 8. Length of curves 9. Curvature and normal vectors		
7-8	Week 7-8	**Functions of Several Variables** 1. Planes and surfaces 2. Graphs and level curves 3. Limits and continuity		

		4. Partial derivatives 5. The chain rule 6. Directional derivatives and the gradient 7. Tangent planes and linear approximation 8. Maximum/minimum problems		
9-11	Week 9-11	**Multiple Integration** 1. Double integrals over rectangular regions 2. Double integrals over general regions 3. Double integrals in polar coordinates 4. Triple integrals		
11-14	Week 12-14	**Vector Calculus** 1. Vector fields 2. Line integrals 3. Conservative vector fields 4. Green's theorem		
15	Week 15	**Final Exam**		

4. Text Book

1. Thomas" Calculus (Global Edition) 13th Edition

5. Reference Material

1. Anton" Calculus Early Transcendental 10th Edition
2. James Stewarts Multivariable Calculus 7th Edition

6. Course Learning Objective

Course Learning Outcomes (CLOs)

1. Students will be able to identify parametric curve as a trajectory described by a position vector, parametric equations and compute the curve's acceleration and velocity vectors.
2. Students will be able to differentiate and compute these equations in multivariate calculus. They will also be able to understand the physical meaning of these equations in various contexts.
3. Students will be able to solve optimization problems and two-dimensional regions using the multivariate calculus.

CLO-SO Map

	SO IDs										
CLO ID	**GA1**	**GA 2**	**GA3**	**GA4**	**GA5**	**GA6**	**GA7**	**GA8**	**GA9**	**GA10**	**GA11**
GA1	1	0	0	0	0	0	0	0	0	0	0
GA2	0	1	0	0	0	0	0	0	0	0	0
GA3	0	0	1	0	0	0	0	0	0	0	0

Approval

Prepared by	
Approved by	**Not specified**
Last Update	**10/ 08/2023**