

Course Title	Multivariable Calculus	Course Code	MT2008
Department	Department of Electrical Engineering (DEE)	Campus	Lahore
Knowledge Profile	Mathematics & Computing (WK2)	Credit Hrs.	3
Knowledge Area	Mathematics (KA10)	Grading Scheme	Relative
HEC Knowledge Area	Natural Sciences	Applicable From	Spring 2023
SDG	4 Quality Education		
Pre-requisite(s)	MT1006 Differential Equations		

Course Objective	Develop a sound understanding of vectors in 3D space with their applications. Understand the concept of derivatives of functions of multivariable, multiple integrals (Cartesian, cylindrical and spherical coordinates) and vector calculus.
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No.	Assigned Program Learning Outcome (PLO)
2	An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

I = Introduction, R = Reinforcement, E = Evaluation, A = Assignment, Q = Quiz, M = Midterm, F=Final, L = Lab, P = Project, W = Written Report.

No.	Course Learning Outcome (CLO) Statements	Assessment Tools	Taxonomy Levels	PLO
1	Formulate the equation of lines, planes and surfaces.	Q1, M1, A1	C5	2
2	Calculate the rate of change of multivariable functions and its applications.	Q2, M2, A2, F	C3	2
3	Evaluate the integral of a multivariable function and its applications.	Q3, A3, F	C3	2

Text Books	Title	Calculus, 7th Edition
	Author	James Stewart
	Publisher	
Reference Books	Title	Vector Calculus, Linear Algebra, and Differential Forms: A Unified Approach
	Author	Hubbard, J. H. and Hubbard, B. B.
	Publisher	
	Title	Engineering Mechanics: Statics and Dynamics
	Author	Calculus, 11th Edition
	Publisher	Thomas

Week	Course Contents/Topics	Chapter*	CLO*
1	Vector equation of a line, various forms of equation of a line. Vector and scalar equation of a plane.	12.5	1
2	Equations of cylinders and quadratic surfaces.	12.6	1
3	Arc length, the arc length function (both in 2D and 3D), curvature.	8.1, 13.3	3
4	Functions of several variables, limit and continuity of functions of several (two, three and more) variables.	14.2	2
5	Partial derivatives. Higher derivatives, Laplace and wave equations.	14.3	2
6	Tangent planes and linear approximations, differentials. Chain rule of differentiation of function of two and three variables, implicit differentiation.	14.4, 14.5	2
7	Directional derivatives and the gradient vector. Tangent planes to level surfaces. Divergence and curl of a vector field.	14.6	2
8	Extreme values problems for function of two variables.	14.7	2
9	Iterated integrals, double integrals over general regions.	15.1, 15.2	3
10	Double integrals in polar coordinates. Surface area.	15.3, 15.5	3
11	Change of variables in multiple integrals	15.9	3
12	Line integrals, fundamental theorem for line integrals	16.2, 16.3	3
13	Green's theorem	16.4, 16.5	3
14	Parametric surfaces and their areas, Surface integrals,	16.6, 16.7	3
15	Stokes' Theorem, The Divergence Theorem.	16.8, 16.9	3

*Reference book chapters are given in brackets

Assessment Tools	Weightage
Quizzes, Assignments	20.0%
Midterms (I+II)	30.0%
Final Exam	50.0%