UNIVERSITY OF CALGARY

FACULTY OF SCIENCE
Department of Mathematics and Statistics

Mathematics 367	University Calculus III

Calendar Description: H(3-1T-1)

Functions of several variables; limits, continuity, differentiability, partial differentiation, applications including optimization and Lagrange multipliers. Vector functions, line integrals and surface integrals, Green's theorem, Stokes' theorem. Divergence theorem. Students will complete a project using a computer algebra system..

Prerequisite(s): One of Mathematics 267 or 283 or 349 or Applied Mathematics 219; and Mathematics 211 or 213.

Antirequisite(s): Credit for more than one of Mathematics 353, 331, 367, 377, 381 or Applied Mathematics 309 will not be allowed.

Syllabus

Topics	**Number of Hours**
Vectors and vector functions	4
Functions of several variables: Differentiation and applications	13
Multiple integration: Change of variables	6
Vector Calculus: line and surface integrals, Green's theorem, Stokes's theorem, divergence theorem	13
TOTAL HOURS	**36**

See accompanying page for a detailed breakdown of instructional hours.

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2016:08:11 Effective: Spring 2015
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Detailed breakdown of instructional hours

Math 367 University Calculus III

VECTORS AND VECTOR FUNCTIONS	
Vector functions in R^2 and R^3, Derivatives and Integrals	(1)
Curve, parametrization	(1)
Application: Motions in space	(1)
Quadric surfaces	(1)
FUNCTIONS OF SEVERAL VARIABLES	
Functions of several variables, graph, level curves and surfaces	(1)
Limits and continuity	(2)
Partial derivatives	(1)
Tangent plane and Linear approximation	(1.5)
Chain Rule	(1.5)
Implicit functions	(1)
Directional derivatives and the gradient vector	(1)
Maximum and minimum values	(2)
Lagrange multipliers	(2)
MULTIPLE INTEGRALS	
Review of Double Integrals in Rectangular and Polar coordinates	(1)
Triple integral in Rectangular, Cylindrical and Spherical coordinates	(3)
Change of variables, Jacobian	(2)
VECTOR CALCULUS	
Vector fields	(1)
Line integrals	(1.5)
Conservative fields, Independence of path	(1.5)
Green’s Theorem	(1)
Curl and Divergence	(1)
Parametric surfaces and area	(2)
Surface Integrals	(2)
Stokes’ Theorem	(2)
Divergence Theorem	(1)
Total =	(36)

Course outcomes

Overview

Aspects of ‘single variable’ calculus are extended to higher dimensions (focusing on dimensions 2 and 3). This involves a synthesis of both geometric and algebraic aspects of mathematics to explore the analytic concepts of limits, differentiation and integration of functions.

Functions, the basic object of study in introductory calculus, are an indispensable conceptual tool in extending the calculus to higher dimensions. This requires exploring the concept of function in higher dimensional contexts, very often in an abstract and nonexplicit way.

Some mathematical concepts involving topological and geometric properties of higher dimensional sets are touched upon and illustrated, as they play a role in higher dimensional versions of the fundamental theorem of calculus.

After completing this course students should be able to:

1. **Work with both geometric and algebraic aspects of vector geometry and apply it in extending the analytic exploration of functions.** This includes interpreting the gradient vector field of (scalar) functions and finding and using tangent and normal vector fields for curves and surfaces determined in diverse ways.

2. Describe, recognise, and use basic topological and geometric properties of sets, and know how they play a role in the properties and behaviour of functions.

3. **Recognize how functions arise in diverse geometric and algebraic contexts and then apply analytic concepts.** This involves the ability to apply appropriate approaches to locate extreme values of (scalar valued) functions, and to explicitly compute partial derivatives, Jacobian matrices and determinants of functions without a given explicit description.

4. **Describe, define, and be able to apply concepts and methods involving integration of functions.** This culminates in the ability to move between and have facility with several types of notations involving integration of vector valued functions (vector fields) over oriented curves and surfaces, and to state, calculate and explore the interrelationships of types of integrals via: the fundamental theorem for line integrals, Green's theorem, Gauss' divergence theorem, and Stokes' Theorem.

5. Appreciate and recognise the use and application of these mathematical developments in diverse fields.