MATH 241 Calculus IV

1. Catalog Description

MATH 241 Calculus IV **4 units**

Prerequisite: MATH 143.

Partial derivatives, multiple integrals, introduction to vector analysis. 4 lectures. Crosslisted as HNRS/MATH 241.

2. Required Background or Experience

Math 143.

3. Learning Objectives

The student should be able to:

a. Do partial differentiation and study applications such as tangent planes, maximum/minimum problems with and without constraints.
b. Do multiple integration and/or applications such as volumes, surface area and moments.
c. Work with vector fields, and vector integral theorems.

4. Text and References

- Weir, Maurice, et al., Thomas' Calculus, Addison-Wesley.

5. Minimum Student Materials

Paper, pencils, and notebook.

6. Minimum University Facilities

Classroom with ample chalkboard space for class use.

7. Content and Method

The sections listed below are considered to be the core of the course. It is estimated that about 30 lectures will be needed to cover them. Quarters vary from 38 to 41 lectures. Possible uses for any remaining lectures include: covering more sections, covering some sections in more depth computer labs, and group projects/class presentations.

Content	No. of Lectures
CHAPTER 12 – **Vectors and the Geometry of Space**	
12.6 Cylinders and Quadric Surfaces	1

CHAPTER 14 – **Partial Derivatives** 11

14.1 Functions of Several Variables
14.2 Limits and Continuity in Higher Dimensions
14.3 Partial Derivatives
14.4 The Chain Rule
14.5 Directional Derivatives and Gradient Vectors
14.6 Tangent Planes and Differentials
14.7 Extreme Values and Saddle Points
14.8 Lagrange Multipliers

CHAPTER 15 – **Multiple Integrals** 11

15.1 Double and Iterated Integrals over Rectangles
15.2 Double Integrals over General Regions
15.3 Area by Double Integration
15.4 Double Integrals in Polar Form
15.5 Triple Integrals in Rectangular Coordinates
15.6 Moments and Centers of Mass
15.7 Triple Integrals in Cylindrical and Spherical Coordinates

CHAPTER 16 – **Integration in Vector Fields** 7

16.1 Line Integrals
16.2 Vector Fields and Line Integrals: Work, Circulation, and Flux
16.3 Path Independence, Conservative Fields, and Potential Functions
16.4 Green's Theorem in the Plane (connections of divergence with physics should be made; include a discussion of curl and divergence in 3-dim from sect. 16.7, p. 962-3 and sect. 16.8, p. 972-973)
16.5 Surfaces and Area (optional)
16.6 Surface Integrals (optional)
16.7 Stokes' Theorem (optional)
16.8 The Divergence Theorem and a Unified Theory (optional)

Total 30

8. Methods of Assessment

The primary methods of assessment are: essay examinations, quizzes and homework. Typically, there will be one or more hour-long examinations during the quarter, and a required comprehensive final examination. Students are required to show their work and are graded not only on the correctness of their answers, but also on their understanding of the concepts and techniques.