1. **Department, Course Number, and Course Title:**

MATHEMATICS AND COMPUTER SCIENCE
MATH 209 CALCULUS IV: SEVERAL VARIABLES (4)

2. **Designation:** Required ☑ Elective ☐
    Lower Division ☑ Upper Division ☐

3. **Course Description:** Calculus and Analytic Geometry, 9th ed., George B. Thomas, Jr. and Ross L. Finney, Addison-Wesley Publishing Co., Reading, Massachusetts

4. **Prerequisites:** MATH 207 with minimum C grade.

5. **Text and Materials:** Calculus, Early Transcendentals, 5th ed., Stewart, Thomson, 2002
    Single Variations Calculus, Early Transcendentals, 5th ed., Stewart, ITP

6. **Course Objectives:** This course is designed to teach the principles and techniques of differential and integral calculus of functions of several variables with a selection of typical applications. The ideas and tools developed in MATH 206-208 are applied to these ends.

<div align="center">Course Outcomes</div>

*   The student should be familiar with the idea of and the description of functions of several variables through graphs and level curves or surfaces.
*   The student should have an understanding of and computational facility with partial derivatives.
*   The student should be familiar with and have computational facility in the application of partial derivatives to linear approximation, tangent planes, and optimization problems. This should include first derivative tests, second derivative test in two variables, and methods for constrained extrema such as Lagrange multipliers.
*   The students should be familiar with multiple integrals, especially double and triple integrals including their computation as iterated integrals and change of order of integration. The student should be familiar with the expression of double integrals in polar coordinates and of triple integrals in cylindrical or spherical coordinates.
*   The student should be familiar with tools of vector analysis including directional derivatives, gradients, divergence and curl. The student should be familiar with line integrals, vector fields, path independence, and Green's theorem.
*   Further work if time permits continues (E) to include parametrized surfaces, surface integrals, surface area, divergence theorem and Stoke's theorem.

7. **Topics Covered:** (in Order of Presentation)

*   Functions of several variables (Ch. 12)
*   Graphs and level sets (Ch. 12)
*   Partial derivatives (Ch. 12)
*   Linear approximation (Ch. 12)
*   Directional derivatives, gradient (Ch. 12)
*   Tangent planes (Ch. 12)
*   Extremes and saddle points (Ch. 12)
*   Constrained extrema (Ch. 12)
*   Double integrals and appl. (Ch. 13)
*   Integrals in polar coordinates (Ch. 13)
*   Triple integrals and appl. (Ch. 13)
*   Cylindrical and Spherical (Ch. 13)
*   Line integrals (Ch. 14)
*   Vector fields (Ch. 14)
*   Path independence (Ch. 14)
*   Green's theorem (Ch. 14)

8. **Class Schedule:** Number of Sessions per week: 2 lectures
    Duration of each session: Lectures 1 hour and 40 minutes

9. Contribution of course to meeting the professional component:

This course is part of the one year (48 quarter units) of Basic Mathematics and Science.

                             Mathematics   4 units

10. Relationship of course to program objectives:

This course relates to the program objectives by contributing to the following measurable outcomes at the level indicated for all engineering graduates:

Knowledge outcomes:
- an ability to apply knowledge of mathematics, science, and engineering (abet a)

Skill outcomes:
- an ability to communicate effectively (abet g)
- an ability to think in a logical sequential process

Attitudes Outcome:

11. Prepared by: Michael Hoffma   03/2000
                                         Updated by Maj Dean Mirmirani   01/2006