



## COURSE OUTLINE

**Course Number**  
MAT251

**Course Title**  
Calculus III

**Credits**  
4

**Hours:**  
**Lecture/Lab/Other**  
4 Lecture

**Co- or Pre-requisite**  
MAT152 with a minimum C grade or better, successful completion of an equivalent course, or approval of the department chair.

**Implementation**  
**sem/year**  
Fall 2003

**Catalog description (2009-2012 Catalog):**

An introduction to multivariable calculus. Topics include vectors, planes, and quadratic surfaces in three-space; vector-valued functions; partial derivatives, gradients, multiple integrals, and the theorems of Gauss, Green and Stokes.

**Is the course New, Revised or Modified?** No

**Required texts/other materials**

1. Text: Multivariable Calculus  
Author: Stewart  
Publisher: Thomson
2. A graphing calculator is required. Recommended models include the TI-83, TI-84, or TI-86. If other software is used for class, the instructor should make that known to students.

**Revision date:**  
Spring 2009

**Course coordinator:**  
Art Schwartz 609.570.3761

**Information resources:**

- The college library has many books and CDs available for reference..
- WebAssign is an online companion to the text offering a lot of practice.
- The Learning Center has tutoring and help available to the students.

**Course Competencies/Goals:**

Upon successful completion of this course, students will be able to demonstrate the ability to:

1. understand the concepts of vectors and define, calculate and apply dot and cross products.
2. calculate arc length, unit tangent and normal vectors, curvature, and surface area.
3. use polar, cylindrical, and spherical coordinates.
4. describe the basic analytic geometry of lines, planes and spheres in three space, both with vector equations and with scalar equations.
5. understand the concepts of limits and continuity of multivariable functions
6. illustrate functions of two variables as surfaces and level curves.
7. work with vector-valued functions.
8. calculate and apply partial derivatives and gradient fields.
9. set up and solve optimization problems for functions of several variables, and find extreme values by a variety of methods, including Lagrange multipliers.
10. apply the properties of curves, surfaces and vector fields to velocity, curl, and divergence problems.
11. calculate double and triple integrals, establish the relationship of the integrals with geometric regions of integration in both rectangular and other coordinate systems, and apply them to area and volume problems.
12. calculate line and surface integrals by applying the fundamental theorems of calculus.
13. determine path independence and state and use Gauss', Green's and Stokes' theorems.
14. use calculus methods to model and solve applications problems, including selecting or developing appropriate procedures and verifying the validity and appropriateness of the solution.

**Course-specific General Education Knowledge Goals and Core Skills:****General Education Knowledge Goals:**

**Goal 1. Communication.** Students will communicate effectively in both speech and writing.

**Goal 2. Mathematics.** Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

**Goal 4. Technology.** Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

**MCCC Core Skills:**

**Goal A. Written and Oral Communication in English.** Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.

**Goal B. Critical Thinking and Problem-solving.** Students will use critical thinking and problem solving skills in analyzing information.

**Goal D. Information Literacy.** Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.

**Goal E. Computer Literacy.** Students will use computers to access, analyze or present information, solve problems, and communicate with others.

In the following **Units of Study in Detail** Course Competencies/Goals will be denoted CG, **General Education Knowledge Goals** will be denoted GE and **MCCC Core Skills** will be denoted CS

### Units of Study in Detail:

#### **UNIT I Vectors** (3 weeks)

At the conclusion of this unit the student should be able to:

1. define, understand and use vectors in Euclidean 2- and 3-space. (CG 1, 2; GE 1, 2, 4; CS B)
2. compute dot products and cross products, and interpret them as work, area, volume. (CG 1, 14; GE 1, 2, 4; CS A, B)
3. resolve a vector into its components given a basis of unit orthogonal unit vectors (CG 1,2,14; GE 1,2,4;CS B)
4. find the normal vector given the equation of a plane and find the equation of a plane given a normal and a point; similarly in two dimensions for a line. (CG 1, 2; GE 1, 2, 4; CS A, B)
5. write equations for and identify and sketch quadric surfaces. (CG 1, 4; GE 1, 2, 4; CS A, B, E)
6. convert to and from cylindrical and spherical coordinates (CG 1,3; GE 1,2,4; CS A, B, E)
7. apply cylindrical coordinates to problems involving symmetry around an axis. (CG 1, 3, 14; GE 1, 2, 4; CS A,B,E)
8. apply spherical coordinates to problems involving symmetry about a point. (CG 1, 3, 14; GE 1, 2, 4; CS A, B, E)

#### **UNIT II Vector-Valued Functions** (2 weeks)

At the conclusion of this unit the student should be able to:

1. interpret, apply and visualize functions of two (or more) variables. (CG 6, 7; GE 1, 2, 4; CS B, D, E)
2. calculate derivatives and integrals of vector-valued functions. (CG 7; GE 1, 2, 4; CS B, D, E)
3. parameterize a curve with respect to arc length and find the arc length. (CG 1, 2, 6, 7; GE 1, 2, 4; CS A, B)
4. define curvature as a measure of how quickly the curve changes direction. (CG 1, 2, 7; GE 1, 2, 4; CS B)





**Statement of Academic Integrity**

Under no circumstance should students knowingly represent the work of another as one's own. Students may not use any unauthorized assistance to complete assignments or exams, including but not limited to cheat-sheets, cell phones, text messaging and copying from another student. Violations should be reported to the Academic Integrity Committee and will be penalized. Please refer to the Student Handbook for more details.