MISSOURI WESTERN STATE UNIVERSITY

COLLEGE OF LIBERAL ARTS AND SCIENCES

DEPARTMENT OF COMPUTER SCIENCE, MATHEMATICS, AND PHYSICS

COURSE NUMBER: MAT 287

COURSE NAME: Calculus with Analytic Geometry III

COURSE DESCRIPTION:

The third of three sequenced courses in calculus. Includes the study of solid analytic geometry, vectors and vector calculus, partial differentiation, and multiple integrals. 5 credit hours. F, Sp.

PREREQUISITE:

Grade of C or better in MAT 177, or equivalent.

TEXT:

Calculus-w/Access (Looseleaf), Larson, Edition 10th 14, Cengage L,
ISBN 9781305718661

TECHNOLOGY:

Use of graphing calculators will be required throughout the course and each student must have access to a suitable graphing calculator. The graphing calculator must have at least the capacity of the TI-83/84 (the recommended calculator). Graphing calculators other than Texas Instruments calculators may be used but classroom instruction on calculators will be given for TI equipment only.

COURSE OBJECTIVES:

The major goal of this course is to provide students with understanding and proficiency sufficient to enable successful students to pursue further study in mathematics and in disciplines which rely upon understanding of or proficiency in the calculus. In order to meet this major goal, students will learn how to:

1. Graph points, lines, and surfaces in three dimensions.

(MoStep Mathematics Competencies 3.5)

2. Find sums and products of vectors.
   (MoStep Mathematics Competencies 3.3, 3.4, 5.6, 6.2)

3. Find limits, derivatives and integrals of vector-valued functions.
   (MoStep Mathematics Competencies 3.3, 6.2, 8.1)

4. Apply vector calculus to the laws of motion.
   (MoStep Mathematics Competencies 1.6, 3.5, 8.2)

5. Find limits and partial derivatives of functions of several variables.
   (MoStep Mathematics Competencies 5.5, 5.7)

6. Use partial differentiation to find directional derivatives, tangent planes and normal lines to surfaces, and maxima and minima in applied problems.
   (MoStep Mathematics Competencies 1.1, 1.6, 3.3, 8.2)

7. Evaluate multiple integrals and solve applied problems utilizing multiple integrals.
   (MoStep Mathematics Competencies 3.3, 5.7, 8.2)

8. Apply elementary vector calculus to the physical sciences.
   (MoStep Mathematics Competencies 1.1, 1.6, 3.5, 8.2)

9. Utilize mathematical language and notation to communicate ideas and represent relationships.
   (MoStep Mathematics Competencies 1.2)

10. Interact verbally with others to clarify and extend understanding of mathematical situations.
    (MoStep Mathematics Competencies 1.2)

STUDENT COMPETENCIES:

In order to meet the above objectives, successful students will be able to:

1. Construct mathematical models to analyze real-world phenomena.

2. Demonstrate understanding of the concepts of a function, its algebraic properties, and its use in building various mathematical models.

3. Construct algebraic relationships involving two or more variables using properties of geometric figures.

4. Identify and use interpretations of the derivative to solve problems and prove theorems.

5. Identify and use interpretations of the integral to solve problems and prove theorems.

6. Utilize the Riemann sum to motivate the use of integration to solve problems.

7. Compute limits of real functions, sequences, and series and understand the use of limits in definitions of the derivative and integral.

8. Utilize mathematical language and notation to communicate ideas and represent relationships.

9. Graph points, lines, and surfaces in three dimensions.

10. Find sums and products of vectors.

11. Find limits, derivatives, and integrals of vector-valued functions.

12. Apply vector calculus to elementary problems involving the laws of motion.

13. Understand the concept of a function of several variables and the definitions of limits and continuity of functions of several variables.

14. Find directional derivatives and interpret their use.

15. Find tangent plane and normal lines to surfaces.

16. Find extrema of functions of several variables.

17. Evaluate multiple integrals and solve applied problems utilizing multiple integrals.

18. Apply elementary vector calculus to the physical sciences.

COURSE OUTLINE:

I. Vectors and the Geometry of Space
   A. Vectors in the Plane
   B. Space Coordinates and Vectors in Space
   C. The Dot Product of Two Vectors

D. The Cross Product of Two Vectors in Space
E. Lines and Planes in Space
F. Surfaces in Space
G. Cylindrical and Spherical Coordinates

II. Vector-Valued Functions
A. Vector-Valued Functions
B. Differentiation and Integration of Vector-Valued Functions
C. Velocity and Acceleration
D. Tangent Vectors and Normal Vectors
E. Arc Length and Curvature

III. Functions of Several Variables
A. Introduction to Functions of Several Variables
B. Limits and Continuity
C. Partial Derivatives
D. Differentials
E. Chain Rules for Functions of Several Variables
F. Directional Derivatives and Gradients
G. Tangent Planes and Normal Lines
H. Extrema of Functions of Two Variables
I. Applications of Extrema of Functions of Two Variables
J. Lagrange Multipliers

IV. Multiple Integration
A. Iterated Integrals and Area in the Plane
B. Double Integrals and Volume
C. Change of Variables: Polar Coordinates
D. Center of Mass and Moments of Inertia
E. Surface Area
F. Triple Integrals and Applications
G. Triple Integrals in Cylindrical and Spherical Coordinates
H. Change of Variables: Jacobians

V. Vector Analysis
A. Vector Fields
B. Line Integrals
C. Conservative Vector Fields and Independence of Path
D. Green's Theorem
E. Parametric Surfaces
F. Surface Integrals
G. Divergence Theorem
H. Stokes's Theorem