MISSOURI WESTERN STATE UNIVERSITY

COLLEGE OF LIBERAL ARTS AND SCIENCES

DEPARTMENT OF COMPUTER SCIENCE, MATHEMATICS, AND PHYSICS

COURSE NUMBER: MAT 177

COURSE NAME: Calculus with Analytic Geometry II

COURSE DESCRIPTION:

The second of three sequenced courses in calculus. Includes the study of applications of integration, integration techniques, L'Hopital's Rule, improper integrals, infinite series, conic sections, plane curves, parametric equations, and polar coordinates. 5 credit hours. F, Sp.

PREREQUISITE:

Grade of C or better in MAT 166 or MAT 167.

TEXT:

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

TECHNOLOGY:

Use of a graphing calculator having at least the capacity of the TI-82 will be beneficial to the student throughout the course. A computer algebra system will be used for some problem exploration, enhanced conceptual understanding, and to engage students as active participants in the learning process.

COURSE OBJECTIVES:

A 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 and/or proficiency in the calculus. In order to meet this major goal, students will learn how to:

1. Use the definite integral to solve applications; i.e., area of region between two curves, volume by the disc and shell method, arc length, and other topics.
   (MoStep Mathematics Competencies 1.1, 1.8, 3.1, 3.3, 3.4, 5.3, 5.5, 5.6, 5.7, 8.1, 8.2)

2. Utilize various techniques of integration; i.e., integration by parts, powers of sine and cosine, trigonometric substitution, partial fractions, tables, and the computer.
(MoStep Mathematics Competencies 1.1, 3.4, 5.5, 5.6, 5.7, 8.1, 8.2)

3. Identify and evaluate limits in indeterminate form and integrals with infinite limits or discontinuous integrands.
(MoStep Mathematics Competencies 5.5, 8.1, 8.2)

4. Identify and evaluate infinite series, test for convergence or divergence, and develop guidelines for choosing the appropriate test.
(MoStep Mathematics Competencies 1.1, 5.1, 5.5, 8.1, 8.2, 8.3)

5. Utilize Power series representation of functions as well as Taylor and Maclaurin series and the Binomial series.
(MoStep Mathematics Competencies 3.4, 5.1, 5.5, 8.1, 8.2, 8.3)

6. Analyze conic sections by putting the equation in standard form, identify the center, vertices, foci, directrix, axes or asymptotes, and sketch a graph.
(MoStep Mathematics Competencies 3.3, 5.5)

7. Write parametric equations for a given rectangular equation, utilize polar coordinates and polar graphs, and find area of a polar region.
(MoStep Mathematics Competencies 1.10, 1.11, 5.5)

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

9. 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:

1. Construct and solve mathematical models for real world problem situations utilizing algebraic and transcendental functions and geometric relationships in which differentiation and integration techniques are employed in the model analysis.

2. Apply numerical methods to approximate definite integrals.

3. Utilize available software packages on numerical methods to approximate definite integrals.

4. Evaluate convergent improper integrals.

5. Represent problem situations using sequences and series.

6. Examine the convergence or divergence of certain series by direct calculation.

7. Apply the Integral Test, Ratio Test, etc., to determine the convergence or divergence of a series.

8. Computer Taylor polynomials and series as they are used to approximate various functions.

9. Become familiar and find the interval of convergence of a power series.

10. Become familiar with the polar coordinate system.

11. Become familiar with some functions which are simpler to use and graph in polar form.

12. Solve problems including area and arc length using polar form.

13. Comprehend and apply mathematical relationships expressed as plane curves and relationships utilizing polar coordinates.

COURSE OUTLINE:

I. Applications of Integration

- A. Area of a Region Between Two Curves
- B. Volume: The Disc Method
- C. Volume: The Shell Method
- D. Arc Length and Surfaces of Revolution
- E. Work
- F. Fluid Pressure and Fluid Force
- G. Moments, Centers of Mass, and Centroids

II. Integration Techniques, L'Hopital's Rule, and Improper Integrals

- A. Basic Integration Rules

B. Integration by Parts
C. Trigonometric Integrals
D. Trigonometric Substitution
E. Partial Fractions
F. Integration by Tables and Other Integration Techniques
G. Indeterminate Forms and L'Hopital's Rule
H. Improper Integrals

III. Infinite Series

A. Sequences
B. Series and Convergence
C. The Integral Test and p-Series
D. Comparisons of Series
E. Alternating Series
F. The Ratio and Root Tests
G. Taylor Polynomials and Approximations
H. Power Series
I. Representation of Functions by Power Series
J. Taylor and Maclaurin Series

IV. Conics, Parametric Equations, and Polar Coordinates

A. Conics and Calculus
B. Plane Curves and Parametric Equations
C. Parametric Equations and Calculus
D. Polar Coordinates and Polar Graphs
E. Area and Arc Length in Polar Coordinates
F. Polar Equations of Conics and Kepler's Laws