

**MISSOURI WESTERN STATE UNIVERSITY**

**COLLEGE OF SCIENCE AND HEALTH**

**DEPARTMENT OF COMPUTER SCIENCE, MATHEMATICS, AND PHYSICS**

***COURSE NUMBER:*** MAT 147

***COURSE NAME:*** Applied Calculus I

***COURSE DESCRIPTION:***

An applied course in techniques of differentiation and integration; applications primarily from the technological fields; analytic geometry, functions, differential and integral calculus.

***PREREQUISITE:***

ACT math score of 25 or higher or a grade of C or better in MAT 116.

***TEXT:***

Active Calculus, Boelkins, Austin and Schlicker  
ISBN 978-1724458322

***TECHNOLOGY:***

Use of a graphing calculator having at least the capabilities of the TI-83 will be required for the student throughout the course.

***COURSE OBJECTIVES:***

This course is intended to satisfy the general studies mathematics requirement for a baccalaureate degree. It is also designed to serve as a prerequisite for future study in engineering technology. The student will learn to:

1. Evaluate limits.
2. Find derivatives of polynomial, exponential, logarithmic, and trigonometric functions.
3. Solve application problems from the technological field using differentiations.

4. Find integrals of polynomial, exponential, logarithmic, and trigonometric functions.
5. Solve application problems from the technological fields using integration.

***STUDENT COMPETENCIES:***

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

1. Understand the concept of a function.
2. Use a graphing calculator to graph functions.
3. Use the point-slope and slope-intercept form of a line.
4. Evaluate a limit writing out the solution in a mathematically correct way.
5. Understand the concept of continuity.
6. Understand and determine derivatives of polynomial, exponential, logarithmic, and trigonometric functions.
7. Understand and apply the geometric interpretation of the derivative to prove selected theorems.
8. Build mathematical models for real world situations such as the velocity and acceleration of moving objects, determine minimum distance, estimate error with differentials, and find maximum volume.
9. Draw the graph of a function using information obtained by computing the first and second derivative of the function.
10. Solve exponential growth and decay problems.
11. Compute the derivative of a function defined implicitly.
12. Determine vertical and horizontal asymptotes to the graph of a function by evaluating the appropriate limits.
13. When given an integration problem, choose and use appropriate techniques of integration.
14. Compute the enclosed area between two curves.
15. Find solutions to homogeneous separable first order differential equation.

16. Solve the logistic differential equation.
17. Utilize integration techniques to find a probability given its probability density function.
18. Plot contour maps.
19. Find local extremum for three dimensional surfaces.

***COURSE OUTLINE:***

- I. Prerequisites for Calculus
  - A. The Cartesian Coordinate System
  - B. Functions and Their Representations
  - C. Linear Functions: Straight Lines
  - D. Polynomial Functions: Parabolas
  - E. Exponential Functions:  $e^x$
  - F. Logarithmic Functions:  $\ln(x)$
- II. The Derivative
  - A. Measuring Change
  - B. Limits
  - C. Rates of Change and Derivatives
  - D. Derivative as a Function
- III. Techniques of the Differentiation
  - A. Derivatives of Polynomials
  - B. Derivatives of Products and Quotients
  - C. Derivatives of Composition of Functions
  - D. Implicit Differentiation and the Derivative of Logarithmic Functions
  - E. Derivative of Exponential Functions
  - F. Derivative of Trigonometric Functions
- IV. Applications of the Derivative
  - A. Related Rates
  - B. Maximum and Minimum Values
  - C. Asymptotes
  - D. Curve Sketching
  - E. Optimization

V. Integrals

- A. Area and the Definite Integral
- B. Fundamental Theorem of Calculus
- C. The Net Change and its applications
- D. The Substitution Rule
- E. Integration by Parts

VI. Applications of the Definite Integral

- A. Area Between Two Curves
- B. Applications to Engineering
- C. Applications to Economics
- D. Differential Equations
- E. Improper integrals
- F. Probability

VII. Functions of Several Variables

- A. Functions of Several Variables
- B. Partial Derivatives
- C. Maximum and Minimum Values
- D. Lagrange Multipliers