Math 2131: Applied Calculus

Credit hours: **4 credits (4 class hours per week)**
Prerequisites: **Math 2103 or Math 2111 with a minimum grade of C or Math Placement Test**

Course Description

This course is intended for students in the life and social sciences. The differential and integral calculus are developed with an emphasis on solving real world application problems in the sciences. Limits, derivatives and integrals of algebraic, logarithmic, exponential and trigonometric functions are studied. Applications will include analyzing graphs, finding maximum and minimum values of functions, calculating rates of change and computing areas and cumulative change. This course is not intended for students planning to study mathematics, statistics, computer science, physical sciences, engineering or any other discipline requiring the complete calculus sequence. Math 2131 is not an alternative to Math 2141 (Calculus I) and does not satisfy the prerequisite for Math 2142 (Calculus II).

Course Objectives

1. Interpret and use calculus in practical ways applicable to the life and social sciences, economics, or pharmacy
2. Analyze problems from a graphical, algebraic and numerical perspective
3. Gain a fundamental understanding of functions, limits, differentiation, integration and associated applications

Learning Outcomes

1. Recognize and classify functions as being algebraic, exponential, logarithmic or periodic and use these functions to model real world phenomena
2. Compute average rates of change for a variety of functions and solve problems involving exponential growth and decay
3. Find the limits of functions using graphs, tables, and numerical and graphical techniques
4. Use graphs, tables and the difference quotient to approximate rates of change
5. Understand the derivative as a rate of change
6. Calculate the instantaneous rate of change and the derivative for a function by taking the limit of the difference quotient
7. Use the power, product, quotient, chain, exponential, logarithmic and trigonometric derivative rules to differentiate a function
8. Use the derivative to find slopes and tangent lines, and calculate rates of change
9. Solve application problems involving functions and their rates of change
10. Compute the second derivative of a function and graph both derivatives
11. Use derivatives to solve optimization problems
12. Use the power rule, exponential rule, logarithmic rule, trigonometric rules and basic substitution to find the anti-derivative of a function
13. Use the Fundamental Theorem of Calculus to evaluate definite integrals
14. Use definite integrals to find areas and solve other application problems, including cumulative change problems

Course Topics

I. FUNCTIONS
   A. The definition of a function
   B. The graph of a function
   C. Recognizing linear, polynomial, rational, exponential, logarithmic and periodic functions

D. Properties and applications of linear functions
E. The average rate of change of a function
F. The exponential functions
G. The logarithm and natural logarithm
H. Growth and decay applications

II. LIMITS AND CONTINUITY
A. Calculating a limit graphically
B. Calculating a limit numerically
C. Calculating a limit algebraically
D. The continuity of a function

III. THE DERIVATIVE
A. Instantaneous change
B. The definition of the derivative and the limit of the difference quotient
C. The derivative as a function
D. Interpretation of derivatives as rates of change

IV. RULES OF DIFFERENTIATION
A. The power rule
B. The product rule
C. The quotient rule
D. The chain rule
E. The exponential rule
F. The logarithmic and natural logarithmic rules
G. Trigonometric rules
H. Logarithmic differentiation*

V. USING THE DERIVATIVE
A. The slope of a graph
B. The equation of a tangent line
C. Solve problems involving rates of change
D. The second derivative
E. Curve sketching
F. Sketching derivatives
G. Optimization problems

VI. THE INTEGRAL
A. Accumulated change and approximating the area under a curve
B. The antiderivative
C. The fundamental theorem and definite integrals
D. Area under a curve
E. Area bounded between two curves
F. Integration by substitution*
G. Total change
H. Average value

VII. SPECIAL FUNCTIONS
A. The logistic growth function
B. The surge function

*Optional