Mathematics 161 Calculus for the Life Sciences I

1. Catalog Description

MATH 161 Calculus for the Life Sciences I **4 units**
GE Area B1

Prerequisite: Completion of ELM requirement and passing score on appropriate Mathematics Placement Examination, or MATH 118.

Review of exponential, logarithmic, and trigonometric functions. Differential and integral calculus with applications to the biological sciences. Introduction to differential equations and mathematical modeling. Examples, exercises and applications to emphasize problems in life sciences. Not open to students with credit in MATH 141. 4 lectures. Fulfills GE B1; for students admitted Fall 2016 or later, a grade of C- or better in one GE B1 course is required to fulfill GE Area B.

2. Required Background or Experience

Math 118 or equivalent.

3. Learning Objectives

Upon completion of Math 161, the student should:

a. Understand the algebraic and graphical properties of elementary functions: linear, polynomial, exponential, logarithmic, trigonometric and their inverses.
b. Understand the geometric significance of the derivative, and be able to interpret the derivative in the context of biological applications.
c. Be able to apply the basic rules of differentiation to the elementary functions.
d. Be able to apply the concepts of differential calculus in the analysis of the graphical behavior of functions.
e. Be able to apply the techniques of linearization and optimization in the mathematical analysis of biological phenomena.

4. Text and References

- Stewart, James and Day, Troy, Biocalculus: Calculus for the Life Sciences, Cengage Learning.

5. Minimum Student Materials

Paper, pencils, calculator and notebook.

6. Minimum University Facilities

Classroom with ample chalkboard space for class use.

7. Content and Method

Content	No. of Lectures
1. Functions and Sequences	5
1.1 Four Ways to Represent a Function	
1.2 A Catalog of Essential Functions	
1.3 New Functions from Old Functions	
1.4 Exponential Functions	
1.5 Logarithms; Semilog and Log-Log Plots	
1.6 Sequences and Difference Equations	
2. Limits	5
2.1 Limits of Sequences	
2.2 Limits of Functions at Infinity	
2.3 Limits of Functions at Finite Numbers	
2.4 Limits: Algebraic Methods	
2.5 Continuity	
3. Derivatives	11
3.1 Derivatives and Rates of Change	
3.2 The Derivative as a Function	
3.3 Basic Differentiation Formulas	
3.4 The Product and Quotient Rules	
3.5 The Chain Rule	
3.6 Exponential Growth and Decay	
3.7 Derivatives of the Logarithmic and Inverse Tangent Functions	
3.8 Linear Approximations and Taylor Polynomials	
4. Applications of Derivatives	9
4.1 Maximum and Minimum Values	
4.2 How Derivatives Affect the Shape of a Graph	
4.3 L'Hospital's Rule: Comparing Rates of Growth	
4.4 Optimization Problems	
4.5 Recursions: Equilibria and Stability	
Total	30

Method

Largely lecture with blackboard illustration of the discussion along with supervised work and individual conferences. Most examples, exercises and applications will be taken from the life sciences.

8. Methods of Assessment

The primary methods of assessment are: essay examinations, quizzes and homework. Typically, there will be one or more hour-long examinations during the quarter, and a required comprehensive final examination. Students are required to show their work, and are graded not only on the correctness of their answers, but also on their understanding of the concepts and techniques.

Additional Comments:

When at all possible, use applications from the life sciences to illustrate concepts from calculus. Also, Math 119 (Precalculus Trigonometry) is not a prerequisite for this course.