COURSE SYLLABUS

Course Title: **Calculus for Life Sciences**

Abbreviated Title As Appears on Transcript: `Calculus for Life Sciences`

Course Number: DMAT 202

Credit Hours: 3 credits [semester credit hours]

Course Description: A single course in differential and integral calculus for management and business with emphasis on computational techniques and graphical analysis. Topics include a study of the algebraic and numerical aspects of linear, quadratic, polynomial, exponential, and logarithmic functions, function growth, derivative analysis and optimization, integration, applications to life sciences, and the Fundamental Theorem of Calculus.

Prerequisite: Successful completion of 3 years high school mathematics (C- or higher) or instructor consent.

Course Workload: 3 semester credit hours • 3 student work hours per credit hour • 14 week Carnegie semester = 126 hours student course workload average

Examination Requirements: Proctored written final examination must be passed at 60% or higher to earn passing grade in course. "B" and "A" grade paths have additional examinations.
See https://www.distancecalculus.com/grades/ for more information.

Course Professor: Robert R. Curtis, Ph.D.<rcurtis@rwu.edu>, <robert@distancecalculus.com>

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Accredited by New England Commission of Higher Education (NECHE).
See https://www.rwu.edu/academics/accreditation/ for more information.

E-Textbook: "Business Calculus & LiveMath" by Robert R. Curtis, Ph.D., adapted from Davis/Porta/Uhl "Calculus&Mathematica" courseware series

Mathematical Software: LiveMath™ Computer Algebra & Graphing System

ADA ACCOMMODATIONS

Roger Williams University has a continuing commitment to providing reasonable accommodations for students with documented disabilities. Students with disabilities who need accommodations in order to fully participate in this class are urged to contact Student Accessibility Services, as soon as possible, to explore

the arrangements needed to be made to assure access. Student Accessibility Services is open Monday through Friday from 8:00AM to 5:00PM Eastern Time; Email: sas@rwu.edu or Voice: 401-254-3841. For more information about SAS, visit https://www.rwu.edu/undergraduate/academics/student-academic-success/student-accessibility-services-sas

Learning Outcomes for DMAT 202 - Calculus for Life Sciences

1. To identify, manipulate, and understand the algebraic, numerical, and graphical fundamentals of linear, polynomial, exponential, logarithmic, and rational polynomial functions
2. To understand and compute numerical, and graphical limits at finite and infinite values
3. To understand and compute the fundamental concept of the derivative
4. To understand and compute various measurements of growth of a function
5. To algebraically compute derivatives of common functions using summation, product, quotient, and chain rules for derivatives
7. To understand and compute optimization of functions using derivatives, finding critical values
8. To understand and compute the second derivative
9. To understand and calculate numerically and graphically the core concepts of the integral for applications to signed area measurements;
10. To compute numerically, algebraically, and graphically integrals of a variety of functions;
11. To algebraically compute integrals of basic polynomial and exponential functions, with an introduction to the algebraic substitution technique;
12. To use the tools of differential and integral calculus in various applications in life sciences
13. To understand and compute the Fundamental Theorem of Calculus
14. To understand and compute partial derivatives of multivariable functions, to begin study of optimization in higher dimensions.
15. To utilize computer algebra and graphing software to amplify traditional manual computation techniques.

Syllabus Topics Outline for DMAT 202 - Calculus for Life Sciences

1. Getting Started
   - 1.1 Email and Chat
   - 1.2 Learning About the Course
   - 1.3 Required Hardware
   - 1.4 Software Fundamentals

2. The Big Picture
   - 2.1 Solving (easy) equations in 1 variable.
   - 2.2 What if you can't solve for x?
   - 2.3 Finding solutions numerically
   - 2.4 Finding solutions graphically
   - 2.5 Solving equations of more than 1 variable

3. Functions
   - 3.1 Function notation
   - 3.2 Data sets

- 3.3 Graphing functions
- 3.4 Data sets and smooth curves
- 3.5 Domain and Range
- 3.6 Algebraic combinations of functions

4. Linear Functions
   - 4.1 Algebraic definition
   - 4.2 Slope
   - 4.3 Graphing linear functions by hand
   - 4.4 Properties of linear functions
   - 4.5 Linear data sets

5. Quadratic Functions
   - 5.1 Algebraic definition
   - 5.2 Graphing and Properties of Quadratic Functions
   - 5.3 Solving quadratic equations algebraically: Factoring
   - 5.4 Solving quadratic equations algebraically: Quadratic formula
   - 5.5 Solving quadratic equations numerically and graphically

6. Power and Polynomial Functions
   - 6.1 Algebraic definition
   - 6.2 Graphing and Properties of Polynomial Functions
   - 6.3 Solving polynomial equations algebraically: factoring
   - 6.4 Solving polynomial equations numerically and graphically
   - 6.5 Radicals and fractional exponents

7. Rational Polynomial Functions
   - 7.1 Algebraic definition
   - 7.2 Graphing and Properties of Rational Polynomial Functions
   - 7.3 Solving rational polynomial equations algebraically: factoring

8. Exponential Functions
   - 8.1 Algebraic definition
   - 8.2 Graphing and Properties of Exponential Functions
   - 8.3 Solving exponential equations numerically and graphically
   - 8.4 Exponential Growth and Applications
   - 8.5 Data sets and exponential functions

9. Logarithmic Functions
   - 9.1 Inverse Functions
   - 9.2 Algebraic Definition
   - 9.3 Graphing and Properties of Logarithmic Functions
   - 9.4 Solving exponential and logarithmic equations algebraically
   - 9.5 Solving logarithmic equations numerically and graphically
   - 9.6 Logarithmic Growth and Applications

9.7 Data sets and logarithmic functions

10. Growth: Preparing for the Derivative
- 10.1 Growth of Linear Functions
- 10.2 Growth of Power Functions
- 10.3 Growth of Exponential Functions
- 10.4 Dominance of Growth of Functions
- 10.5 Percentage Growth of Functions
- 10.6 Global Scale: Infinite Limits
- 10.7 Data Functions and Interpolation
- 10.8 Approximation of Functions by Linear Functions

11. Exponential Functions and Natural Logarithms
- 11.1 e = Euler's Number
- 11.2 Natural Logarithm
- 11.3 Growth Analysis
- 11.4 Applications: Carbon Dating
- 11.5 Percentage Growth and Steady Growth of Exponential Functions
- 11.6 Data Functions and Logarithmic Analysis
- 11.7 Applications: Compound Growth Rates
- 11.8 Applications: World Population
- 11.9 Applications: Growth and Half-Life Decay

12. The Derivative of Polynomial, Exponential, Logarithmic, and Fractional Powers
- 12.1 Instantaneous Growth Rates
- 12.2 Definition of the Derivative
- 12.3 Computing the Derivative Graphically
- 12.4 Computing the Derivative Algebraically
- 12.5 Computing the Derivative Numerically
- 12.6 Average Growth Rate vs. Instantaneous Growth Rate
- 12.7 Applications of the Derivative: Spread of Disease
- 12.8 Finding Maxima and Minima of Functions
- 12.9 Relating a Function and Its Derivative

13. Computing Derivatives
- 13.1 Sum, Difference, Product, Quotient Rule
- 13.2 Chain Rule
- 13.3 Instantaneous Percentage Growth
- 13.4 Growth Dominance

14. Using Derivatives
- 14.1 Finding Maxima and Minima
- 14.2 Finding Good Representative Plots
- 14.3 The Second Derivative

15. Integration
    - 15.1 Measuring Area Under a Curve
    - 15.2 Definition of the Integral
    - 15.3 Properties of Integrals, Symmetry
    - 15.4 Integrals of Data Functions
    - 15.5 Numerical Methods: Rectangles, Trapezoids
    - 15.6 Undefined Integrals
    - 15.7 Numerical Calculation of Integrals

16. Fundamental Theorem of Calculus
    - 16.1 Derivative of an Integral
    - 16.2 Integral of a Derivative
    - 16.3 Fundamental Formula
    - 16.4 Properties of Integrals
    - 16.5 Indefinite Integrals and Antiderivatives
    - 16.6 u-Substitution

17. Higher Dimensions
    - 17.1 Multivariable Functions
    - 17.2 Partial Derivatives
    - 17.3 Tangent Planes
    - 17.4 Optimization