

MATH 1251  
Calculus and Differential Equations for Biology 1

Spring 2011  
8:00 am – 9:05 am, Monday, Wednesday, Thursday

4 credit hours  
Ell Hall 410

Instructor: Nicholas Matteo  
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Nightingale 537

Course Coordinator: Thao Tran  
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Nightingale 540A

**Office Hours:** 1:00 – 2:00, Monday, Wednesday, Thursday. If you can't make it to these hours, email me to arrange a convenient time.

**Textbook:** Calculus and Its Applications, by Goldstein, Lay, Schneider, and Asmar, 12<sup>th</sup> edition. We'll only follow the book loosely; there will also be a lot of notes on Blackboard. The 10<sup>th</sup> or 11<sup>th</sup> editions should work, if you find older copies; homework problems may be different.

**Important Dates:**

Monday, January 10	First day of class
Monday, January 17	Martin Luther King Jr.'s Birthday (No class)
Friday, January 28	Last day to drop without a W grade
Monday, January 31	Last day to file a final exam conflict form
Monday, February 21	President's Day (No class)
February 26–March 6	Spring Break
Friday, April 1	Last day to drop with a W grade
Monday, April 18	Patriot's Day (No class)
Wednesday, April 20	Last day of class
Thursday, April 21	Reading day
April 22–29	Final exam period

MATH 1251 is the first semester of the two semester Calculus, Differential Equations, and Linear Algebra Sequence for Biology Majors. The course will roughly cover the first four or five chapters of the text as a (re)introduction to differential calculus, in order to get quickly into Differential Equations commonly used by biologists, which form the main body of the course. We cover methods to solve these equations and to obtain solutions from actual laboratory data. A considerable amount of material not in the book will be covered. There just is no book yet doing what we want to do at the level we need. Goldstein *et al* is mainly there as a security blanket. Nonetheless, reading the sections we do cover – whether I mention it or not – is an excellent idea!

**Prerequisites:** YOU MUST KNOW HIGH SCHOOL ALGEBRA COLD! If you are weak in this area, you'll be better off in MATH 1241 (Calculus 1). If you have had no calculus at all and feel unsure about your math skills, you'll be better off in MATH 1120. I suggest reviewing Chapter 0 from the textbook.

**Quizzes:** There will be one quiz each week, generally on Thursdays, taking 15 minutes. There will be no make-ups. For University-excused absences (check your handbook) the missed quiz will not count against you. In that case you should notify me as soon as possible that you will miss the quiz.

**Homework:** Homework will be assigned in nearly every class, and collected one week later. Homework is graded for completion, not correctness. It's important to keep up with homework, but your grade is primarily based on the quizzes and the final.

**Class participation:** If I notice you asking or answering questions, I'll make a note. Participating a lot can help your grade, but you can get a good grade without participating at all. Don't feel bad about coming in late; just try not to disrupt the class. If for some reason you must leave early, please see me before class. No other early departures will be tolerated with the exception of severe medical problems. All cell phones must be turned off!

**Grade:** Your grade is weighted variably in your favor.

- Quizzes: 40–58%
- Final: 40–58%
- Homework and Participation: 2–20%

The combination, totaling 100, which yields the highest grade for the individual student will be used. Grades are not otherwise curved (so 90 and above is an A, 80–90 is a B, 70–80 is a C, 60–70 is a D.)

**Tutoring:** The Math department offers free tutoring in Nightingale 540B. Students must come in person to schedule appointments. The tutoring center is open MTW 10-9, R 10-6, F 10-1. The Peer Tutoring Center (373-2150) in Snell Library, 2<sup>nd</sup> floor, is another resource.

**Calculators:** A scientific calculator (ie, one with a button marked “sin”) is required. A graphing calculator is useful but not required. Use of cell phones is not permitted on quizzes or tests.

If you have concerns about the course, the first step is to contact me. If I cannot be reached or do not resolve your concern, contact the course coordinator, Thao Tran. If the course coordinator does not settle the matter, contact the undergraduate director, Professor D. King (donking@neu.edu, 447 Lake, x5679).

## Tentative Course Outline

### Differential Calculus

Infinity and Beyond  
Standard Parts  
Smooth Graphs  
The derivative  
The Rules of Differentiation  
Second Derivatives  
Curve Plotting  
The Function That is Its Own Derivative  
Exponentials and Logarithms

### Pharmacokinetics

How to use semilog graph paper  
Zero-order and first-order processes  
Processes tending toward equilibrium  
Bi-exponential processes\*  
“Peeling” Data\*  
Biological Half-life

### Differential Equations

First steps  
Homogeneous Linear Equations with Constant Coefficients  
First Order Linear Non-homogeneous Differential Equations with Constant Coefficients  
Non-homogeneous Linear Equations with Constant Coefficients I (particular solutions)  
Non-homogeneous Linear Equations with Constant Coefficients II (general solution)  
Deeper into non-homogeneous equations  
Systems of differential equations

### Compartmental Problems

Non-zero initial concentration  
Two compartment series dilution  
Diffusion between compartments

### Tracer experiments\*

Quantification of radioactivity  
Inflow and outflow through cell membranes

### Trigonometric Functions

Radian Measure  
Sine and Cosine  
Calculus of trigonometric functions

### More Differential Equations

Complex Numbers  
Complex Roots of Characteristic Polynomials  
Nonhomogeneous Differential Equations with Trigonometric Right Hand Side

### Linear Algebra

Matrix, Matrices  
Inverses of Matrices  
Determinants  
Eigenvalues

\* optional – if time permits