BMED 3520: Biomedical Systems and Modeling

Summer Term 2026

Credits: 3.0

Prerequisites:

BMED 3100, BMED 2210, MATH 2403

Catalog Description

The course introduces juniors in BME to the field of computational systems biology. It covers all typical aspects of biomathematical modeling, including: the choice of a modeling framework from among alternative approaches; the design of interaction diagrams; the identification of variables and processes; the design of systems models; standard methods of parameter estimation; the analysis of steady states, stability, sensitivity and gains; numerical evaluations of transients; phase-plane analysis; and the simulation of representative biomedical scenarios. All theoretical concepts are exemplified with applications.

Objectives

This course introduces the student to the emerging field of systems biology. It will consist of a weekly overview lecture, an interactive review session, and a Problem-Solving Studio. The overarching objective is to equip students with solid basic knowledge of different types of mathematical and computational modeling approaches and their applications to solving biomedical problems.

Expected Outcomes

By the end of the course the students should:

1. Understand the basic strengths and limitations of quantitative modeling
2. Have acquired a basic skill set for designing and implementing quantitative models of biomedical systems
3. Have mastered standard techniques of steady-state and dynamical analysis
4. Understand how to apply different modeling tools to the analysis of dynamical systems in biomedicine

Textbook

Voit, E.O.: *A First Course in Systems Biology*. Garland Science, New York, NY, 2017, 2nd or 3rd Edition

Instructional Format

Six hours 45 minutes each week are scheduled for the class. The weekly 1 hour 15 minutes overview lecture on Wednesday presents a high-level discussion of the topics to be studied during the week. The sessions on Tuesday and Thursday are dedicated to hands-on projects and problem solving, as well as reviews and additional explanations of details regarding the topics addressed during the week. The primary weekly assignment is the reading and understanding of selected text from the book. Homework must be done individually. It is due at 11:55pm on Sundays of the week listed in the syllabus. Two midterm exams and one final (cumulative) exam assess each student's mastery of the materials discussed in class.

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Piazza

This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates and the TA. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com.

Grading Policy

Grades will be determined based on demonstrated proficiency on **homework submissions, problem solving studios,** and **exams**. The points associated with each graded event are shown below. Consider the following numbers as a plan subject to change if necessary:

Problem Solving Studio:	15.0% (sixteen sessions, 1 point each)
Homework Assignments:	18.0% (six HW, 3 points each)
Midterm Exam 1:	21.0%
Midterm Exam 2:	22.0%
Final Exam:	24.0%

Your final grade will be assigned according to the accumulated score. The specific cutoffs will be determined at the end of the course, but we will try to stay as close as possible to the following targeted values:

A ("Excellent"):	$\geq 90\%$
B ("Good"):	$\geq 80\%$
C ("Satisfactory"):	$\geq 70\%$
D ("Passing"):	$\geq 60\%$
F ("Failure"):	$< 40\%$

Problem Solving Studio Assessment

PSS will be graded based on participation/contribution. No paper submissions will be required. Each session will be given a grade 0 or 1 (adding to maximal 15 points in total for 15 studios).

Software:

While you are welcome to use any programing language, such as C++ or Python, we will mostly use MATLAB.

Honor Code:

Students are expected to abide by the GT Honor Code (www.honor.gatech.edu) at all times. The objective of the honor code is "to prevent any students from gaining an unfair advantage over other students through academic misconduct". Starting with the first offense, any potential violations of the honor code will be reported to the Dean of Students for review. To preserve the integrity of the classroom and the instructor-student relationship, the instructors cannot use personal discretion in instances of potential honor code violations – ***consider this the first and only warning***.
Examples of honor code violations include:

- Looking at another individual's solutions during an exam.

- Communicating with other students during an exam.
- Claiming other students' work as your own.
- Making untrue claims/statements (of any sort) to the instructors regarding use of electronic resources (Canvas submission, PLAS/Matlab, your personal laptop crashing, etc.).
- Illegally copying, sharing, or downloading the textbook.
- Misrepresenting attendance in class through signing in when not present or facilitating another student signing in who is not present.

For any questions involving these or any other Academic Honor Code issues, please consult your instructor or visit www.honor.gatech.edu.