BMED 3520 Biomedical Systems and Modeling SPRING 2027

Credit Hours: 3

Prerequisites: BMED 2100 AND CS 1301/1371 AND MATH 2403/2413/2552/2562

Monday Lectures (all sections): 12:30pm – 1:20pm Mol Science G011

Tuesday – Thursday sections:

Section A01:	Tu/Th	8:10 – 10:05	Whitaker 1232 (Prof. Chris Kieslich)
Section A02:	Tu/Th	10:20 – 12:15	Whitaker 1232 (Prof. Melissa Kemp)
Section A03:	Tu/Th	12:30 – 2:25	Whitaker 1232 (Prof. Peter Kasson)

Instructors (Office Hours TBD):

Chris Kieslich (Section A01)
chris.kieslich@bme.gatech.edua
Office hours:

Melissa Kemp (Section A02)
melissa.kemp@bme.gatech.edu
Office hours:

Peter Kasson (Section A03)
peter.kasson@bme.gatech.edu
Office hours:

Teaching Assistants (TBD):

Students are welcome to attend any instructor or TA's office hours, which will be announced on Canvas.

Course Graders (TBD):

All Graders will be serving all three sections.

Overview:

January 11:	First day of classes
January 15:	Deadline to register
January 18:	Martin Luther King Jr Day, Official Institute Holiday
March 8-12:	Spring break
March 17:	Withdrawal deadline
April 26-27:	Final instructional class days
TBD:	Final exam scheduled by registrar

Note: This syllabus may be subject to change during the semester.

Course Objective

The overarching objective is to equip BME students with solid basic knowledge of different types of mathematical and computational modeling approaches and their applications to solving biomedical problems.

Catalog Description
The course introduces BME students 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; the concept of approximations; 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 biomedical applications.

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.

Text
Voit, E.O., Kemp, M.L. *A First Course in Systems Biology; 3rd edition.* Taylor & Francis, New York, NY, 2025. Hard copy available from the Georgia Tech Library on hold under course reserves, and available for purchase at the bookstore or Amazon.

Our anticipation in administering this class was that this edition would be readily available as an e-book through the Georgia Tech Library. This has not happened and we are aware of the financial burden on students for purchasing textbooks. To accommodate this, we are listing associated reading from the 2nd edition (red cover) in red text on the syllabus and reading from the 3rd edition (pink/purple cover) in purple text where possible. Students NOT purchasing the 3rd edition are still responsible for all material covered in the class.

Instructional Format and Delivery Mode
It is expected that all classes will be in person. Supplemental instructional videos may be used to assist in learning.

Roughly five hours are scheduled for the class each week. A weekly one-hour overview lecture on Monday presents a high-level discussion of the topics to be studied during the following week. This class summarizes materials from the textbook that all students are required to read and understand. Lecture slides will be posted on Canvas.

The computational "problem solving studio" (PSS) 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. **Every student must bring a laptop to every PSS in order to work on the assigned practice problems.** You are expected to engage in active learning during PSS. Deliverables will be required from students on occasion during PSS as a portion of your course grade.

There will be two PSS with reviews held by the TAs during the first week of class. This will focus on concepts from calculus and linear algebra that every student needs to master to pass BMED3520 as well as basics

of Matlab programming. Past experience shows that many students need this refresher. Please don't miss this material and then be mathematically and/or computationally "under water" for the rest of the term.

The primary weekly assignment is the reading and understanding of selected materials from the book. Secondary assignments consist of exercises uploaded to Canvas. While the problem statements will be posted on Canvas, solutions will be discussed extensively in class, but not recorded or posted.

Communication is very important. As the primary tool for communication, we will use announcements via Canvas under the general Section A. We will also use Piazza as the primary forum for student questions. Piazza may be used at any time, except during exams. The instructors and TAs will make every attempt to respond to Piazza inquiries in an expedient manner, with delays to be expected outside normal business hours and on weekends.

Software
While you are welcome to use any pertinent software you like, such as Python or R, we will use Matlab for most PSS instruction. Installation of software or online use of Matlab will be necessary throughout the semester for specific computational exercises. There are 3 ways to use access. 1) For laptop downloads, please refer to the **Georgia Tech Matlab Portal** for installation. 2) You may use VLab, or 3) you can use your browser by logging onto your Mathworks account at **https://matlab.mathworks.com/** for the online version.

Websites
Class notes, homework, homework solutions, etc. will be posted on the course website on Canvas, unified across all three sections by placing pertinent information under the 3520-A listing. This course site will be used to send critical and section-specific information to the class; therefore, you must verify that you are enlisted in the membership.

Piazza website
We will be using Piazza for class discussion collectively. The system is highly effective at getting you help fast and efficiently from classmates, the TA, and instructors. Rather than emailing questions to the teaching staff, we encourage you to post your questions on Piazza. While we have set up automatic enrollment for the Piazza site, you are ultimately responsible for making sure you have access to the course Piazza page. If you have any problems or feedback for the developers, email team@piazza.com. Find our class page on the tool tabs of the course Canvas site or at:
https://piazza.com/gatech/spring2027/bmed3520a

Evaluation

Homework assignments (4)	12% (total)
In-semester exams (2)	26% (each)
Final exam	24%
PSS deliverables	12% (total)

*Deliverables from problem-solving studios require in-person participation. Institute-approved absences or illness must be notified in advance of the missed class through written communication with your instructor.

Your final grade will be assigned according to the accumulated score. In the past, the final grades have sometimes been curved at the very end. The instructors reserve the right to curve or not to curve. 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"): ≥ 90%
B ("Good"): ≥ 80%
C ("Satisfactory"): ≥ 70%
D ("Passing"): ≥ 60%
F ("Failure"): < 40%

The two in-semester exams will be held in person during the regular PSS sessions of all sections and will be closed book with one page of notes allowed.

The date of the final exam will be determined by GT's administration. ***Please be patient as we are "off-matrix" in scheduling with a M/T/Th class and are officially assigned our final exam slot later in the term***. We understand that you want to make travel and graduation plans but we do not have control over the delays. The final exam will also be closed book with one page of notes allowed.

Homework Submission and Regrade Policy:
Homework assignments must be completed and submitted individually. Each homework must be uploaded as a single PDF accessed from the *Assignments* section of Canvas and uploaded on the Gradescope tab; other submissions or file formats will not be accepted.

Homework is due at 11:55pm of the day listed in the syllabus. No homework will be due during exam weeks.

Requests for regrades on exams and homework are permitted **up to one week** after graded materials are returned to the student. Requests for any regrades must go through the section TA and put in writing.

AI Policy:
A number of AI tools are available for public use that facilitate code generation, including Python and Matlab syntax. These tools can accelerate the model-building process and are transforming our discipline; however, they are also riddled with mathematical errors and inaccurate information that can be difficult to pinpoint unless you have mastery of the material. Our goal is to help you form the analytical thinking skills in this class that will allow you to critically evaluate the quality of generative AI output. Thus, it is important to learn the course content without using AI tools as a crutch. We will give you explicitly defined exercises to explore the use of AI tools in systems biology so that you can learn effective prompts and fallacies associated with usage. Outside of these explicitly permitted situations:

- You may use AI programs e.g. ChatGPT to help generate ideas and brainstorm (but not to generate answers that you turn in). However, you should note that the material generated by these programs may be inaccurate, incomplete, or otherwise problematic. Be aware that use may also stifle your own independent thinking and creativity and hinder your ability to perform well in closed-book exam assessments.

- You may not submit any work generated by an AI program as your own. If you include material generated by an AI program, you should include an appendix that provides the complete prompt and output from the exchange.

- You may NOT use AI tools during in-class examinations or problem-solving exercises unless explicitly permitted and instructed.

- Any plagiarism or other form of cheating will be dealt with severely under relevant Georgia Tech policies (see below).

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". 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.

Examples of honor code violations include:

- Looking at another individual's solutions during an exam.
- Communicating with other students during an exam, such as online communication, texting, or use of websites such as Chegg
- Claiming other students' work as one's own.
- Making untrue claims/statements (of any sort) to the instructors regarding use of electronic resources (Canvas submission, Matlab, your personal laptop crashing, etc.).
- Using ChatGPT or other LLMs to generate answers for submitted homework or exams

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