# CSE 8803 BMS Syllabus

Biomedical Modeling and Simulation Name, Section 01, 3 Credits
Fall 2026

## Instructor Information


| Instructor | Email |
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## General Course Information

### Description

Modeling has become an increasingly important tool for understanding and treating biomedical conditions. Mathematical equations are developed to describe the physiological setting, and these equations are then solved and the results analyzed to gain new insights. Many types of normal and diseased behaviors can be described in this way. Because the models necessarily reduce the complexity of the real-world setting, there are simplifications and errors in formulation and solution that impact interpretation of results obtained using such models.

This course will introduce various models and modeling techniques for describing the dynamics of different cells including neurons, cardiac cells, and pancreatic cells, and various diseases. Modeling techniques will be extended to address emergent behavior when cells are coupled into tissue or organs or when detailed subcellular structure must be included. Although emphasis will be placed on mechanistic modeling techniques, such as differential-equations and related approaches, data-driven methods will also be considered. At the same time, computational approaches will be considered for representing and solving the models, and we will look at how physiological structures can be created. Furthermore, model sensitivity, parameter estimation, identifiability, and uncertainty quantification will be considered as important components of model development and analysis given variability within and across individuals. In addition, we will look at the uses of these models to describe physiological mechanisms and to develop and test treatment strategies for various diseases. These topics at times may be discussed separately but often will overlap, as model development involves parameterization and may depend on solution approaches, and advances in model development and solution frequently are proposed in the context of a particular application.

### Course Learning Outcomes

Explain how the mathematical context of mechanistic biomedical models encodes physiological meaning.
Develop and use programs to solve biomedical models.
Interpret results obtained using biomedical models.
Articulate strengths and limitations of biomedical modeling approaches.

### Required Course Materials

No textbooks will be required; instead, the course will be based on original research papers and reviews from the scientific literature.

### Grading Policy:

Assignments 13.33%, 13.33%, 13.33%; Project 40%; Participation 20%.

A: 90-100%; B: 80-89%; C: 70-79%; D: 60-69%; F: 0-59%.

- Assignment 1, 13.33%
- Assignment 2, 13.33%
- Assignment 3, 13.33%
- Project, 40%
- Participation, 20%

### Description of Graded Components

Homework assignments (40%): There will be three homework assignments for you to get hands-on experience in the topical areas covered in the class and in related subjects.

Project (40%): You will complete a project on a topic of your choice (subject to approval) within the broad area of biomedical modeling and simulation. The project will include a proposal, mid-term report, final project report, and final project presentation.

Class participation (20%): Your participation will be an integral component of the class. Attendance and general participation during class will be considered. In addition, you will be required to lead the discussion of original research papers during the semester.

## USG Required Course Policies

### Attendance and/or Participation

This will be an active classroom where you will be expected to participate. Thus, attendance and participation will be factors in your grade.

### Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

## Additional Georgia Tech Required Policies

### Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

### Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.