

BIOE 446 COMPUTATIONAL MODELING LAB Fall 2024

Instructor: Oleg Igoshin, Ph.D. igoshin@rice.edu BRC 767, ext x5502

TAs: Jon DeBonis jd111@rice.edu

Meeting Time 1:00PM - 4:00PM Friday BRC

TA's and Instructor's Office Hours: By appointment –email to schedule

Prerequisites: BIOE391 and BIOE330

Class Materials: The class website is functioning on Canvas . The textbook we will closely follow is Quantitative Biosciences: Dynamics across Cells, Organisms, and Populations by Joshua Weitz <https://www.amazon.com/Quantitative-Biosciences-Dynamics-Organisms-Populations/dp/0691181519/> It is highly recommended for students to get the textbook and read the corresponding chapters as indicated on the syllabus schedule.

You need to be registered for class and log in with your Rice ID to have access to class materials. Contact me if you have a problem. Syllabus, reading topics & lab manuals will be posted there. You will receive announcements in your email once new materials are uploaded to the website. The students are expected to use MATLAB for all labs. Either lab computer or personal laptop computers can be used.

Grading will be based on

Lab reports(HWS)	75%
Image-Analysis Lab/Project	20%
In class participation/attendance/discussions	5%*

No curve-grading. All students have a chance to get an A on this class.

Major Topics to be covered:

1. Intro to the class and MATLAB basics; Simple curve fitting and ODE simulations
2. PK Models
3. Biochemical Circuits: Bistability
4. Biochemical Circuits: Oscillators and Clocks
5. Stochastic Chemical Kinetics
6. Fluctuations and Mutations
7. Evolutionary Population dynamics
8. SIR Model
9. Predator-prey dynamics
10. Signal Processing in Neurons
11. Excitatory Dynamics in Cardiac Cells and Tissue
12. Flocking – agent-based models
13. Image Analysis Project

Background Reading: For each class after the first one, a reading assignment prior to each lab will be posted. It should take you about 1hr to familiarize yourself with the material. A lecture/guided discussion of this will be given by the instructor at the beginning of each lab.

Assignments:

Each report should be combined into a single Word or PDF file and include text answers, figures/captions, and MATLAB codes as an appendix (copy-pasted into the document with preserved formatting or printed to PDF and merged into a single file). Reports are expected to be typeset. Figures can be exported directly from MATLAB (or screenshot) and inserted into your word-processing program.

- **Lab reports:**

A multi-part problem associated with each lab topic will be assigned. A demo of problems that introduce key conceptual steps and coding practices for these will be demonstrated by the TAs during the lab. The TA will also be able to help students during the lab and after the lab (by appointment). It is expected that most coding will be completed during the lab, and the majority of the results will be generated in class. Reports are due a week after the class (before the beginning of the class). Late reports are subject to a 10% per day penalty in the grade unless there is an advanced extension from the instructor.

Lab reports are individual work but the students can collaborate as defined in Article II. Section of the honor council document:

<https://cpb-us-e1.wpmucdn.com/blogs.rice.edu/dist/c/490/files/2022/08/Honor-Council-Standard-Definitions-and-Policies.pdf>

- **Image Analysis Project:** In addition to well-defined labs a more open-ended mini-project on Image Analysis will be assigned at the last 3 weeks. The students will be working on these in the self-formed teams of 2 or individually. The amount of work is expected to be 2-3x larger than a typical lab and 3 classes will be dedicated. The students are expected to spend about 5 additional hours on the project outside of the class and the report will be due during final week.

Attendance Policy: Students are expected to attend all the labs. Students who missed a class are expected to complete lab reports outside of the class. Those who miss more than one class may get a reduced class participation grade.

Class participation will be part of your grade and will be earned by voluntarily answering (or asking) questions in class and participating in the reading material discussions. You will NOT be penalized for giving the wrong answers. You would get extra points for being active in class. Speak up, and don't be afraid to ask or answer questions. If you are nervous about asking or answering questions, try writing down what you want to say before you speak up. You will only lose points if you are actively avoiding participation.

Disability accommodations: Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All such discussions will remain as confidential as possible. Students with disabilities must also contact Disability Support Services in the Allen Center.