BIOE 504: Analytical Methods for Bioengineering Fall 2023

Instructor: Michael Insana   Offices: 2108 EL & 4247 BI, mfi@illinois.edu

Time and place: MW 9:00 am – 10:50 am, Engineering Hall 106B3

Discussion and office hours are scheduled after class MW and by appointment most days.

Prerequisites: Calculus through ODEs, linear algebra, scientific programming,
                      elementary statistics, or graduate standing

Required Book: "Biomedical Measurement Systems and Data Science," by MF Insana,
                       Cambridge University Press, 2021 www.cambridge.org/9781107179066
                       Notes available in the bookstore.

This core graduate bioengineering course is open to students from other engineering and science programs with graduate standing or undergraduates with permission from the instructor. The objective is to introduce and review a broad range of mathematical, statistical, and computational modeling methods related to data representation and measurement systems that are common to the design and evaluation of biomedical instruments and biological modeling. Assignments involve combinations of mathematical, statistical, and numerical modeling in Matlab.

Course grades are based on student performance on graded homework assignments (75%) and one take-home exam/project (25%).

Grades: A (90-100%), A- (80-89%), B+ (75-79%), B (70-74%), B- (65-69%), C (<65%)

Semester Schedule:

Classes begin	Monday August 26
Labor Day Holiday	Monday Sept. 2
Thanksgiving Holiday	Nov. 23 – Dev. 1
Last Day of Instruction	Wednesday Dec. 11
Take home exam due	Wednesday Dec. 18 at noon

- Course materials are found on Canvas at https://canvas.illinois.edu/courses/48382 . Homework must be submitted through Canvas as a pdf file.

Dates	Lectures and Discussions
Week 1	• Introduction and review of Matlab • Linearity
Week 2	• Time-Frequency Analysis
Week 3	• Managing Uncertainty
Week 4	• Bayesian Regression (Section 5.1)
Week 5	• Statistical Decision Making (Ch 8)
Week 6	• Statistical Decision Making
Week 7	• Statistical Pattern Recognition (Ch 9)
Week 8	• Clustering Analysis (Ch 9)
Week 9	• Mathematical Biology (Ch 10)
Week 10	• Mathematical Biology (Ch 10)
Week 11	• Modeling Infectious Disease (Sec 10.9)
Week 12	• Second-Order ODEs (Ch 11)
Week 13	• Modeling Sensors (Ch 11)
Week 14	Fall break
Week 15	• Preparing projects
Week 16 (Dec. 18)	• Take home exam assignment due Monday Dec 18 at noon.

You can access the VPN needed to connect to Matlab at the webstore via (it's free):

https://webstore.illinois.edu/Shop/product.aspx?zpid=2600

You can also obtain a VPN through the AppStore for iPads and other Apple products.

The following websites offer hardware and software resources that might be useful to you.
https://it.engineering.illinois.edu/keeplearning

https://answers.uillinois.edu/illinois.engineering/104402

A nice college website with advice on remote learning:
https://students.grainger.illinois.edu/GFX/remote-learning/

You may use Engineering IT's Citrix Workspace to access Matlab at this site:
https://it.engineering.illinois.edu/services/instructional-services/remote-connections-citrix/remote-connections-citrix-sld

At the bottom of the page, you will find this link for connecting to Citrix:
https://it.engineering.illinois.edu/ews/lab-information/remote-connections/connecting-citrix

You need to connect to the campus VPN to use this service. Let me know if you have difficulties.

New in 2024: Matlab is now free to students:
https://webstore.illinois.edu/shop/product.aspx?zpid=4105

Academic Integrity

This course is designed to encourage students to cooperate with each other and collaborate in problem solving assignments. Effective collaboration is a trait of successful researchers and educators in the 21st century. Students are strongly encouraged to participate in "classroom" discussions, offer perspectives, and ask questions that foster a vital part of the learning process.

I expect everyone to attend class and behave in an ethical and respectful way at all times.

Homework assignments: You may use textbooks and electronic resources to solve HW problems, but you must give credit to those sources. This is the same requirement that must be followed when publishing in the peer-reviewed literature. Ethical practice demands that you **acknowledge the contributions of others**.

Take-home final exam: I ask that you NOT collaborate but work alone to solve these problems. You may use textbooks and electronic resources of your choice.

In both forms of assessment, you will need to code in Matlab. Unless you have spent considerable time coding, the computational aspects of problem solving and modeling can be time consuming. Cooperation and code sharing is acceptable and encouraged if the sharing is equitable and acknowledged in writing within each assignment.