ILLINOIS

THE GRAINGER COLLEGE OF ENGINEERING

Department of Bioengineering
1102 Everitt Laboratory, MC-278
1406 W. Green St.
Urbana, IL 61801

BIOE 210: Linear Algebra for Biomedical Data Science Spring 2024

Instructor: Michael Insana mfi@illinois.edu, offices at 2108 Everitt Lab & 4247 Beckman Institute

Class time and place: TR 9:30 am – 10:50 am, 2100 Sidney Lu Mech Engr Bldg.

Teaching assistant: Will Newman willn2@illinois.edu

Office hours are scheduled after class TR and by appointment. Will Newman will hold office hours on Wednesdays from 2-4pm in Room 2108 Everitt Lab. For those struggling with Matlab, this is an opportunity to catch up.

Graders: Ashley Sung asung8@illinois.edu and Aidan Steuck astue2@illinois.edu

Prerequisites: MATH 231 (calc II), courses in scientific programming & differential eqs (Co-req)

Required Textbooks:
(1) *Linear Algebra: Foundations of Machine Learning by P.A. Jensen* is available free of charge at https://canvas.illinois.edu/courses/33359 under the tab “pages.” There are two files Textbook_Part_1.pdf and Textbook_Part_2.pdf.

(2) Matlab is required for the course and can be accessed via the EWS machines (https://it.engineering.illinois.edu/ews/lab-information/remote-connections). Off-campus users of Matlab require a VPN connection. Working with Python on HW assignments is acceptable.

Course Contents and Objectives: BIOE 210 is a core course required for all bioengineering undergraduates. The goal is to introduce students to essential analytical and computational tools from linear algebra. In addition to describing vector and matrix arithmetic, students will solve systems of linear equations. These methods can be applied to analyze large, multivariable datasets to quantify relationships between variables; decompose complex datasets into simpler representations; solve common problems in classification and image processing; and develop a geometric view of high-dimensional data spaces. Course topics include definitions of vector spaces; linear systems; solvability; rank; basis; transformation matrices; and vector & matrix decompositions (eigenanalysis, SVD, PCA). The course focuses on mathematical and computation aspects of problem solving, and consequently requires students to access Matlab. Completing assignments with other array-based scientific computing software, e.g., Python, is acceptable.

Assessments:
Two in-class paper exams. Any non-electronic materials are allowed during the exam, including paper pages from the course textbook and notes. Exams are based on homework problems.

Eleven or twelve homework sets are assigned through Canvas every week or two. Due dates and times are listed on Canvas. Assignments will include both analytical problems and Matlab-based exercises. Written answers to the analytical problems and your Matlab solutions (including code) must be uploaded to Canvas. Additional details and demonstrations of homework submission will be provided during the first week of class.

Late Homework:
Any work submitted after the deadline will be penalized. The penalty is 50% if submitted within 24 hours of the deadline. Homework submitted more than 24 hours after the deadline will not be scored. Exceptions may be granted if the instructor is informed of the reason for a late submission before the due date and an extension is granted. The submission time for an assignment is the time of the latest submission. If half of the assignment is submitted before the deadline and the other half late, the entire assignment will be scored as late.

Attendance: Attendance is not required but it is absolutely expected and highly encouraged. Numerous problem-solving and coding examples are provided during lectures, which inform the subsequent homework assignments. Each week, after a homework due date, the assigned problems will be worked out during scheduled class time and all questions will be answered. Because the exams are based on homework problems, regular attendance is strongly encouraged.

Grading: Homework 50%, Exams 50%

A+ >97%	B+ >87%	C+ >77%
A > 93%	B > 83%	C > 73%
A− >89.5%	B− >79.5%	C− >67%

Homework grades are posted on Canvas.

Academic Integrity and Responsibilities

This course is designed to encourage students to cooperate in problem solving assignments. Effective collaboration is a trait of successful professional engineers and technical innovators. Students are strongly encouraged to participate in “classroom” discussions, offer perspectives that benefit everyone, and ask questions that foster a vital active learning process.

Collaboration on homework assignments is encouraged. However, it is professional practice to acknowledge your sources and your collaborators in your homework writeup.

Every student is responsible for conducting themselves safely, ethically, and with consideration for others. You must also adhere to campus policies related to participation in educational activities, either in-person or remote, especially with respect to public health and safety.

If you experience difficulties completing assignments for any reason, including managing an illness, you have a responsibility to email the instructor and/or arrange a face-to-face meeting. I am always happy to discuss possible accommodation that will aid in your progress toward achieving course objectives.