ILLINOIS

THE GRAINGER COLLEGE OF ENGINEERING

Department of Bioengineering
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BIOE 210: Linear Algebra for Biomedical Data Science Fall 2026

Instructor: Will Newman willn2@illinois.edu, office at 2244 Everitt Lab

Class time and place: MWF 9:00 am – 9:50 am at 4025 Campus Instructional Facility (CIF)

Office hours: TBD. At least two hours per week scheduled and additionally by appointment

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 under the tab "files → Textbook." There are two files Textbook_Part_1.pdf and Textbook_Part_2.pdf.

(2) Matlab is required for the course and can be downloaded for free using the instructions on the Webstore: https://webstore.illinois.edu/shop/product.aspx?zpid=4105.

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 and explore linear regression. 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 visualize high-dimensional data spaces. Course topics include definitions of vector spaces; solvability; rank; basis; linear 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:
Three paper exams (two midterms and a final exam). Non-electronic materials are allowed during the exam, including paper pages from the course textbook and notes. Exams are primarily based on homework problems and

examples worked out in class.

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. *All homework must be submitted to Canvas (Gradescope) as a pdf file.*

In-class assessments will be assigned randomly and during normal class time. These will be used to assess understanding of the lecture material and provide additional practice. Electronic devices will not be allowed, but I will allow you to work with each other.

Late Homework:
Any work submitted after the deadline **will be penalized**. The penalty is 25% if submitted within 24 hours of the deadline. Homework submitted more than 24 hours after the deadline will not be scored. **This includes work that was incorrectly submitted.**

Homework Extensions:
Exceptions may be granted if the instructor is informed of the reason for a late submission at least **24 hours before the due date** and an extension is granted. **There will be no exceptions to this 24-hour policy.** 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.

The use of AI tools: There is no penalty for using AI tools to complete your homework assignments, however their use should be properly acknowledged in the assignment submission. **You must include all prompts used as a part of your homework submission.** During exams and in-class assessments, electronic devices (including AI tools) will not be allowed. Completing the homework assignments without using AI tools is highly encouraged to best prepare for the exams and assignments.

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. After a homework due date, the assigned problems will be worked out during scheduled class time and any questions will be answered. Because the exams are based on homework problems, regular attendance is strongly encouraged. Additionally, some graded assessments will be given during class and there will be no way to make them up.

Course Content: Most of the content for this course (worked out examples) will not be posted to the canvas site. It is the student's responsibility to take notes on the material, follow along in class and come to office hours if they are missing any of the content. Lecture slides will generally be posted to the Canvas site and can be found in the Files tab.

Grading: Homework 40%, Midterm exams 30%, Final exam 20%, In-class assessments 10%

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

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.