EK103 FALL 2021
Computational Linear Algebra

Lectures (A1): Tuesdays and Thursdays 1:30pm – 2:45pm in PHO 117 (Not available on Zoom and not recorded)
Lecturer: Prof. S. Hamid Nawab
Office: PHO 433
Hamid’s Office Hours: Start Thursday Sept 9.
  1. Thursdays 5:30pm to 6:30pm (on Zoom)
  2. Fridays 12:00pm to 1:00pm (on Zoom)

Graduate Teaching Assistant: Chen Ling
Chen’s Office Hour: Friday 2:00pm-3:00pm (on Zoom), starting Friday Sept. 10

Discussions (B1): Start Friday Sept 10
B1:  Fridays 8:00am-8:50am on Zoom

Textbook:
The recommended (not required) textbook for this course is Introduction to Linear Algebra (5th Edition) by Gilbert Strang, ISBN 978-0980232776.

In addition, Lecture summaries, blackboard photographs, important formulas, and practice exams will be periodically posted on the Blackboard Learn site for the course to help you stay updated and to verify the accuracy of your own lecture notes.

Course Description for EK103: This course introduces you to a mathematical language, commonly known as linear algebra, that enables you to systematically and efficiently start thinking about and understanding the fundamentals of modern data science – How can we best store/transmit large amounts of data? How best can we represent data to make it easy to examine patterns implicit within that data? How best can we transform data into forms that are useful for engineering purposes? In EK103, we will motivate many of the fundamental concepts of linear algebra via applications in which the data being examined is produced via physical devices such as microphones and cameras.

Prerequisites for EK103: High School Algebra and Trigonometry, EK125

Learning Outcomes for EK103: This course is designed to produce certain learning outcomes. As such, you can expect that as a result of taking this course, you will be able to:
  1) Understand how linear algebra is related to the acquisition, analysis, and manipulation of physical signals, images, waves, and transforms.
  2) Understand the central role of linear combinations in linear algebra.
  3) Understand and become proficient in the world of vectors and vector spaces.
4) Understand the *computational power* linear algebra gives us in the world of vectors and vector spaces.

5) Understand how *solving systems of linear equations* is related to linear algebra.

6) Understand how data of interest may be represented using *matrices*.

7) Understand and become proficient in *multiplying matrices*.

8) Understand the concept of the *inverse of a matrix* and why it is useful.

9) Understand and become proficient in *analyzing whether or not the inverse of a matrix exists*.

10) Understand and become proficient in *finding the inverse* (if it exists) of a matrix.

11) Understand the relationship between linear algebra and practical algorithms for *computing the FFT and the inverse FFT*.

12) Understand and become proficient in using the concepts of *eigenvectors and eigenvalues*.

13) Understand *Principal Components Analysis*.

14) Understand *Singular Value Decomposition*.

15) Understand *Face Recognition*.

**MATLAB Component of EK103:** The MATLAB component is incorporated within the homework assignments and consists of MATLAB assignments. GTA will be available during discussions to help with any MATLAB questions you might have regarding the homework.

**Grading Rubric for EK103:**
- Closed Book Test 1: 25% (Performance Based)
- Closed Book Test 2: 25% (Performance Based)
- Closed Book Final: 25% (Performance Based)
- Homework: 25% (Participation Based)

**Homework Policy for EK103:**
Homework will be *posted* online (on Blackboard Learn) every *Sunday* and it is *due* on Blackboard Learn by the *following Sunday* before Midnight. The discussion on Friday (as well as Prof. Nawab’s office hours) are designed to help you with the homework.

We will only check to see if the homework you submitted is original work (i.e., that you have not plagiarized someone else’s work). If there is no evidence of plagiarism in your submitted homework, you will receive full credit for that homework assignment (even if it is full of mistakes/errors). You are allowed to miss up to 3 homework assignments during the semester without incurring any penalty. We expect there to be a total of 10 homework assignments.

Soon after each homework assignment due date, solutions will be posted on Blackboard Learn for that homework in the form of a video in which Prof. Nawab explains the process of solving the homework problems on that assignment.
**Test Dates:**
Test 1: Thursday, **October 21** in class  
Test 2: Thursday **November 18** in class  
Final: TBA (Between Dec 14 and Dec 18)

**Special Dates:**
- Tuesday October 12: No class, **Monday schedule** at BU  
- Wednesday November 24 to Sunday November 28: **Thanksgiving Recess**  
- Thursday December 9: **Last EK103 Lecture**  
- Friday December 10: **Last EK103 Discussion**

**Academic Misconduct:**

BU takes academic integrity very seriously. Academic misconduct is conduct by which a student misrepresents his or her academic accomplishments, or impedes other students’ opportunities of being judged fairly for their academic work. Knowingly allowing others to represent your work as their own is as serious an offense as submitting another’s work as your own. More information on BU’s Academic Conduct Code, with examples, may be found at [http://www.bu.edu/academics/policies/academic-conduct-code](http://www.bu.edu/academics/policies/academic-conduct-code).

**Collaboration Policy:**

In this class you may use any textbooks when completing your homework, and/or any number of human collaborators (from class) per homework, subject to the following strictly enforced conditions:

- You must clearly acknowledge all your sources (including your collaborators) on the top of your homework.  
- You must write all homework answers in your own words.  
- You must be able to fully explain your answers upon demand.  
- You may not use any human resource outside of class (including web-based help services, outside tutors, etc.) in doing your homeworks.

The two tests and the final exam in this course are closed book and the use of any electronics is strictly forbidden during each exam. Collaboration with others during any of these three exams is also strictly forbidden. The course instructor (Prof. Nawab or his representative) will provide you a detailed formula sheet during each exam. You are not to bring any other written material (such as “cheat sheets”) to any of the three exams.

Failure to meet any of the above conditions would constitute plagiarism and will be considered cheating in this class. If you are not sure whether something is permitted by the course policy, please ask Prof. Nawab.