

**Hunter College of The City University of New York**  
**Department of Mathematics and Statistics**  
**STUDENT SYLLABUS**  
**MATH 160 – Matrix Algebra**  
**3 hrs – 3 Credits**  
**Spring 2021**

**Section: Math 160.02**

**Time: MW 7 – 8:15 PM**

**Room:** Online – access through Blackboard (*Classroom* in the course navigation menu)

**Instructor:** Ivana Stanisavljevic

**Email:** ivanashunter@gmail.com

**Office Hours:** Mondays 5 – 6PM, Thursdays 4 – 5PM

**OH Room:** Online – **the same as class** on Blackboard

**Textbook:** Linear Algebra with Applications, by Steven J. Leon, 9<sup>th</sup> ed., Pearson, 2015

**N.B. Very important! I use the GMAIL account above. If you try to email me through Blackboard or reply to a CUNYfirst announcement (which uses Hunter email), very likely you will not get a response *at all*.** You may use your non-Hunter account to communicate with me, however, you must have a working Hunter email because any correspondence via Blackboard or CUNYfirst uses your Hunter email.

**Blackboard:** We will use CUNY Blackboard for this course. To access the Bb, go to [cuny.edu](http://cuny.edu) –> login –>blackboard –> log in with your CUNY login credentials Under our course you will find a menu on the left-hand side with links for orientation, syllabus and calendar, classroom access as well as a lot of useful material and assignments.

**Prerequisite:** Math 125 – Precalculus or appropriate score on placement exam.

**Textbook:** This course uses the 9<sup>th</sup> edition, all the assigned homework will be from this edition. You are not required to bring the textbook to class, however, you are responsible to find the correct assigned problems for the homework and submit such. Incorrect problems (and problems that do not show each step or explain reasoning) will receive zero credit.

**Learning Outcomes:** Upon successful completion of this course, students will be able to:

1. Write systems of linear equations in four ways: as a system of linear equations, as a matrix equation, as a vector equation, as an augmented matrix.
2. Determine whether a system of linear equations has solutions and determine the number of solutions.
3. Solve systems of linear equations using row-reduction.
4. Use matrices to solve a variety of application problems.
5. Approximate solutions to systems of linear equations and determine the error.
6. Perform algebraic operations on matrices.
7. Express elementary row operations as elementary matrices and vice versa.
8. Evaluate determinant of a matrix by using both row/column expansion and properties of determinants.

9. Define, verify, and give examples of vector spaces.
10. Verify linear independence.
11. Determine span of vectors.
12. Determine basis and dimension of vector spaces.
13. Evaluate both scalar and cross product of vectors.
14. Find equation of a plane.
15. Evaluate eigenvectors and eigenvalues of matrices.
16. Orthogonalize a matrix.

**Assessment:**

10% Quizzes

20% Homework

15% Midterm 1 (topics 1 – 3)

15% Midterm 2 (topics 4 – 6)

40% Final (cumulative)

**Grading scale:**

A+ > 97.4%

A 92.5-97.4%

A- 90.0-92.4%

B+ 87.5-89.9%

B 82.5-87.4%

B- 80.0-82.4%

C+ 77.5-79.9%

C 70.0-77.4%

D 60.0-69.9%

F < 60.0%

**Quizzes:** During class time you will have pop-up quizzes based on the material covered up to that point in the semester. Quizzes may be anywhere from 5 minutes to 20 minutes long. The type of questions can be True/False, Multiple Choice, Multiple Answer, Short Answer. For True/False questions on Quizzes you will not be asked to explain why. However, **True/False questions on exams without detailed reasoning will get no credit.**

**Homework: Late homework is not accepted.** Therefore, plan accordingly as the assignments will require time to complete!

First of all, you must use proper notation. Work that does not use proper notation such as, but not limited to = sign in equations, proper matrix/determinant notation, etc. will not get credit. At this point in college, you should be able to effectively use mathematical notation.

In order to get credit, you have to show all (substantial) work. Furthermore, work that does not provide reasoning why something is true or not, freehand sketches (no help of graphing apps, calculators, etc.) when necessary, step-by-step evaluations for topics that you are being assessed for, will get zero credit.

There will be about four homework assignments due every three to four weeks before the beginning of class. I will announce the problems in class and you will have at least a week after

the topic is covered in class to submit the homework problems (for example, if the topic is covered on Wednesday, homework for that chapter will be due no sooner than the following Wednesday before the beginning of class; exceptions may occur if the midterm falls on that day, in which case, for your benefit, the homework will be due on Monday so that solutions can be posted in a timely manner for your review before the exam).

Homework assignments are to be uploaded on Blackboard. For your convenience, within each homework, there is a link for each chapter so that you can upload your work as you finish it.

Homework grade has two portions:

- 30% of the grade is based on how much of the homework is submitted (amount, form, notation, vocabulary, organization, but if you make a computational (arithmetic) mistake, it will not be marked wrong, of course, if it's a bunch of nonsense, student will get 0 points).
- A few randomly selected problems will be graded carefully. Those problems carry 70% of the weight of the homework grade.

**Exams: All exams are closed books, closed notes. You are not allowed to use any help besides a scientific calculator.** You may NOT use a GPRADING CALCULATOR or any electronic device during the exam!

***Academic dishonesty will not be tolerated. If there is a suspicion of cheating, you will be reported to the Office for Student Conduct for investigation. Such reports usually yield failing the course, facing disciplinary charges, and being expelled.***

***Also, I reserve the right to give an oral exam in a video conference call via ZOOM which may result in a score of 0 on the exam.***

There will be 2 exams and a final. First exam will cover topic from chapters 1, 2, and 3; second exam will cover material from chapters 4 and 5, and 6. Final exam is cumulative. There is **no makeup policy**. If you miss an exam, your score will be 0 for that exam. If you miss a final, you will get a WU. ***In-class exams are tentatively scheduled for March 24<sup>th</sup>, and May 3<sup>rd</sup>. Final will be held on Monday, May 24<sup>th</sup>, 6:20 – 8:20PM.***

If you know in advance that you will not be able to take the exam on a particular day (you have a surgery, or a wedding you need to go to), you may take the exam BEFORE the scheduled date. Provided with the proof for such an excuse, I will accommodate this if request is made no later than 10 days before the exam. Unfortunately, there will be no makeup after the exam date/time.

***Instructions for the exams:***

You must DO EVERY PROBLEM STEP BY STEP on a paper (or using a writing tool) in an organized manner:

- Your name on each page
- emplid
- Problem number
- Neat work in **pen**
- Graphs can be sketched using colored pencils as long as they are legible
- If you make a mistake, it is enough to cross it once

- **Keep all your ORIGINAL scratch work for each problem** of the exam
- Take (**clear and visible**) pictures or scan your work (using a scanner or any app for scanning) with your **student ID place on the top of the page**
- Save your work as a **PDF**
- **Upload your work on Blackboard** under Exam Submissions; there will be 3 attempts in case you have internet issues, or if it does not allow you to upload too many pages within one submission. If you are using multiple attempts to upload your work in parts, make sure to write that in the *Writing Submission* window.
- Note that you need to submit the scratch work **no later than 15 minutes after the end of the class.**

**Please, use pen so the work is legible. Failure to provide evidence of your work in a clear, legible manner, showing every step will result in score deduction.**

I will email you comments on work provided. It is in your best interest to review my comments.

**Attendance:** Attendance is required, and it will be obtained from remote lectures. I may ask you by name to answer a question during the lecture. If you do not respond when your name is called, you will be marked absent for that session. Missing a lecture will reflect negatively on your course performance. We will also have pop-up quizzes during class time which are 10% of your grade. You are responsible for all work missed. That being said, if you miss a class, utilize Bb Collaborate tool, Discussion Board, or contact your peers, but do not email me to ask me what you missed or if you missed something. Do note, course moves very fast, missing one lecture will put you at a big disadvantage. Class will not meet on the days of Midterms.

### **How to Approach This Course and How to Study:**

- You are expected to look at the syllabus calendar and read the chapters that will be covered that day. I will post definitions/propositions on Blackboard. You are expected to read the material before the class, have it printed, or copied in your notes. Matrix Algebra is based on a lot of theory. Due to the nature of online classes: limited whiteboard space, possible hard to read handwriting, time everyone needs to copy the board, I will not take away the precious time during class to write the theory again. Class-time will be used for proofs of propositions, additional information, problem solving and answering any questions students may have.
- Take good notes, and keep course materials organized including your homework problems.
- In-class Quizzes are timed. You can only see one question at a time, and you may not go back. Each quiz may test on anything that was done up to that point in the semester.
- Homework can be done in any order, however, make sure to upload on the correct link for the chapter number, subchapter, and write the problem number next to each question. Make sure to do homework in a timely manner so you do not fall behind. The nature of this class is that it is all building blocks, if you skip a subchapter, you may not be able to follow the next class, or any of the following classes for that matter.
- Review homework solutions posted on Bb
- If you need extra help, go to office hours or contact the math learning center

**Be responsible for your own learning!** This can't be stressed enough. It is up to you to find the best way for you to assimilate these ideas. Read the text, read your notes, do all the homework until you understand every problem, and think about the concepts as much as you can, do not learn a way how to do a problem without understanding why. Come to class—every day! Don't be afraid to ask questions, and seek help when you need it. It is better to study often in small doses than infrequently for long periods.

**Tutoring: FREE TUTORING** is available through the Dolciani Mathematics Learning Center (DMLC) which is located on the 7th floor in the Library (HE). You are encouraged to take advantages of this service beginning the first week of classes.

Due to current NYS and NYC regulations, the center is closed for in-person visits, but it is available online. Please, check [www.hunter.cuny.edu/dolciani](http://www.hunter.cuny.edu/dolciani) for more information. You may reach out to them at [dmlc@hunter.cuny.edu](mailto:dmlc@hunter.cuny.edu)

**DON'T WAIT UNTIL IT'S TOO LATE!**

***Academic Integrity:** Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.*

***Disability:** In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical and/or Learning) consult the Office of AccessABILITY located in Room 1214B Hunter East to secure necessary academic accommodations. For further information and assistance please call (212- 772-4857)/TTY (212-650-3230).*

***Hunter College Policy on Sexual Misconduct:** "In compliance with the CUNY Policy on Sexual Misconduct, Hunter College reaffirms the prohibition of any sexual misconduct, which includes sexual violence, sexual harassment, and gender-based harassment retaliation against students, employees, or visitors, as well as certain intimate relationships. Students who have experienced any form of sexual violence on or off campus (including CUNY-sponsored trips and events) are entitled to the rights outlined in the Bill of Rights for Hunter College.*

*a. Sexual Violence: Students are strongly encouraged to immediately report the incident by calling 911, contacting NYPD Special Victims Division Hotline (646-610-7272) or their local police precinct, or contacting the College's Public Safety Office (212-772-4444).*

*b. All Other Forms of Sexual Misconduct: Students are also encouraged to contact the College's Title IX Campus Coordinator, Dean John Rose ([jtrose@hunter.cuny.edu](mailto:jtrose@hunter.cuny.edu) or 212-650-3262) or Colleen Barry ([colleen.barry@hunter.cuny.edu](mailto:colleen.barry@hunter.cuny.edu) or 212-772-4534) and seek complimentary services through the Counseling and Wellness Services Office, Hunter East 1123.*

*CUNY Policy on Sexual Misconduct Link: <http://www.cuny.edu/about/administration/offices/la/Policy-on-SexualMisconduct-12-1-14-with-links.pdf>*

**Note: I reserve the right to adjust this syllabus as required to address the needs of the class.**

**Important Dates:**

02/12/2021 Friday: College Closed

02/15/2021 Monday: College Closed

03/27/2021 – 04/04/2021 Saturday – Sunday: Spring Recess

05/17/2021 Monday: Last day to withdraw from course with a grade of W

## Topics:

### 1. MATRICES AND SYSTEMS OF EQUATIONS

- System of linear equations
- Row echelon form
- Matrix algebra
- Elementary matrices

### 2. DETERMINANTS

- The determinant of a matrix
- Properties of determinants

### 3. VECTOR SPACES

- Definition and examples
- Subspaces
- Linear independence
- Basis and dimension

### 4. LINEAR TRANSFORMATIONS

- Definition and examples

### 5. ORTHOGONALITY

- The scalar product in  $\mathbb{R}^n$ ; cross product

### 6. EIGENVALUES

- Eigenvalues of a square matrix. The characteristic polynomial and the characteristic equation. Eigenvectors; Finding the eigenvalues and the corresponding eigenvectors of a matrix.

### 7. ADDITIONAL (TIME PERMITTING)

- Least Squares Problem
- Change of Basis