

MA 405 - 002. Introduction to Linear Algebra and Matrices

Instructor:	Catie Acitelli (she/her/hers)
Email:	cbacitel@ncsu.edu
Lectures:	online synchronous; available on the course Moodle page
Office Hours:	Tuesdays and Thursdays from 11am-12pm (or by appointment) Zoom link: https://go.ncsu.edu/ma405officehours
Teaching Assistant:	Michelle Pace (she/her/hers)
Email:	bmmurphy@ncsu.edu
Office Hours:	Fridays from 2pm-3pm (or by appointment) Zoom link: https://go.ncsu.edu/ma405_michelle

Course Text

There is no required textbook for this course. However, there are several good resource textbooks available through the NC State Libraries, some of which are listed below. Others are listed on the course Moodle page. Each lesson will be accompanied by a textbook resource.

1. Nair M.T., Singh A. (2018) Linear Algebra. Springer
2. Olver P.J., Shakiban C. (2018) Applied Linear Algebra. Undergraduate Texts in Mathematics. Springer
3. Said-Houari B. (2017) Linear Algebra. Compact Textbooks in Mathematics. Birkhäuser
4. Axler S. (2015) Linear Algebra Done Right. Undergraduate Texts in Mathematics. Springer
5. Chahal, J. (2019). Fundamentals of Linear Algebra. New York: Chapman and Hall/CRC

Catalog Description

Prerequisite: MA 241, (recommended: MA225)

Co-requisite: MA 242

This course offers a rigorous treatment of linear algebra, including systems of linear equations, matrices, determinants, abstract vector spaces, bases, linear independence, spanning sets, linear transformations, eigenvalues and eigenvectors, similarity, inner product spaces, orthogonality and orthogonal bases, and factorization of matrices. Compared with MA 305 (Introductory Linear Algebra), more emphasis is placed on theory and proofs. MA 225 is recommended as a prerequisite. Credit is not allowed for both MA 305 and MA 405.

Course overview

Linear Algebra provides one of the cornerstones for much of modern Mathematics and has important applications in Physics, Engineering, and Economics. The main purposes of this course are to introduce the basic concepts from linear algebra, explain the underlying theory and computational techniques, and study how these concepts and results can be productively used in other areas of mathematics and physical sciences, especially in applied mathematics where multivariable models are involved. The subject involves a mix of practical and theoretical and will serve as a good introduction to mathematical proofs. For this reason, the course is considered to be a difficult one in undergraduate mathematics. Students should be prepared to invest considerable time in understanding the class material and doing homework.

Course Structure and Rules of Engagement

All course learning materials and resources are housed in Moodle: <http://wolfware.ncsu.edu/>. Attendance at Zoom lectures is expected and necessary. While not mandatory, it is encouraged that you attend lecture with your video on. This helps me respond to non-verbal cues to modify the lesson. All lectures will be recorded and made available on our Moodle page, along with PDF copies of the course notes. The posted recordings will show only the shared screen.

I will also have office hours via Zoom on Tuesdays and Thursdays from 11:00AM - 12:00PM (or by appointment). These are optional, but they are a good place to get your questions answered. If you plan on attending, please join the call with audio and video within the first 15 minutes. If no students have shown up by 11:15AM without communicating ahead of time, I will end the office hours. The same 15-minute rule applies to Michelle's office hours as well.

Course Delivery and COVID-19:

The situation regarding COVID-19 is frequently changing. Regardless of the online delivery method of the course, we (instructor and students) should all strive to provide a high-quality teaching and learning experience.

Learning Objectives

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

1. **Use Mathematical Notation and Terminology.** Students will demonstrate mastery in the correct use of mathematical notation, terminology, definitions, and interpretations.
2. **Understand and Describe the Fundamental Concepts of Linear Algebra.** Students will identify and apply theorems about abstract vector spaces and linear transformations to gain a clear understanding of basic concepts, including linear independence, spanning sets, bases, similarity, eigenvalues, and eigenvectors.
3. **Identify and Utilize Linear Algebra Tools.** Students will be able to apply course techniques and procedures to solve problems. Students will master various techniques for solving linear systems, compute determinants and inverses of square matrices, compute various factorizations of matrices, apply the Gram-Schmidt process, and calculate the characteristic equation of a matrix to determine eigenvalues and eigenvectors. Moreover, students will identify vector spaces, analyze differences among spanning sets and bases, and develop proof strategies for specific problems.
4. **Develop Cognitive Skills.** Students will demonstrate the ability to reason with abstract linear algebra concepts by reading and comprehending mathematical arguments via direct and indirect proof, case analysis, and mathematical induction. Students will develop familiarity with the axiomatic approach in mathematics through the study of vector spaces and linear transformations. Students will be proficient in manipulating linear algebra concepts and in analyzing and evaluating applicability in future studies.

Grading Policy

Your final grade in this course will be determined by short weekly quizzes, homework assignments, three 50-minute tests, and the final exam, weighted as follows:

Weekly Quizzes	5%
Homework	20%
Three 50-minute Tests	45 %
February 15, March 12, and April 19	
Final Exam	30%
May 7, 12 – 2 : 30PM	

Grading Scale		
$97 \leq A+ \leq 100$	$93 \leq A < 97$	$90 \leq A- < 93$
$87 \leq B+ < 90$	$83 \leq B < 87$	$80 \leq B- < 83$
$77 \leq C+ < 80$	$73 \leq C < 77$	$70 \leq C- < 73$
$67 \leq D+ < 70$	$63 \leq D < 67$	$60 \leq D- < 63$
	$F < 60$	

Note: I do not round final averages or curve grades in this course. It is theoretically possible for everyone in the class to get an A (or an F). A student's performance does not depend on anyone that of any other student. While it is in everyone's best interest to help classmates, students must abide by the university's academic integrity policy.

Testing

Testing will be done on Gradescope, accessible via Moodle. Procedural details about the tests will be made available in Moodle. The three tests will be 50–minutes apiece, and you will be able to take them during a prescribed time window (the dates above are *tentative*). The final exam is 2.5 hours long and will be set up in a similar way. The Moodle site will have guidance regarding the material covered on each tests. The final exam is mandatory and cumulative.

Homework Assignments and Weekly Quizzes

Homework will be submitted using an Internet-based homework service called WeBWorK. There are ten homework assignments throughout the semester. The lowest two homework grades will be dropped. Use these drops wisely. The links to the homework assignments are available in Moodle. You will also have weekly quizzes, due via Moodle each Sunday at 11:59PM. Quizzes are short (2-5 questions) and open-note. You may take each quiz twice.

Corrections to Grading

If you believe a grading error has been made on your test, write a statement making your case, and email it to me within *1 week of getting your test back*.

Attendance

Students are expected to attend Zoom lectures. Students are responsible for keeping up with their work so that they do not fall behind. While students are encouraged to ask questions in office hours, these office hours will not be utilized to re-teach material presented in course videos.

Make-Up Policy

Late assignments and make-up work will only be allowed for excused absences. These include university duties or trips (certified by an appropriate faculty or staff member), required court attendance (certified by the Clerk of Court), or religious observances (certified by the Department of Parent and Family Services 515-2441). Notify me via email *prior* to an anticipated excused absence. In the event of an unanticipated absence, such as a medical emergency, contact the instructor within a week of returning to class. Complete attendance and excused absence policies are available at <https://policies.ncsu.edu/regulation/reg-02-20-03-attendance-regulations/>.

Instructor's Commitment

You can expect your instructor to be courteous, punctual, well organized, and prepared for class activities; to answer questions clearly and in a non-negative fashion; to be available during office hours or, if unable, to notify students beforehand; and to grade fairly and consistently.

Grading/Scheduling Changing Options Related to COVID-19

Undergraduate students have the option to make changes to their enrollment status. In particular, if the delivery mode has a negative impact on academic performance, students should consult the following resources: Enhanced Satisfactory/ Unsatisfactory Grading policy and Enhanced Late Drop Option. The late drop date for the Spring 2021 semester is May 24, 2021.

If students select the enhanced S/U grading option, they will still need to complete the course and receive at least a C- to pass the course. An alternate option could be to request an incomplete in the course. Prior to using any of these tools, please discuss the options with the instructor and an academic advisor.

Auditing the Course

To audit the course, a student must have the approval of their advisor and the Mathematics Department. In order to receive an AU, the student must attend the majority of the sessions, submit all of the homework, and take all of the tests. See: <https://policies.ncsu.edu/regulation/reg-02-20-04/>.

Incomplete Grades

Incomplete Grades will be handled on an individual basis. If an extended deadline is not authorized by an instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) the end of 12 months if the student is not enrolled, whichever is shorter. See: <https://policies.ncsu.edu/regulation/reg-02-50-03/>.

COVID-19 Related Absences

If a student needs to miss coursework because they have been advised that they may have been exposed to COVID-19 or have a personal/family situation related to COVID-19 that prevents them from doing their work, they should contact the instructor to devise a plan. COVID 19-related absences will be considered excused, and no additional documentation is required.

Academic Integrity Statement and Academic Dishonesty

Both faculty and students at North Carolina State University have a responsibility to maintain academic integrity. Students are required to comply with the university policy on academic integrity/honesty found in the Code of Student Conduct: <https://policies.ncsu.edu/policy/pol-11-35-01/>. A student's signature on any test or assignment means that they have adhered to the Pack Pledge:

“Academic dishonesty is the giving, taking, or presenting of information or material by a student that unethically or fraudulently aids oneself or another on any work which is to be considered in the determination of a grade or the completion of academic requirements or the enhancement of that student's record or academic career.” (NCSU Code of Student Conduct)

Scholarly activity is marked by honesty, fairness, and rigor. A scholar does not take credit for the work of others, does not take unfair advantage of others, and does not perform acts that frustrate the scholarly efforts of others. The violation of any of these principles is academic dishonesty. Penalties for a violation: For the first violation, the student will receive a zero for their work and will be put on academic integrity probation for the remainder of their stay at NCSU. The second violation may result in the student's suspension from NCSU. Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02).

Electronically-hosted Components

See the relevant technology requirements (Zoom, WeBWorK) provided in Moodle. Please be advised that students may disclose personally identifiable information to other students in the course, via electronic tools like email or web-postings. Examples include online discussions of class topics and posting of student coursework. All students are expected to respect the privacy of others by not sharing or using such information outside the course. Please be advised that this course is being recorded for current and potential future educational purposes. By your continued participation in this recorded course, you are providing your permission to be recorded.

Accommodations for Students with Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. To take advantage of available accommodations, students must register with the Disability Resource Office at Holmes Hall, Suite 304, 2751 Cates Avenue, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.01).

Non-Discrimination Policy

NC State engages in equal opportunity and affirmative action efforts and prohibits discrimination, harassment and retaliation, as defined by NC State's Equal Opportunity and Non-Discrimination Policy (POL 04.25.05). NC State will promptly, thoroughly and impartially respond to all complaints of Discrimination, Harassment and Retaliation. Any individual with a complaint of Discrimination, Harassment or Retaliation should follow NC State's Discrimination, Harassment and Retaliation Complaint Procedure (REG 04.25.02). Substantiated instances of Discrimination, Harassment and Retaliation, as defined in the policy, are violations of the policy and will not be tolerated by NC State.

Health and Well-Being Resources

These are difficult times, and academic and personal stress are natural results. Everyone is encouraged to take care of themselves and their peers. If you need additional support, there are many resources on campus to help you:

- NCSU Counseling Center
- Student Health Center
- NC State CARES Team: As members of the NC State Wolfpack community, we each share a personal responsibility to express concern for one another and to ensure that our campus remains a healthy and safe environment for learning. You may occasionally come across a classmate whose personal behavior concerns or worries you, for the well-being of you, your classmates, or others. When this is the case, I encourage you to report the behavior to the NC State CARES team: Share a Concern.
- If you or someone you know are experiencing food, housing, or financial insecurity, please see the Pack Essentials Program.

Additional COVID-19 Information

Due to the Coronavirus pandemic, public health measures have been implemented across campus. You should stay current with these practices and expectations listed on the Protect the Pack site <https://www.ncsu.edu/coronavirus/>.

NC State is most concerned about your health and the health of the students, faculty, and staff across campus. If you test positive for COVID-19, or are told by a healthcare provider that you are presumed positive for the virus, please follow university guidelines, including self-reporting: Coronavirus Self Reporting. Self-reporting is not only to help provide support to you, but also to assist in contact tracing for containing the spread of the virus.

Community Standards Related to COVID-19

We are all responsible for protecting ourselves and our community. Please see the Community Standards and Rule 04.21.01 regarding Personal Safety Requirements Related to COVID-19.

NC State Rules and Regulations

Students are responsible for reviewing the NC State University Policies, Rules, and Regulations (PRRs) which pertain to their course rights and responsibilities, including those referenced both below and above in this syllabus:

- Equal Opportunity and Non-Discrimination Policy Statement and additional references
- Code of Student Conduct

Course Evaluations

Online class evaluations will be available for students to complete during the last three weeks of classes. You will receive an email message directing you to a website where you can login using your Unity ID and complete the evaluation. All evaluations are confidential; instructors will not know how any one student responded to any question, and students will not know the ratings for any instructors. Course evaluations inform my teaching for semesters to come. Please take the time to fill these out honestly and completely.

Other Remarks

- All course communications will be sent via the Moodle announcement forum to your official NCSU email. Check Moodle regularly.
- When emailing the instructor, include the course number in the subject and your name in the email.
- If office hours are not convenient for you, please email the instructor to set up a one-on-one Zoom call.
- Test and homework grades will be recorded in the Moodle gradebook. Please notify the instructor immediately of any discrepancies.
- Reserve the test dates on your calendar *now*, and do not schedule dental/doctor/interview/etc. appointments on top of the test dates.
- Be respectful to your peers and to your instructor.
- This syllabus is subject to change. Last updated January 19, 2021.