

Course Syllabus

MAT 513 - Linear Algebra

Spring 2024

Lecture Meeting: T 4:25 PM - 7:10 PM, 25 University Ave. 125

Professor: Dr. Jeremy Brazas

Office: 25 University Ave. Room 111

Office Hours:

MW 1:00 PM - 3:00 PM

F 12:00 PM - 1:00 PM

or by appointment (for instance, if you work during the day and cannot make regular office hours). Note that Zoom is a possibility for appointment meetings.

Office Telephone: 610-436-2054

Public Safety: 610-436-3311

email: jbrazas@wcupa.edu (*this is, generally, the most effective way to contact me*)

Textbook: *A Second Course in Linear Algebra, 2nd Edition*, by S.R. Garcia, R.A. Horn. Cambridge University Press 2019. (ISBN: 9781108837101)

Laptop: We will often make computations using software. While many programs have linear algebra capabilities, we will be using Mathematica, which has a huge number of built-in commands. WCU students have access to Mathematica Desktop and also can using Mathematica via RamCloud. For instance, see:
<https://www.wcupa.edu/infoServices/mathematica.aspx>

Prerequisites: There are no official prerequisites; however, it will be assumed that you have taken an undergraduate linear algebra course.

D2L: Course-related materials and grades will be posted throughout the semester on [Desire2Learn](#)

Course Outline: This is intended as a second course in linear algebra. Topics covered include:

1. Real and complex vector spaces, matrices, and linear transformations
2. Inner product spaces, orthonormal vectors
3. Eigenvalues and eigenvectors
4. Unitary and Normal Matrices
5. Decompositions of matrices such as LU-Factorization, QR-Factorization, Diagonalization, and Singular Value Decomposition.
6. A variety of applications

Program Goals and Learning Outcomes (PSLO): This course will assess the following program goals and program student learning outcomes for the MA in Mathematics Degree.

Program Goal 1: Acquire a core of mathematical knowledge in linear and abstract algebra

PSLO 1a: identify fundamental algebraic structures, including groups, rings, fields, and vector spaces;

PSLO 1a: construct proofs of algebraic results;

PSLO 1b: solve problems by manipulating abstract definitions and theorems;

PSLO 1c: investigate the mathematical applications of algebra;

PSLO 1d: explain algebraic concepts orally and in writing.

Program Goal 4: Apply technology effectively to solve mathematical problems

PSLO 4a: utilize computers for the solution, visualization, and analysis of theoretical and applied mathematics problems;

Course Student Learning Outcomes (CSLO): Upon completion of this course, students will:

1. identify fundamental algebraic structures, including vector spaces and linear transformations;
2. construct proofs of results in linear algebra;
3. solve problems by manipulating abstract definitions and theorems;
4. investigate the mathematical applications of linear algebra;
5. explain algebraic concepts orally and in writing;
6. utilize computers for the solution, visualization, and analysis of theoretical and applied mathematics problems.

Evaluation: Student learning outcomes will be assessed through graded homework assignments and 3 exams (see the table below). Your grade will be determined (**as a weighted average**) by your performance on these assessments.

%	Component	Week	PSLO	CSLO
20 %	Exam 1	Week 5	(1a)-(1d), (4a)	(1)-(4),(6)
20 %	Exam 2	Week 10	(1b)-(1e), (4a)	(2)-(6)
20 %	Exam 3	Finals week	(1a)-(1e), (4a)	(1)-(6)
40 %	Written Homework	bi-weekly	(1a)-(1e), (4a)	(1)-(6)

Once your numerical grade is computed, your letter grade will be assigned according to the following breakdown:

92.5-100.0 %	A	72.5-76.4 %	C
89.5-92.4 %	A-	69.5-72.4 %	C-
86.5-89.4 %	B+	0.0-69.4 %	F
82.5-86.4 %	B		
79.5-82.4 %	B-		
76.5-79.4 %	C+		

Written Homework Assignments: It can be difficult to feel comfortable with an area of mathematics without exploring a variety of examples. To this end, homework will be assigned regularly and scored out of 100 points. Typically, the option to complete some corrections to certain homework problems may be possible upon request. Homework corrections must be turned in with a brief reflection describing what went wrong the first time and what you learned from doing it again.

Class cancellation policy: If a class must be canceled, you will be informed at a prior class meeting.

Make-up Policy: Make-up exams will be granted only for excused absences accompanied with documentation, e.g. a doctor's note, police report, etc. In order to be approved for a make-up quiz or exam, you must notify me prior to the start of that assessment. Exceptions to this policy only occur in special, emergency circumstances. The University has a support system if you miss more than three days of classes due to an illness, personal/family emergency. In such a situation, you may be asked to fill out an absence form through [student services](#).

Attendance Policy: Attendance is not a graded part of this course but, since this is an in-person class, good attendance is vital to successfully completing the course. If you miss a class, you are still responsible for all material covered during that class period, any assessments given, and any announcements made. You are welcome to come to office hours with questions about something you missed, but lectures cannot be repeated during office hours.

Tentative Course Outline

Week	Topic	Assignments & Reading
1	Matrices, Vectors, Syst. of Linear Eq.	Chp. 0
2	Fields, Vectors spaces, Subspaces, Linear ind.	Chp. 1
3	Basis and Linear Transformations	Chp. 2
4	Block Matrices, Cramer's Rule	Chp. 3
5	Exam 1	Exam 1 Take-home
6	Inner Products, Gram-Schmidt, Reisz Rep.	Chp. 4-5
7	Unitary Matrices, QR Fact.	Chp. 6
8	Orthogonal Compl., Approx. & Least Squares	Chp. 7
9	Eigenvalues, Eigenvectors, Eigenspace	Chp. 8
10	Exam 2	Exam 2 Take-home
11	Char. Polynomial and Diagonalization	Chp. 9
12	Unitary Triangularization	Chp. 10
13	Normal Matrices and the Spectral Theorem	Chp. 12
14	Singular Value Decomposition	Chp. 14

As time permits, we will look at a variety of applications and other special topics such as Jordan Canonical Form and Positive Semidefinite Matrices.

University Policies

Academic Integrity & Personal Integrity: It is the responsibility of each student to adhere to the university's standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which means copying any part of another's work and/or using ideas of another and presenting them as one's own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in the automatic failure and removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the Department Graduate Handbook, the Graduate Catalog, the Ram's Eye View, and the University website at www.wcupa.edu

Accommodations for students with disabilities: West Chester University is committed to providing equitable access to the full WCU experience for Golden Rams of all abilities. Students should contact the [Office of Educational Accessibility \(OEA\)](#) to establish accommodations if they have had accommodations in the past or if they believe they may be eligible for accommodations due to a disability, whether or not it may be readily apparent. There is no deadline for disclosing to OEA or for requesting to use approved accommodations in a given course. However, accommodations can only be applied to future assignments or exams; that is, they can't be applied retroactively. Please share your letter from OEA as soon as possible so that we can discuss accommodations. If you have concerns related to disability discrimination, please contact the university's ADA Coordinator in the [Office of Diversity, Equity, and Inclusion](#) or 610-436-2433.

Excused absences policy: Students are advised to carefully read and comply with the excused absences policy, including absences for university-sanctioned events, contained in the WCU Graduate Catalog. In particular, please note that the "responsibility for meeting academic requirements rests with the student," that this policy does not excuse students from completing required academic work, and that professors can require a "fair alternative" to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

Inclusive Learning Environment and Anti-Racist Statement: Diversity, equity, and inclusion are central to West Chester University's mission as reflected in our [Mission Statement](#), [Values Statement](#), [Vision Statement](#), and [Strategic Plan: Pathways to Student Success](#). We disavow racism and all actions that silence, threaten, or degrade historically marginalized groups in the U.S. We acknowledge that all members of this learning community may experience harm stemming from forms of oppression including but not limited to classism, ableism, heterosexism, sexism, Islamophobia, anti-Semitism, and xenophobia, and recognize that these forms of oppression are compounded by racism.

Our core commitment as an institution of higher education shapes our expectation for behavior within this learning community, which represents diverse individual beliefs, backgrounds, and experiences. Courteous and respectful behavior, interactions, and re-

sponses are expected from all members of the University. We must work together to make this a safe and productive learning environment for everyone. Part of this work is recognizing how race and other aspects of who we are shape our beliefs and our experiences as individuals. It is not enough to condemn acts of racism. For real, sustainable change, we must stand together as a diverse coalition against racism and oppression of any form, anywhere, at any time.

Resources for education and action are available through WCU's [Office for Diversity, Equity, and Inclusion \(ODEI\)](#), DEI committees within departments or colleges, the [student ombudsperson](#), and centers on campus committed to doing this work (e.g., [Dowdy Multicultural Center](#), [Center for Women and Gender Equity](#), and the [Center for Trans and Queer Advocacy](#)). Guidance on how to report incidents of discrimination and harassment is available at the University's Office of Diversity, Equity and Inclusion.

Reporting incidents of sexual violence: West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to comply with the requirements of Title IX of the Education Amendments of 1972 and the University's commitment to offering supportive measures in accordance with the new regulations issued under Title IX, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the University Protection of Minors Policy. Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at: [The sexual misconduct reporting page](#).

Emergency Preparedness: All students are encouraged to sign up for the University's free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone. For more information, visit www.wcupa.edu/wcualert. To report an emergency, call the Department of Public Safety at 610-436-3311.

Electronic Mail Policy: It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.