MATH 3203, Spring 2023
Matrix Methods

Instructor Information	
Professor:	Dr. Stephen Graves
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The preferred method of contact is via Canvas.
uttyler.instructure.com

Class Meeting Times

Section	Days	Times	Location
001	MoWe	09:05 – 10:00	RBN 4032

Office Hours

MoWeFr 10:15 — 11:15 RBN 4011
Otherwise by scheduled appointment.

1. Course Information

1.1. **Official Course Description.** Matrices and matrix algebra, determinants, systems of linear equations, Gaussian elimination, eigenvalues and eigenvectors, linear transformation, applications in science and engineering.

1.2. **Course Prerequisites.** A grade of C or better in Math 2413.

1.3. **Important Dates from Academic Calendar.**

Date	Important Event	
9 Jan.	First day of classes	
16 Jan.	*Martin Luther King, Jr. Day*	*(No classes)*
23 Jan.	Census date	
13 – 18 Mar.	Spring break	*(No classes)*
23 Mar.	Withdrawal deadline	
24 – 29 Apr.	*Finals week*	*(No classes)*

2. Course Content

2.1. **Textbook.** The primary textbook will be the source of lecture notes and homework problems; the others are provided so you can have an additional explanation of topics if you need them.

Primary: *Linear Algebra with Applications*[1]
by W. Keith Nicholson[2]

Reference: *Fundamentals of Matrix Algebra*[3]
by Gregory Hartman[4]

Reference: *Linear Algebra*[5]
by Jim Hefferon[6]

Reference: *Introduction to Applied Linear Algebra - Vectors, Matrices, and Least Squares*[7]
by Stephen Boyd[8] and Lieven Vandenberghe[9]

Reference: *Linear Algebra*[10]
by David Cherney, Tom Denton, Rohit Thomas[11], and Andrew Waldron[12].

Recommended: *The 5 Elements of Effective Thinking*
by Edward Burger and Michael Starbird
ISBN 978-0691156668
This inexpensive book can totally change how you view learning and I recommend it to anyone who thinks they might struggle with course material, whether or not they're in my classes.

2.2. **Student Learning Outcomes.** Students should be able to successfully:

- Perform basic matrix operations including row reduction, transpose, finding the inverse and finding the determinant.
- Perform basic matrix operations including row reduction, transpose, finding the inverse and finding the determinant.
- Solve systems of linear equations using substitution, Gauss-Jordan elimination, Cramer's rule and inverse matrices.
- Find eigenvalues and eigenvectors as well as understanding their properties and importance to matrix theory and applications.
- Understand the basic properties of Euclidean space including linear independence, dimension, rank, orthogonality, norm and projection.

3. Course Policies

3.1. **Academic Honesty.** *All work submitted must be your own*. If this is determined not to be the case, you will be referred to the Director of Judicial Affairs, with a consequence appropriate to the level of the infraction. You will be reminded of the UT Tyler Honor Code on every exam.

Submitting the homework or lecture notes of another student is **plagiarism** and will result in an earned grade of 0 **for the category**, not just the assignment. Cheating on an exam will result in an F for the **course**. Posting copyrighted material to the internet without the prior written permission of the copyright holder is **illegal**.

3.2. **Civil Environment.** The free exchange of ideas is a central part of a university education. Class will be conducted in a polite and professional manner and I expect students to behave politely and professionally. *Disruptive behavior will not be allowed and is judged at my sole discretion*. Persistent incivility will result in your removal from the classroom.

3.3. **Canvas & Email.** You are expected to check Canvas at least daily, and also expected to check your university email. **All at-home work will be submitted via Canvas**.

3.4. **Personal Electronics.** Students are required to have access to a device capable of accessing Canvas and a device capable of scanning hand-written work for upload to Canvas. **Graphing calculators are not permitted in this class.** You are expected to keep all personal electronics (phones, laptops, tablets, headsets, earpods, etc.) stowed in your bag during class *unless actively being used for class purposes*.

3.5. **Late & Missed Work.** Late work will not be accepted. Missed lecture notes and homework will count as 0s. In the event that a student misses a single in-class exam, the final exam grade will increase to cover the missing points. Students missing more than one in-class exam fail the course.

4. University Policies

The University has many policies required to be included on syllabi. As these policies can change, please find the most recent version online.[13]

5. Course Structure

The course content will be tentatively organized by week in Canvas modules; this is subject to change as our use of class time necessitates. Your grade will be calculated in **percentage points (PP)**: lecture notes (5 PP), homework (5 PP), and exams (90 PP).

5.1. **Grade Scale.** Student letter grades will be recorded based upon their earned percentage points (PP). The grade scale will be no stricter than the standard:

PP Range	$[0, 60]$	$(60, 70)$	$[70, 80)$	$[80, 90)$	$[90, \infty)$
Letter	F	D	C	B	A

5.2. **Lecture Notes, 5 PP.** Students who consistently attend class and participate by writing notes and asking questions outperform students who do not. In order to encourage attendance, you will be required to scan and upload your hand-written course notes before 23:59 on the same day as class. *When that you miss class, make sure to obtain lecture notes **from a classmate** and submit them before the deadline. Notes will not be provided by the instructor.* Each day's notes will be graded as a 0 (no meaningful notes), 1 (halfway complete and meaningful notes), or 2 (complete and meaningful notes). The notes *do not need to be an exact transcript of class to be complete*, but must contain all meaningful ideas from class.

There are 24 days for which notes can be submitted; at 2 points each that totals 48 points. Your grade x will be taken out of 40 points, and you will earn $5x/40$ PP for lecture notes.

> *Extra Credit.* If you receive $x > 40$ points from lecture notes, you will receive an additional $1/8$ PP per point above 40, for a maximum of 6 PP.
>
> This makes the formula $5 + (x - 40)/8$.

5.3. **Homework, 5 PP.** There is no practice as reliable as working homework to help you learn mathematics, so I will assign homework regularly. You are encouraged to work together and even more strongly encouraged to contact me when you struggle. Homework must be written by hand, scanned, and uploaded to Canvas before 23:59 on the due date. Homework will be graded for *completeness only*, on a similar scale as lecture notes: 0 for minimal completion, 1 for at least half completion, and 2 for full completion. A tentative homework schedule appears at the end of this syllabus.

There are 24 homework assignments. Your grade x will be taken out of 48 points, and you will earn $5x/48$ PP for homework.

5.4. **Exams, 90 PP.** There will be 3 in-class exams as well as a final exam. In-class exams dates are listed on the Schedule at the end of this syllabus and will be posted to Canvas. The Final Exam is scheduled by the University administration and happens to also fall on Tuesday. In-class exams each contribute 20 PP towards your final grade, while the final contributes 30 PP. All exams will be comprehensive, but will be skewed toward the newer material covered since the last exam.

> *Extra Credit.* A student who takes all exams and earns all nonzero scores will receive an additional 1 PP towards their grade.

5.5. **Tentative Schedule of Topics.** A tentative schedule of topics appears on the final page of the syllabus, along with the assigned homework.

Class	Date	Class Schedule	HW	Due Date
M	Jan 9	1.1 Solution to SLEs	1.1: 4, 6, 7, 9, 10, 14, 15, 19, 20	Jan 11
W	Jan 11	1.2 Gauss-Jordan Elimination	1.2: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Jan 13
M	Jan 16	**NO CLASS**		
W	Jan 18	1.2 Gauss-Jordan Elimination	1.2: 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Jan 20
M	Jan 23	1.3 Homogeneous SLEs	1.3: 2, 3, 4, 5, 7, 8; 1.4: 1, 2, 3	Jan 25
W	Jan 25	2.1 Basic Matrix Operations	1.5: 1, 2, 3, 5; 2.1: 1, 3, 5, 7, 9, 15	Jan 27
M	Jan 30	2.2 Matrix-Vector Products	1.6: 2, 3, 4; 2.1: 10, 14; 2.2: 1, 2, 3, 4, 5	Feb 1
W	Feb 1	2.2 Matrix-Vector Products	2.2: 6, 7, 8, 9, 10, 11, 12, 13, 14	Feb 3
M	Feb 6	2.3 Matrix-Matrix Products	2.3: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Feb 8
W	Feb 8	**Exam 1**		
M	Feb 13	2.3 Matrix-Matrix Products	2.3: 11, 12, 16, 17, 18, 25, 26	Feb 15
W	Feb 15	2.4 Matrix Inverses	2.4: 1, 2, 4, 6, 8, 12	Feb 17
M	Feb 20	2.5 Elementary Matrices	2.5: 2, 3, 6, 8	Feb 22
W	Feb 22	2.6 Linear Transformations	2.6: 1, 2, 3, 4, 7, 10, 12	Feb 24
M	Feb 27	3.1 Cofactor Expansion	3.1: 1, 5, 7, 10, 16, 18	Mar 1
W	Mar 1	3.2 Determinants and Inverses	3.2: 1, 2, 3, 4, 5, 6, 7, 8	Mar 3
M	Mar 6	3.3 Diagonalization and Eigenvalues	3.3: 1, 7, 8, 9, 12	Mar 8
W	Mar 8	4.1 Vectors and Lines	4.1: 1, 2, 3, 4, 10, 12, 14, 18, 22	Mar 10
M	Mar 13	**SPRING BREAK**		
W	Mar 15	**SPRING BREAK**		
M	Mar 20	**Exam 2**		
W	Mar 22	4.2 Projections and Planes	4.2: 2, 4, 8, 10, 12, 13, 14	Mar 24
M	Mar 27	4.3 More on the Cross Product	4.3: 3, 4, 5	Mar 29
W	Mar 29	4.4 Linear Operators on $\mathbb{R}^n$	4.4: 3, 4, 5, 6	Mar 31
M	Apr 3	5.1 Subspaces and Spanning	5.1: 1, 2, 3, 4, 5	Apr 5
W	Apr 5	5.2 Independence and Dimension	5.2: 1, 2, 3, 4, 6	Apr 7
M	Apr 10	5.3 Orthogonality	5.3: 1, 2, 3, 4, 5, 6	Apr 12
W	Apr 12	5.4 Matrix Rank	5.4: 1, 2, 3	Apr 14
M	Apr 17	5.5 Similarity and Diagonalization	5.5: 1, 2, 4	Apr 19
W	Apr 19	**Exam 3**		
M	Apr 24	**FINALS WEEK**		
W	Apr 26	**FINALS WEEK**		

Notes

1. https://lyryx.com/linear-algebra-applications/
2. https://contacts.ucalgary.ca/info/math/profiles/101-152962
3. https://open.umn.edu/opentextbooks/textbooks/fundamentals-of-matrix-algebra
4. https://www.vmi.edu/academics/departments/applied-mathematics/faculty-and-staff/
5. https://joshua.smcvt.edu/linearalgebra/
6. https://joshua.smcvt.edu/math/hefferon.html
7. https://web.stanford.edu/~boyd/vmls/
8. https://web.stanford.edu/~boyd/
9. http://www.seas.ucla.edu/~vandenbe/
10. https://www.math.ucdavis.edu/~linear/
11. https://www.math.ucdavis.edu/people/general-profile?fac_id=rthomas
12. https://www.math.ucdavis.edu/people/general-profile?fac_id=wally
13. Usually at https://www.uttyler.edu/academic-affairs/files/syllabuspolicy.pdf