

**SPRING 2023**

**MATH 3323 CRN 21898**

**MATRIX ALGEBRA**

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**TR 1:30 pm – 2:50 pm LART 202**

**PREREQUISITES:** MATH 1312. Students are assumed to be proficient on all prerequisites

**Office Hours:** Bell Hall 222 MTWR 12:10 – 1:00 pm or by appointment

## **COURSE DESCRIPTION / COURSE OBJECTIVES**

In this course we will discuss several topics that evolve from the solution of linear systems via matrix methods, including matrix operations, linear dependence and independence of vectors, invertible matrices, vector spaces and subspaces, basis and dimension of a vector space, orthogonal bases and the Gram-Schmidt process, linear transformations, and determinants. These fundamental techniques will then be used to study the eigenvalue and eigenvector problem for a square matrix, and the techniques developed applied in turn to the solution of the diagonalization problem for a square matrix.

A common thread through these topics is the notion of the RREF (reduced row echelon form) of a matrix, a construction that can be used to answer a very wide range of questions. Deciding when and how to use this tool requires a good understanding of the algorithms that emanate from RREF. Unlike other courses, say Calculus, where the justification behind some results can be very intricate, in our case all justifications will be very accessible and require only mathematical maturity and attention to detail (hence the university junior level of the course). Computationally, all algorithms will involve only the operations of addition and multiplication of integers (with the occasional fractions). Conceptually the content will be more demanding since many new definitions and terminology will be introduced and used to verify all algorithms we use.

The emphasis will be in the application of the algorithms developed, that is, in the details of the justification and procedure that answer a question rather than just on the answer. For this reason, we will work only with relatively small matrices with nice integer entries where all necessary operations can be performed by hand without the need of any software or calculator.

At the end of the course the student will be expected to be able solve a wide range of problems by using the skills and understanding gained through the lectures to pick the correct tools, results or algorithms as developed in the course.

## **REQUIRED MATERIALS**

The course is organized by following the presentation of the material in Chapters 1, 3 and 4 of this textbook:

***Introduction to Linear Algebra, by Johnson-Riess-Arnold, Addison Wesley, Fifth Edition***  
(an earlier edition may be used but user is responsible to make up for any differences in content)

Lecture notes posted in Blackboard follow the same organization and content of the lectures; though not as complete as the textbook, the notes may be used as a summary of the textbook material and a source of further examples.

## **SUGGESTED FREE MATERIALS (see also Other Resources in Blackboard)**

**Linear Algebra, by Jim Hefferon**; free textbook with exercise answers, download at <http://joshua.smcvt.edu/linearalgebra/>

*A first course in Linear Algebra*, by Robert Beezer; free textbook, download at <http://linear.ups.edu/>

These free textbooks can be used as alternate sources of examples with solutions and practice exercises.

## **COURSE ASSIGNMENTS AND GRADING**

--Suggested homework problems for each section (not to be collected) are posted in Blackboard. **General instructions for homework can be found at the end of this Syllabus.**

--There will be three midterm exams and a comprehensive final exam.

--Partial/full credit will be given to solutions of exam problems only when procedures discussed in the lectures are used and justifications for steps are provided. For example, if a linear system is solved using the standard elimination method without taking advantage of the augmented matrix method developed in the course, the solution will receive very little or no credit. Credit may also be reduced when using incorrect notation or notation not defined in the textbook/lectures.

--**Extra credit** will be available in the form of **online quizzes (10%)** and a series of **2-3 projects (10%)** on technical skills related to quantum computing topics. Details to be provided later.

-- Midterm 1 (20%): Chapter 1 (**2/23**)

-- Midterm 2 (20%): Chapter 3 (**date 3/30**)

-- Midterm 3 (20%): Chapter 4 (**date 5/2**)

-- **The final exam (40%, on Thurs 5/11, 1:00 pm – 3:45 pm) will be comprehensive and include material from all three midterms (see [UTEP final exam calendar](#)).**

**Each midterm exam is worth 20% and the final exam is worth 40%.** Grades will be assigned as follows: A $\geq$ 90; B $\geq$ 80, C $\geq$ 70, D $\geq$ 60, F $<$ 60.

**The course grade will be the total grade obtained by combining midterms and final exam points, or a C if the total grade is  $<$  70 and the final exam grade is  $\geq$ 70.**

**A course grade of F will be assigned if the final exam is missing.**

**Academic performance on the items indicated above will be the only factor used to determine course grades.**

## COVID-19 PRECAUTIONS

For official up-to-date UTEP Covid-19 announcements and policies please visit <https://www.utep.edu/chs/shc/covid-19-information.html>

For more information about the current rates, testing, and vaccinations, please visit [epstrong.org](http://epstrong.org)

## SPECIAL DATES (see [UTEP Academic Calendar](#))

- March 13-17      Spring Break
- March 30        Drop/Withdrawal Deadline: **No drops will be authorized after this date.**
- March 31        Cesar Chavez Holiday (no classes)
- May 5            Dead Day

## COURSE COMMUNICATION

- **Office Hours**
- **Email: When e-mailing me, be sure to email from your UTEP student account and include the course number and class meeting time in the subject line.** In the body of your e-mail, clearly state your question. At the end of your e-mail include your first and last name, and your university identification number.
- **Announcements:** Check the Blackboard announcements frequently for any updates, deadlines, or other important messages.

## NETIQUETTE

As we know, sometimes communication online can be challenging. It's possible to miscommunicate what we mean or to misunderstand what our classmates mean given the lack of body language and immediate feedback. Therefore, please keep these netiquette (network etiquette) guidelines in mind. Failure to observe them may result in disciplinary action.

- Always consider audience. This is a college-level course; therefore, all communication should reflect polite consideration of other's ideas.
- Respect and courtesy must be always provided to classmates and the instructor. No harassment or inappropriate postings will be tolerated.
- When reacting to someone else's message, address the ideas, not the person. Post only what anyone would comfortably state in a face-to-face situation.
- Blackboard is not a public internet venue; all postings to it should be considered private and confidential. Whatever is posted on in these online spaces is intended for classmates and professor only. **Do not copy documents and paste them to a publicly accessible website, blog, or other space.**

## COPYRIGHT STATEMENT FOR COURSE MATERIALS

**All materials used in this course are protected by copyright law.** The course materials are only for the use of students currently enrolled in this course and only for the purpose of this course. **They may not be further disseminated.**

## ATTENDANCE AND PARTICIPATION

Attendance in the course is determined by participation in the lectures and learning activities of the course. Your participation in the course is important not only for your learning and success but also to create a community of learners. Participation is accomplished by Reading/Viewing all course materials to promote their understanding. **It is also strongly recommended attending the lectures where questions can be asked directly.**

## COURSE DROP POLICY

According to UTEP Curriculum and Classroom Policies, *“When, in the judgment of the instructor, a student has been absent to such a degree as to impair his or her status relative to credit for the course, the instructor may drop the student from the class with a grade of “W” before the course drop deadline and with a grade of “F” after the course drop deadline.”* See academic regulations in the UTEP Undergraduate Catalog for a list of excused absences. **Therefore, if I find that you are at risk of failing due to non-performance in the course, including excessive absence, neglect, or lack of effort (for example, after missing 3 quizzes or 1 midterm without communicating with the instructor and providing an academically valid excuse), I may drop you from the course.**

If you feel that you are unable to complete the course successfully, please let me know and then contact the [Registrar’s Office](#) to initiate the drop process before the drop deadline. If you do not, you are at risk of receiving an “F” for the course.

## MAKE-UP WORK

Extra credit work and the final exam cannot be made up. **Make-up midterms will be given only in the case of a documented academically valid reason.** If you miss a test and the reason is not considered excusable, you will receive a zero for the test. It is therefore important to reach out to me—in advance if possible—and explain with proper documentation why you missed a given course examination. Once a deadline has been established for make-up work, no further extensions or exceptions will be granted.

## INCOMPLETE GRADE POLICY

Incomplete grades may be requested only in exceptional circumstances after you have completed all midterm exams and before taking the final exam. Talk to me immediately if you believe an incomplete is warranted. If granted, we will establish a contract of work to be completed with deadlines.

## ACCOMMODATIONS POLICY

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University.

Students requesting an accommodation based on a disability must register with the [UTEP Center for Accommodations and Support Services](#) (CASS). Contact the Center for Accommodations and Support Services at 915-747-5148, or email them at [cass@utep.edu](mailto:cass@utep.edu), or apply for accommodations online via the [CASS portal](#).

## SCHOLASTIC INTEGRITY

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as ones' own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the [Office of Student Conduct and Conflict Resolution \(OSCCR\)](#) for possible disciplinary action. To learn more, please visit [HOOP: Student Conduct and Discipline](#).

## COURSE RESOURCES

UTEP provides a variety of student services and support:

### Technology Resources

- [Help Desk](#): Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or in person if on campus.

### Academic Resources

- [UTEP Library](#): Access a wide range of resources including online, full-text access to thousands of journals and eBooks plus reference service and librarian assistance for enrolled students.
- [Math Tutoring Center \(MaRCS\)](#): Ask a tutor for help and explore other available math resources.

### Individual Resources

- [Military Student Success Center](#): Assists personnel in any branch of service to reach their educational goals.
- [Center for Accommodations and Support Services](#): Assists students with ADA-related accommodations for coursework, housing, and internships.
- [Counseling and Psychological Services](#): Provides a variety of counseling services including individual, couples, and group sessions as well as career and disability assessments.

### Suggested homework problems instructions.

1. The textbook suggested homework problems will not be collected; the list is provided as an example of a minimal set of problems to be attempted.
2. You should aim at practicing on as many textbook exercises as possible, even those that do not appear in the list of suggested problems.
3. Work on homework exercises on your own before seeking help in solving them, otherwise you will not benefit as much from this activity.
4. Ideally, you should ask any questions about the homework problems in person, either in class or during office hours. Otherwise, after working on a problem for some time on your own, you may ask me a question via email and include a scan of your work.
5. **More solved examples and exercises can be found in the free Suggested Textbooks given in the syllabus or in Blackboard under Other Resources, as well as in the OLD quizzes with solutions.**

### Exams (midterms/final) general instructions.

1. Each midterm exam consists of 5 problems (50 points) and runs for 75 minutes. The final exam may contain 6-8 problems (60-90 points) and runs for 2 hours and 45 minutes.
2. All exam questions require detailed written solutions. Solutions to midterm exams will be posted in Blackboard.

### Extra credit Online quizzes -- general instructions.

1. The goal of the quiz problems is to help you diagnose how well you understand the relevant methods and ideas. They also provide a good idea of the type of problems that will appear in the midterms and final exam. It is therefore very important that you are well prepared before attempting each quiz.
2. Online quizzes will be posted in Blackboard and only be accessible for a certain time period (say 12-24 hours). Quizzes will also have a time limit for its completion (up to 60 minutes); once started, a quiz must be completed within the allotted time, at the end of which the quiz will automatically close. Quizzes will typically be in multiple choice format.
3. Each online quiz should be treated as an in-class quiz, except that you may consult your notes/textbook. **No collaboration with anyone (me included, as well as no online help) is allowed, and no calculator/software may be used.**
4. It is strongly suggested that quiz problems be attempted after reading each textbook section, practicing on the textbook exercises and reviewing the lecture examples and discussion.
5. As a rule of thumb, each quiz problem should be solved in 10-12 minutes once enough practice problems have been attempted successfully. Taking too long to solve a problem (15-20 mins) is an indication of a lack of preparation or insufficient proficiency on prerequisites.
6. Solutions to all quizzes and midterms will be posted in BlackBoard shortly after their deadline. It is your responsibility to compare your quiz/midterm answers with the posted solutions and make corrections when necessary, so as to not repeat any quiz mistakes on an exam.