

**SPRING 2022**

**MATH 3323 CRN 22534**

**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 that will be posted in Blackboard will also follow the same organization and content and, though not as complete as the textbook, may be used as a summary of the textbook material and a source of further examples.

## SUGGESTED FREE MATERIALS

***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 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 will also be reduced when using incorrect notation or notation not defined in the textbook/lectures.

-- Midterm 1: Chapter 1 (**date TBA**)

-- Midterm 2: Chapter 3 (**date TBA**)

-- Midterm 3: Chapter 4 (**date TBA**)

-- **The final exam on 5/12, 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 when the final exam is missing.**

**Academic performance on the items indicated above will be the only factor used to determine course grades. No extra credit work is available.**

## COPYRIGHT STATEMENT FOR COURSE MATERIALS

**All materials used in this course (Blackboard etc) 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.**

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

|                |   |
|----------------|---|
| -- March 14-18 | Spring Break (University closed)  |
| -- March 25    | Cesar Chavez Day – no classes   |
| -- April 1     | Drop/Withdrawal Deadline: <b>No drops will be authorized after this date.</b> |
| -- April 15    | Spring Study Day  |
| -- May 6       | 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.

## **ATTENDANCE AND PARTICIPATION**

Regular attendance in the course is assumed and strongly recommended, as the lectures provide the best opportunity to ask questions directly. 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.

## **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 one 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 contact the [Registrar’s Office](#) to initiate the drop process before the drop deadline; otherwise you are at risk of receiving an “F” for the course.

## **MAKE-UP WORK**

The final exam cannot be made up. Make-up midterms will be given *only* in the case of a *documented* academically valid reason. Note that make-up work may require more intensive preparation and may be graded with penalty points. If you miss a test and the reason is not considered excusable, you will receive a zero. 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 the two 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.

## **COVID-19 PRECAUTIONS**

For official and up to date UTEP Covid-19 announcements and policies please visit <https://www.utep.edu/resuming-campus-operations/guidance/index.html>

Please stay home if you have been diagnosed with COVID-19 or are experiencing COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodations. If you have tested positive for COVID-19, you are encouraged to report your results to [covidaction@utep.edu](mailto:covidaction@utep.edu), so that the Dean of Students Office can provide you with support and help with communication with your professors. The Student Health Center is equipped to provide COVID 19 testing.

The Center for Disease Control and Prevention recommends that people in areas of substantial or high COVID-19 transmission wear face masks when indoors in groups of people. The best way that Miners can take care of Miners is to get the vaccine. If you still need the vaccine, it is widely available in the El Paso area, and will be available at no charge on campus during the first week of classes. For more information about the current rates, testing, and vaccinations, please visit [epstrong.org](http://epstrong.org)

## **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 60-70 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.