

Syllabus

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|-------------|------------------------------------|------------|--------------------------|
| Title | Linear Algebra | Instructor | David Milovich |
| Number | MATH 5306-160 | Email | david.milovich@tamiu.edu |
| Time | TR 6:00–7:15 | Phone | (956) 326-2570 |
| Term | Fall 2017 | Mailbox | LBV 312 |
| Department | Mathematics and Physics | Office | LBV 321 |
| College | Arts and Sciences | Hours | MW 1–3, TR 1–5 |
| Institution | Texas A&M International University | | |

Course description. Topics include: Canonical structure theorems, diagonalization, the spectral theorem, inner-product spaces, and their applications and extensions. Prerequisite: Graduate standing and permission of instructor.

Student learning outcomes. Upon successful completion of this course, the student will be able to:

- recognize, state, and use the definition of terminology, e.g. vector space, inner product space;
- recognize, distinguish and classify linear algebraic substructures, e.g. vector spaces, inner product spaces;
- analyze written proof to problems and theorems in Linear Algebra, e.g. spectral mapping theorem for linear transformations;
- compose written proof to problems and theorems in Linear Algebra, e.g. whether a linear operator is diagonalizable or not; and
- demonstrate the ability to do independent learning and problem solving.

Textbook. Sheldon Axler, *Linear Algebra Done Right*, 3rd edition (2015), Springer, 978-3-319-11079-0. (The 3rd ed. is significantly different from the previous ones.) Read the assigned sections of the book *before* they are discussed in class. (See the schedule below.) Bring your textbook to class, where we will discuss the readings and work through some exercises.

Exams. The exams will be closed-note, and closed-book. Laptops, phones, tablets, are not allowed. Calculators are not needed. The exams will consist of problems selected from homework problems and in-class problems.

Homework. I will assign written homework progressively, a few problems a day, usually exercises selected from the textbook. Until the last class day, there are no due dates. Yet, it is to your advantage to submit a solution sooner so that you have more time to get feedback from me and to eventually find a correct solution before that problem's section is covered on an exam. (If after four class days you have not submitted a solution for a problem, I may put an F in the gradebook, but that F will be revised if you later submit a solution.) I will be happy to help you with your homework in my office or over email, but I will not distribute homework solutions to the class.

After I return your work with grades and comments, you have up to four class days to submit revisions for some or all of the exercises. This revision cycle may be repeated indefinitely up to the last class day. Only the grade for the last version will count.

Grading. I assign a letter grade, which may include a +/- modifier, to each assignment/test. Roughly speaking, an A corresponds to a correct and complete solution with no errors worth mentioning; a B to a solution with minor errors or omissions; a C to a solution with major progress in the right direction, but with major errors or omissions; a D to a solution with only minor progress in the right direction; an F to a solution with no progress in the right direction.

Overall grade. Assignment and test grades will be converted to GPA scores and then averaged according to the following weights: Homework 40%; exams: 60%. $A, B, C, D, F = 4, 3, 2, 1, 0$; $\pm = \pm 0.3$. The final

grade reported to the registrar, which does not include \pm , is computed by rounding the overall average GPA score to the nearest integer. For example, a 3.7 homework average and a 3.3 exam average would correspond to a 3.46 overall average which, being closer to 3 than to 4, would be reported as a B to the registrar.

Make-ups. See the Student Handbook and the attached Policies of the College of Arts and Sciences for rules about make-ups. I promise no make-ups beyond those promised there. Generally speaking, you should have a good excuse.

| day | date | Readings | tentatively scheduled topics |
|-----|---------------|----------|---|
| 1 | Aug 22 | 1.A | introduction; \mathbb{R}^n and \mathbb{C}^n |
| 2 | Aug 24 | 1.B-C | vector spaces and subspaces |
| 3 | Aug 29 | 2.A | span and independence |
| 4 | Aug 31 | 2.B | bases |
| 5 | Sep 05 | 2.C | dimension |
| 6 | Sep 07 | 3.A | spaces of linear maps |
| 7 | Sep 12 | 3.B | null spaces and ranges |
| 8 | Sep 14 | 3.C | matrices |
| 9 | Sep 19 | 3.D | invertibility; isomorphisms |
| 10 | Sep 21 | 3.D | invertibility; isomorphisms |
| 11 | Sep 26 | 3.E | product and quotient spaces |
| 12 | Sep 28 | 3.F | dual spaces |
| 13 | Oct 03 | 5.A | invariant subspaces |
| 14 | Oct 05 | 5.B | eigenvectors; upper-triangular matrices |
| 15 | Oct 10 | 5.C | eigenspaces; diagonal matrices |
| 16 | Oct 12 | 6.A | inner products; norms |
| 17 | Oct 17 | 6.B | orthonormal bases |
| 18 | Oct 19 | | midterm exam (sections 1.A--3.E) |
| 19 | Oct 24 | 6.C | orthogonal complements; optimization |
| 20 | Oct 26 | 7.A | self-adjoint and normal operators |
| 21 | Oct 31 | 7.B | The Spectral Theorem |
| 22 | Nov 02 | 7.C | positive operators and isometries |
| 23 | Nov 07 | 7.D | polar and singular value decompositions |
| 24 | Nov 09 | 8.A | generalized eigenvectors |
| 25 | Nov 14 | 8.B | more operator decompositions |
| 26 | Nov 16 | 8.C | characteristic and minimal polynomials |
| 27 | Nov 21 | | midterm exam (second try) |
| 28 | Nov 28 | 8.D | Jordan form |
| 29 | Nov 30 | 10.A-B | trace and determinant |
| | | | final exam |

Policies of the College of Arts and Sciences

(Required on all COAS Syllabi / Last Revised: August 7, 2017)

Classroom Behavior

The College of Arts and Sciences encourages classroom discussion and academic debate as an essential intellectual activity. It is essential that students learn to express and defend their beliefs, but it is also essential that they learn to listen and respond respectfully to others whose beliefs they may not share. The College will always tolerate diverse, unorthodox, and unpopular points of view, but it will not tolerate condescending or insulting remarks. When students verbally abuse or ridicule and intimidate others whose views they do not agree with, they subvert the free exchange of ideas that should characterize a university classroom. If their actions are deemed by the professor to be disruptive, they will be subject to appropriate disciplinary action, which may include being involuntarily withdrawn from the class.

Student Absences

Students are expected to attend class and to complete all assignments. It is the student's responsibility to communicate absences with his/her professor.

According to University policy, acceptable reasons for an absence, which cannot affect a student's grade, include:

- Participation in an authorized University activity.
- Death or major illness in a student's immediate family.
- Illness of a dependent family member.
- Participation in legal proceedings or administrative procedures that require a student's presence.
- Religious holy day.
- Illness that is too severe or contagious for the student to attend class.
- Required participation in military duties.
- Mandatory admission interviews for professional or graduate school which cannot be rescheduled.

The student is responsible for providing satisfactory evidence (i.e., physician note, medical release, etc.) to the faculty member within seven calendar days of his/her absence and return to class. He/she must substantiate the reason for absence. If the absence is excused, the faculty member must either provide the student with the opportunity to make up the exam or other work missed or provide a satisfactory alternative to complete the exam or other work missed within 30 calendar days from the date of absence.

Students who miss class due to a University-sponsored activity are responsible for identifying their absences to their faculty member(s) with as much advance notice as possible. If an off-campus licensed physician provides evidence of a student's illness, the written excuse, orders or documentation must contain the date and time of the doctor's appointment, the prognosis of illness, doctor's opinion and recommendations for the individual student. In addition, the notice should outline whether or not the student is able to attend class. If a physician determines that the student is not ill, he or she will not receive an excused absence. If absence is not an excused absence, the faculty member will decide whether makeup work will be allowed. In some courses, attendance and in-class participation are ongoing requirements and an integral part of the work of the course. In other courses, occasional in-class assessments may occur, sometimes without advance notice. It is the responsibility of the faculty member to inform each class at the beginning of the semester of the in-class participation expected and the effect that absences will have on the student's evaluation of work in the course.

Plagiarism and Cheating

Plagiarism is the presentation of someone else's work as your own. It occurs when you:

- 1) **Borrow** someone else's facts, ideas, or opinions and put them entirely in your own words, you must acknowledge that these thoughts are not your own by immediately citing the source in your paper. Failure to do this is plagiarism.
- 2) **Borrow** someone else's words (short phrases, clauses, or sentences), you must enclose the copied words in quotation marks as well as citing the source. Failure to do this is plagiarism.
- 3) **Present** someone else's paper or exam (stolen, borrowed, or bought) as your own, you have committed a clearly intentional form of intellectual theft and have put your academic future in jeopardy. This is the worst form of plagiarism.

Here is another explanation from the 2010, sixth edition of the *Manual of The American Psychological Association* (APA):

Plagiarism: Researchers do not claim the words and ideas of another as their own; they give credit where credit is due. Quotations marks should be used to indicate the exact words of another. *Each* time you paraphrase another author (i.e., summarize a passage or rearrange the order of a sentence and change some of the words), you need to credit the source in the text.

The key element of this principle is that authors do not present the work of another as if it were their own words. This can extend to ideas as well as written words. If authors model a study after one done by someone else, the originating author should be given credit. If the rationale for a study was suggested in the Discussion section of someone else's article, the person should be given credit. Given the free exchange of ideas, which is very important for the health of intellectual discourse, authors may not know where an idea for a study originated. If authors do know, however, they should acknowledge the source; this includes personal communications. (pp. 15-16)

Consult the Writing Center or a recommended guide to documentation and research such as the *Manual of the APA* or the *MLA Handbook for Writers of Research Papers* for guidance on proper documentation. If you still have doubts concerning proper documentation, seek advice from your instructor prior to submitting a final draft.

- **Penalties for Plagiarism:** Should a faculty member discover that a student has committed plagiarism, the student should receive a grade of 'F' in that course and the matter will be referred to the Honor Council for possible disciplinary action. The faculty member, however, may elect to give freshmen and sophomore students a "zero" for the assignment and to allow them to revise the assignment up to a grade of "F" (50%) if they believe that the student plagiarized out of ignorance or carelessness and not out of an attempt to deceive in order to earn an unmerited grade. This option should not be available to juniors, seniors, or graduate students, who cannot reasonably claim ignorance of documentation rules as an excuse.
- **Caution:** Be very careful what you upload to Turnitin or send to your professor for evaluation. Whatever you upload for evaluation will be considered your final, approved draft. If it is plagiarized, you will be held responsible. The excuse that "it was only a draft" will not be accepted.
- **Caution:** Also, do not share your electronic files with others. If you do, you are responsible for the possible consequences. If another student takes your file of a paper and changes the name to his or her name and submits it and you also submit the paper, we will hold both of you responsible for plagiarism. It is impossible for us to know with certainty who wrote the paper and who stole it. And, of course, we cannot know if there was collusion between you and the other student in the matter.
- **Penalties for Cheating:** Should a faculty member discover a student cheating on an exam or quiz or other class project, the student should receive a "zero" for the assignment and not be allowed to make the assignment up. The incident should be reported to the chair of the department and to the Honor Council. If the cheating is extensive, however, or if the assignment constitutes a major grade for the course (e.g., a final exam), or if the student has cheated in the past, the student should receive an "F" in the course, and the matter should be referred to the Honor Council. Under no circumstances should a student who deserves an "F" in the course be allowed to withdraw from the course with a "W."

- ***Student Right of Appeal:*** Faculty will notify students immediately via the student's TAMIU e-mail account that they have submitted plagiarized work. Students have the right to appeal a faculty member's charge of academic dishonesty by notifying the TAMIU Honor Council of their intent to appeal as long as the notification of appeal comes within 10 business days of the faculty member's e-mail message to the student. The *Student Handbook* provides more details.

Use of Work in Two or More Courses

You may not submit work completed in one course for a grade in a second course unless you receive explicit permission to do so by the instructor of the second course.

UConnect, TAMIU E-Mail, and Dusty Alert

Personal Announcements sent to students through TAMIU's UConnect Portal and TAMIU E-mail are the official means of communicating course and university business with students and faculty – not the U.S. Mail and no other e-mail addresses. Students and faculty must check UConnect and their TAMIU e-mail accounts regularly, if not daily. Not having seen an important TAMIU e-mail or UConnect message from a faculty member, chair, or dean is not accepted as an excuse for failure to take important action. Students, faculty, and staff are encouraged to sign-up for *Dusty Alert* (see www.tamtu.edu). *Dusty Alert* is an instant cell phone text-messaging system allowing the university to communicate immediately with you if there is an on-campus emergency, something of immediate danger to you, or a campus closing.

Copyright Restrictions

The Copyright Act of 1976 grants to copyright owners the exclusive right to reproduce their works and distribute copies of their work. Works that receive copyright protection include published works such as a textbook. Copying a textbook without permission from the owner of the copyright may constitute copyright infringement. Civil and criminal penalties may be assessed for copyright infringement. Civil penalties include damages up to \$100,000; criminal penalties include a fine up to \$250,000 and imprisonment.

Copyright laws do not allow students and professors to make photocopies of copyrighted materials, but you may copy a limited portion of a work, such an article from a journal or a chapter from a book for your own personal academic use or, in the case of a professor, for personal, limited classroom use. In general, the extent of your copying should not suggest that the purpose or the effect of your copying is to avoid paying for the materials. And, of course, you may not sell these copies for a profit. Thus, students who copy textbooks to avoid buying them or professors who provide photocopies of textbooks to enable students to save money are violating the law.

Students with Disabilities

Texas A&M International University seeks to provide reasonable accommodations for all qualified persons with disabilities. This University will adhere to all applicable federal, state, and local laws, regulations and guidelines with respect to providing reasonable accommodations as required to afford equal education opportunity. It is the student's responsibility to register with the Director of Student Counseling and to contact the faculty member in a timely fashion to arrange for suitable accommodations.

Student Attendance and Leave of Absence (LOA) Policy

As part of our efforts to assist and encourage all students towards graduation, TAMIU provides LOA's for students, including pregnant/parenting students, in accordance with the Attendance Rule (Section 3.24) and the Student LOA Rule (Section 3.25), which includes the "Leave of Absence Request" form. Both rules can be found in the TAMIU Student Handbook ([URL: http://www.tamtu.edu/studentaffairs/StudentHandbook1.shtml](http://www.tamtu.edu/studentaffairs/StudentHandbook1.shtml)).

Pregnant and Parenting Students

Under Title IX of the Education Amendments of 1972, harassment based on sex, including harassment because of pregnancy or related conditions, is prohibited. A pregnant/parenting student must be granted an absence for as long as the student's physician deems the absence medically necessary. It is a violation of Title IX to ask for documentation relative to the pregnant/parenting student's status beyond what would be required for other medical conditions. If a student would like to file a complaint for discrimination due to his or her pregnant or parenting status, please contact the TAMIU Title IX Coordinator (Lauren A. Jones, J.D., 5201 University Boulevard, KL 159B, Laredo, TX 78045, TitleIX@tamiu.edu, 956.326.2857) and/or the Office of Civil Rights (Dallas Office, U.S. Department of Education, 1999 Bryan Street, Suite 1620, Dallas, TX 75201-6810, 214.661.9600).

The University advises a pregnant or parenting student to notify his or her professor once he or she is aware that accommodations for such will be necessary. It is first recommended that the student and professor attempt to work out the reasonable accommodations with each other. The Office of Student Conduct and Community Engagement (Mayra Hernandez, MGHernandez@tamiu.edu) can assist the student and professor in working out the reasonable accommodations. In the event that a student will need a leave of absence for a substantial period of time from the University, the University urges the student to consider a Leave of Absence as outlined in the Student Handbook. As part of our efforts to assist and encourage all students towards graduation, TAMIU provides LOA's for students, including pregnant/parenting students, in accordance with the Attendance Rule and the Student LOA Rule. Both rules can be found in the TAMIU Student Handbook (<http://www.tamiu.edu/scce/studenthandbook.shtml>).

Incompletes

Students who are unable to complete a course should withdraw from the course before the final date for withdrawal and receive a "W." To qualify for an "incomplete" and thus have the opportunity to complete the course at a later date, a student must meet the following criteria:

- 1) The student must have completed 90% of the course work assigned before the final date for withdrawing from a course with a "W", and the student must be passing the course;
- 2) The student cannot complete the course because an accident, an illness, or a traumatic personal or family event occurred after the final date for withdrawal from a course;
- 3) The student must sign an "Incomplete Grade Contract" and secure signatures of approval from the professor and the college dean.
- 4) The student must agree to complete the missing course work before the end of the next long semester; failure to meet this deadline will cause the "I" to automatically be converted to an "F"; extensions to this deadline may be granted by the dean of the college.

This is the general policy regarding the circumstances under which an "incomplete" may be granted, but under exceptional circumstances, a student may receive an incomplete who does not meet all of the criteria above if the faculty member, department chair, and dean recommend it.

WIN Contracts

WIN Contracts are offered only under exceptional circumstances and are limited to seniors. Only courses offered by full-time TAMIU faculty or TAMIU instructors are eligible to be contracted for the WIN requirement. However, a WIN contract for a course taught by an adjunct may be approved, with special permission from the department chair and dean. Students must seek approval before beginning any work for the WIN Contract. No student will contract more than one course per semester. Summer WIN Contracts must continue through both summer sessions.

Student Responsibility for Dropping a Course

It is the responsibility of the STUDENT to drop the course before the final date for withdrawal from a

course. Faculty members, in fact, may not drop a student from a course without getting the approval of their department chair and dean.

Independent Study Course

Independent Study (IS) courses are offered only under exceptional circumstances. Required courses intended to build academic skills may not be taken as IS (e.g., clinical supervision and internships). No student will take more than one IS course per semester. Moreover, IS courses are limited to seniors and graduate students. Summer IS course must continue through both summer sessions.

Grade Changes & Appeals

Faculty are authorized to change final grades only when they have committed a computational error or an error in recording a grade, and they must receive the approval of their department chairs and the dean to change the grade. As part of that approval, they must attach a detailed explanation of the reason for the mistake. Only in rare cases would another reason be entertained as legitimate for a grade change. A student who is unhappy with his or her grade on an assignment must discuss the situation with the faculty member teaching the course. If students believe that they have been graded unfairly, they have the right to appeal the grade using a grade appeal process in the *Student Handbook* and the *Faculty Handbook*.

Final Examination

Final Examination must be comprehensive and must contain a written component. The written component should comprise at least 20% of the final exam grade. Exceptions to this policy must receive the approval of the department chair and the dean at the beginning of the semester.