The American University in Cairo

Linear Algebra

MACT 2132 **Course Syllabus** **Summer 2025**

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Note. *Important information such as exams dates and times, contact details of teaching assistants, and course announcements will be communicated to you via Canvas and university email.* ***So, you should check them frequently.***

Linear Algebra (MACT 2132) is an introductory course to the field of linear algebra which is concerned with systems of linear equations, matrices, vector spaces, linear transformations, and inner product spaces. The course covers the topics below.

1. Systems of linear equations
2. Matrices and their determinants
3. Vector spaces
4. Linear independence, basis, and dimension
5. Linear transformations
6. Eigenvalues and eigenvectors
7. Inner product spaces

Main Textbook
Elementary Linear Algebra, by Ron Larson, 8th edition.

Supplementary Texts

- Introduction to Linear Algebra, by Gilbert Strang.
- Linear Algebra Done Right, by Sheldon Axler.
- How to Think Like a Mathematician - A Companion to Undergraduate Mathematics, by Kevin Houston.

Grade Breakdown

Assignments	Reports	Midterm Exam	Project	Final Exam
20%	10%	30%	10%	30%

Letter Grade Conversion

F	D	D+	C-	C	C+	B-	B	B+	A-	A
0-51	52-54	55-59	60-64	65-69	70-74	75-79	80-84	85-88	89-92	93-100

Assignments: Written assignments are submitted on Canvas. A portion of the written assignment's grade is reserved for the clarity of mathematical writing. Practicing mathematics does not only involve producing correct answers and valid arguments, but also requires a clear and vivid presentation of your work. You are expected to write in complete sentences using correct spelling and punctuation marks so that the reader of your work follows easily and enjoyably.

Reports: By the end of each chapter, you are required to submit a report typed in Latex that clearly and precisely presents the main definitions of that chapter. Moreover, for each definition, you must include at least one interesting example and one interesting non-example. You may think of these examples yourself, and you may also consult an AI chatbot for assistance.

Project: It is due at the end of the semester on a topic that will be announced halfway through the semester. It must be typed in Latex and may be completed in groups of up to three students.

Exams: You must show all your work in exams. Unsupported answers will receive no credit.

Course Plan

	Topic		Topic
1	Matrix Operations	13	Linear Subspaces
2	Properties of Matrices	14	Spanning Sets & Linear Independence
3	Systems of Linear Equations	15	Basis and Dimension
4	Gauß-Jordan Method	16	Rank and Nullity of a Matrix
5	Inverse of a Matrix	17	Linear Transformations
6	Elementary Matrices	18	Matrix Representation
7	Determinant of a Matrix	19	Kernel of Linear Transformation
8	Determinants & EROs	20	Eigenvalues and Eigenvectors
9	Properties of Determinants	21	Dot Product
10	Applications of Determinants	22	Inner Product Spaces
11	n-dimensional space R^n	23	Orthonormal Bases
12	Abstract Vector Spaces		

Academic Integrity
This includes: cheating, plagiarism, fabrication, multiple submissions, obtaining unfair advantage, unauthorized access to academic or administrative systems, aiding and abetting, impersonation, threatening harm, and copyright infringement.
WARNING: *AUC has zero-tolerance for violations of the academic integrity code.*

Important Remarks
- Attend ALL lectures. Never miss a single lecture!
- Full attendance is highly appreciated.
- Late assignments are not accepted.
- Copied assignments will earn no credit and will initiate an academic integrity case.
- Makeups for missed exams will NOT be given.
- More than 6 absences may drop your grade or fail you the course.
- Be punctual. We will start on time. Do not be late to lectures please.
- Respect the lecture. Refrain from side-talking.
- Put your mobile phones on silent mode.
- Feel free to interrupt and ask questions.
- The ultimate goal of the lecture is to enrich your knowledge.

Course Outcomes: After completing this course, students will be able to:
- Apply the Gauss-Jordan algorithm to determine solutions of a given system of linear equations, in particular, to see if the system admits a unique solution.
- Calculate the determinant of a given square matrix, and conclude whether the matrix is invertible or singular.
- Decide whether a set of objects together with operations of addition and scalar multiplication constitute a vector space. If not, determine which of the vector space axioms fail.
- Describe the kernel and the image of a linear transformation between vector spaces. In particular, decide whether it is injective and surjective.
- Investigate eigenvalues and their corresponding eigenvectors of a given square matrix. In particular, conclude whether such a matrix is diagonalizable or not.
- Determine whether a given operation defines an inner product on a vector space or not. If it is, use it to compute lengths, angles, and orthogonal projections of vectors.
- Follow a proof of a theorem as well as write up proofs of theorems clearly using complete sentences.

Emotional Support - Center for Student Well-being: The Center for Student Well-Being (CSW) works to help students develop resiliency to enable them to cope with challenges on the emotional, behavioral, or cognitive levels. They offer private consultation. See https://www.aucegypt.edu/students/well-being for further information.

Office of Disabilities Services: If you are a student with a disability who requires accommodations, please contact the Office of Disabilities Services during the first few days of the semester. If you have established accommodations with Student Disability Services, please activate your accommodations via Simplicity and contact the instructor to discuss how the approved accommodations will be implemented in this course.

Do not worry about grades, enjoy linear algebra!

Daoud Siniora