AUS | الجامعة الأميركية في الشارقة American University of Sharjah

COURSE SYLLABUS

A	Course Title & Number	**Linear Algebra - MTH 221**
B	Pre/Co-requisite(s)	Prerequisite: MTH104 (Calculus II)
C	Number of credits	3-0-3
D	Faculty Name	**Ayman Badawi**
E	Term/ Year	Summer 2024

F Sections

Course	Days	Time	Location
MTH221	MTHR	12—1:45pm	Art-- Room 209
MTH221	MTWR	2—3:45	Art --room 2008

G Instructor Information

Instructor	Office	Email	Office Hours
Ayman Badawi	NAB 262	abadawi@aus.edu	**MTWR: 11:20--11:50 am** **Others by appointment, email me.**

H Course Description from Catalog

Covers systems of linear equations, algebra of matrices, linear transformations, determinants, vector spaces, inner product spaces, eigenvalues and eigenvectors, diagonalization and orthogonality, special matrices and applications.

I Course Learning Outcomes

Upon completion of the course, students will be able to:

	Learning Outcomes	Assessment Instruments
1	Find solutions of systems of linear equations using various methods.	First Exam, second exam, third exam, and the final exam
2	Evaluate determinants and use algebraic properties of matrices in computations.	First Exam, second exam, third exam, and the final exam
3	Demonstrate a thorough knowledge of vector spaces and subspaces.	First Exam, second exam, third exam, and the final exam
4	Find basis and rank for column, row and null spaces of a given matrix.	First Exam, second exam, third exam, and the final exam
5	Find eigenvalues, eigenvectors and eigenspaces of a square matrix and use them for matrix diagonalization.	First Exam, second exam, and the final exam

6	Define linear transformations and examine their properties.	First Exam second exam, and the Final Exam
7	Identify inner product spaces and use Gram-Schmidt orthogonalization process to orthogonalize a given basis.	Third exam, and the Final Exam

J Textbook and other Instructional Material and Resources

Optional: "Elementary Linear Algebra with Supplement Applications," Howard Anton and Chris Rorres, 12th Edition (any edition will do and any basic linear algebra book will do).

(**Strongly recommended**): My personal webpage is rich with a lot of material: class notes, old exams and quizzes with solutions, and links for linear algebra online calculators, http://ayman-badawi.com/MTH221.html

K Teaching and Learning Methodologies

- Ilearn is used as a core tool (posting: syllabus, handouts, review sheets for exams, solutions for quizzes and exams, grades…). Students are advised to check it on regular basis.
- Students are encouraged to seek help during office hours.

L Grading Scale, Grading Distribution, and Due Dates

Cut-off (%)	Grade Points		Cut-off (%)	Grade Points
92 ≤ A ≤ 100	4.0		73 ≤ C+ < 76.99	2.3
88 ≤ A- < 91.99	3.7		67 ≤ C < 72.99	2.0
85 ≤ B+ < 87.99	3.3		60 ≤ C- < 66.99	1.7
81 ≤ B < 84.99	3.0		40 ≤ D < 59.99	1.0
77 ≤ B- < 80.99	2.7		F < 41	0

Assessment	Weight	Due Date and Remarks
Test I	22%	Thursday June 13, in class
Test II	22%	Tuesday July 2, in class
Test III	22%	Monday, July 15, in class
Final Exam	34%	TBA
Total	100%	

Important: **It is considered an academic integrity violation to represent the output of a generative artificial intelligence tool as your own work.**

M Explanation of Assessments

- There will be three exams, and a final exam. The date and time of the final exam will be scheduled by the registrar's office.
- All exams will be held in-person on campus. No online exams will be given.
- **Make-up exams:** There will be no make-up exams. In certain cases, the instructor may give a missed assessment of the average of the other elements in that component. However, the student has to file a petition supported by evidence to the instructor. The instructor will go through all petitions, scrutinizes them and uses his/her discretion to decide.

		• **Late attendance:** Students are expected to be in class for all lectures. • **Incomplete Grades:** Failing to show up on time for the final exam will result in a zero grade in that exam. Only in exceptional cases of compelling medical or other emergencies certified by a medical or other professional and approved by the AUS Health Center, the Instructor and the Dean's Office; will the student be given an "Incomplete" grade. In this case, the instructor will schedule a make-up exam within the first two weeks of the next semester. It is the responsibility of the student to find out from his/her instructor the exact date, time and place of the make-up exam. **Final Grades:** All students are treated equally. Tests and other graded assignments due dates are set. No addendum, make-up exams, or extra assignments to improve grades will be given.
N	**Student Academic Integrity Code Statement**	All students are expected to abide by the Student Academic Integrity Code as articulated in the AUS undergraduate catalog 2023-2024.
O	**Attendance Policy**	Students in this course are required to follow the AUS Attendance Policy as outlined in the AUS Undergraduate Catalog 2022-2023.

Tentative Weekly Schedule, but not in order

Week	CHAPTER	Remarks
1	1.1: Introduction to Systems of Linear Equations 1.2: Gaussian Elimination	
2	1.3: Matrices and Matrix Operations 1.4: Inverses	
3	1.5: Finding A^{-1} 1.6: More on Linear Systems and Invertible Matrices	
4	1.7: Diagonal, Triangular, and Symmetric Matrices 2.1: Determinant by Cofactor Expansion	
5	2.2: Evaluating Determinants by Row Reduction 2.3: Properties of Determinants, Cramer's Rule 4.1: Real Vector Space	
6	4.2: Subspaces 4.3: Spanning Sets	
7	4.4: Linear Independence	
8	4.5: Coordinates and Basis 4.6: Dimension 4.7: Change of basis	
9	4.8: Row Space, Column Space, and Null Space 4.9: Rank, Nullity, and the Fundamental Matrix Spaces	
10	8.1: General Linear Transformations 8.2: Compositions and Inverse Transformations	It is enough to discuss the inverse when T is one-to-one and onto.
11	8.3: Isomorphism 8.4: Matrices for General Linear Transformation	

12 and 13	5.1: Eigenvalues and Eigenvectors 5.2: Diagonalization	
14	6.1: Inner Products 6.2: Angle and Orthogonality in Inner Product Spaces	Sections 3.1, 3.2 & 3.3 will be covered as part of chapter 6.
15	6.3: Gram-Schmidt Process	
16	Final Exams	

Suggested Problems (If you decide to use the text book)

It is highly recommended that you practice writing the full solution of these problems on your own.

Section	Problems
1.1	1,3,6,8,9,12,13,16,20, True-False
1.2	1,2,4,5,8,13,16,17,22,23,26,27,30,35, True-False
1.3	1,2,3,5,12,14,15,17,20,24,26,29, True-False
1.4	3,4,6,10,11,13,14,16,17,20,21,24,25,31,35,36,39,40,45,48, True-False
1.5	1,2,3,5,7,11,16,19,21,27, True-False
1.6	1,5,9,12,13,18,19, True-False
1.7	1,3,6,7,10,11,14,15,17,19,22,23,25,27,30,31,34, True-False
2.1	1,3,9,11,15,18,21,23,24,34,36, True-False
2.2	1,3,5,8,9,14,15,18,21,25,26,29,30, True-False
2.3	1,4,5,7,12,15,18,19,21,25,29,31,32, True-False
4.1	1,2,5,7,8,9,11,17, True-False
4.2	1,2,3,7,8,9,10,12,13, True-False
4.3	1,3,5,6,9,19, True-False
4.4	1,3,5,9,11,14,18, True-False
4.5	1,3,5,7,11,13,14,15,19, True-False
4.6	1,3,5,8,9,11,15,19 True-False
4.7	1,3,6,7,9, True-False
4.8	1,3,5,7,9,11,13,15,17,25, True-False
4.9	1,3,5,7,9,13,19,28,29,31, True-False
8.1	1,3,5,6,10,11,13,14,20,21,23,30, True-False
8.2	3,5,7,9,19,23, True-False
8.3	1,3,9,11,13,17,19, True-False
8.4	1,2,3,4,5,6,8,11, True-False
5.1	1,4,7,10,14,24,25,27,28,29,33,34,36, True-False
5.2	1,3,5,8,9,11,14,15,17,19,21,22, 28, True-False

6.1	1,3,10,12,20,21,27,28,37, True-False
6.2	1,3,6,8,10,11,17,19,26,33,36, True-False
6.3	1,3,5,10,30,38,39,43, True-False