King Fahd University of Petroleum & Minerals
Department of Mathematics
MATH 225 Syllabus
First Semester 2023-2024 (Term 231)
Instructor: Dr. Abdulaziz M. Alassaf
Office: 5 – 426
O.H.: 1:00 PM – 2:00 PM UTR
Email: alassaf@kfupm.edu.sa

Course Title: Introduction to Linear Algebra

Textbook: Linear algebra with applications, Steven J. Leon, 9th edition, Pearson

Description: Matrices and systems of linear equations. Vector spaces and subspaces. Linear independence. Basis and dimension. Inner product spaces. The Gram-Schmidt process. Linear transformations. Determinants. Diagonalization. Real quadratic forms.

Prerequisite: Math 102

Objective: This course introduces the basic concepts and techniques of elementary linear algebra

Learing Outcomes:

Upon completion of this course, students should be able to
- Solve linear systems and compute determinants and matrix inverses.
- Explain fundamental concepts such as vector spaces, subspaces, linear independence and dependence, spanning sets, bases, dimensions, and linear transformations.
- Determine matrix representations of linear transformations.
- Discuss inner product spaces and orthonormal bases.
- Apply the Gram-Schmidt process to construct orthonormal bases.
- Compute eigenvalues and eigenvectors and use them in diagonalization and in classifying real quadratic forms

Grade Distribution

Exam 1:	18%	(1.1 – 2.3, Wednesday, September 27, 2023)
Exam 2:	18%	(3.1 – 4.1, Monday, October 23, 2023)
Exam 3:	18%	(4.2 – 5.6, Wednesday, November 29, 2023)
Class work:	10%	(4 Quizzes)
Final Exam:	36%	(Comprehensive)

Cheating in Exams: Cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will be reported to the higher university administration.

Cheating in exams includes (but is not limited to):
➢ looking at the papers of other students
➢ talking to other students
➢ using mobiles or any other electronic devices.

Missing an Exam: In case a student misses an exam (Exam I, Exam II, Exam III or the Final Exam) for a legitimate reason (such as medical emergencies), he/she must bring an official excuse from Students Affairs. Otherwise, he/she will get zero in the missed exam.

Attendance: Students are expected to attend all lecture classes.

➢ If a student misses a class, he/she is responsible for any announcement made in that class.

➢ A DN grade will be awarded to any student who accumulates more than 20% (09) unexcused absences or 33% (15) excused and unexcused absences.

Note: The student will be warned **twice** before he/she is assigned a DN grade

The Usage of Mobiles in Class: Students are not allowed to use mobiles for any purpose during class time. Students who want to use electronic devices to take notes must take permission from their instructor. Violations of these rules will result in a penalty decided by the instructor.

Academic Integrity: All KFUPM policies regarding ethics apply to this course. See the Undergraduat Bulletin.

Course Plan

Week	Date	Section	Topics
1	Aug 27 - 30	1.1 1.2	Systems of linear equations Row echelon form
2	Sep 3 - 7	1.3 1.4	Matrix arithmetic Matrix algebra
3	Sep 10-14	1.5 2.1	Elementary matrices The determinant of a matrix
4	Sep 17 - 21	2.2 2.3	Properties of determinants Additional topics
Sunday, September 24, 2023: National Day Holiday		
Wednesday September 27, 2023: First Major Exam [1.1 – 2.3]		
5	Sep 25 - 28	3.1 3.2	Vector Spaces: Definitions & examples Subspaces
6	Oct 1 - 5	3.3 3.4	Linear independence Basis & dimension
7	Oct 8 - 12	3.5 3.6	Change of basis Row space & column space
8	Oct 15 - 19	4.1 4.2	Linear transformations: Definitions & examples Matrix representations of linear transformations
Monday October 23, 2023: Second Major Exam [3.1 – 4.1]		
9	Oct 22 – 26	4.3 5.1	Similarity Orthogonality: Scalar product in $\mathbb{R}^n$
10	Oct 29 - Nov 2	5.2 5.4	Orthogonal subspaces Inner product spaces
11	Nov 5 - 9	5.5	Orthonormal Sets
12	Nov 12 - 16	5.6 5.7	The Gram-Schmidt Orthogonalization Process Orthogonal Polynomials
November 19 - 23: Midterm Break		
Wednesday November 29, 2023: Third Major Exam [4.2 – 5.6]		
13	Nov 26 - 30	6.1	Eigenvalues & Eigenvectors
14	Dec 3 - 7	6.3	Diagonalization
15	Dec 10 - 14	6.6	Quadratic Forms
16	Dec 17		A Normal Sunday Classes (Review & catch-up)

Practice Problems

Section	Suggested Practice Problems
1.1	5, 6, 7, 8, 9
1.2	2, 4, 5, 6, 8, 10, 12
1.3	1, 4, 6, 7, 8, 9, 10, 11, 12, 14, 16, 18
1.4	1, 2, 3, 4, 5, 7, 8, 10, 12, 13, 14, 16, 17, 18, 20, 21, 24, 25, 26, 29
1.5	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 18, 19, 20, 21, 22, 27, 31, 32
2.1	1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 13
2.2	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 16, 17
2.3	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 15, 17
3.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16
3.2	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 24, 25
3.3	1, 2, 4, 5, 7, 8, 9, 10, 12, 13, 15, 16, 20
3.4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17
3.5	1, 2, 3, 4, 5, 6, 7, 8, 9, 11
3.6	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 15, 31, 33, 35,
4.1	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 24, 25
4.2	2, 3, 4, 7, 8, 13, 14, 15, 16, 17, 18, 19, 20
4.3	1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15,
5.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 15, 17, 18, 21
5.2	1, 2, 3, 4, 6, 7, 11, 12, 13, 14, 16, 17
5.4	1, 2, 3, 4, 7, 8, 9, 11, 15, 16, 18, 20, 23, 25, 26, 27, 29, 31, 32, 33
5.5	1, 2, 3, 4, 5, 6, 9, 21, 22, 23, 25, 27, 28, 29, 30, 32, 33, 34
5.6	1, 3, 4, 5, 6, 7, 9, 12, 14
5.7	1, 2, 3, 5, 6, 7, 9, 17
6.1	1, 2, 4, 6, 7, 9, 10, 11, 12, 31, 32, 33, 34
6.3	1, 2, 3, 4, 5, 6, 7, 9
6.6	1, 2, 3, 4, 5