

# King Fahd University of Petroleum and Minerals

Department of Mathematics and Statistics

Math 280 – Syllabus (Term 161)

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**Course:** Math 280  
**Title:** Introduction to linear algebra  
**References:** Linear algebra with applications, Steven J. Leon, Pearson (2014).  
**Objectives:** This course introduces the basic concepts and techniques of elementary linear algebra to students.

## Catalogue

### 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.

### Learning Outcomes:

Upon successful completion of this course, a student should be able to:

1. Use elementary row operations to solve systems of linear equations and decide whether a square matrix is singular or nonsingular;
2. Express a nonsingular matrix as a product of elementary matrices;
3. Evaluate the determinant of a matrix using cofactor expansion or elementary row (column) operations;
4. Find the inverse of a nonsingular matrix using its adjoint and solve some linear systems by Cramer's method;
5. Construct a basis for a given vector space and evaluate its dimension;
6. Represent a linear transformation by a matrix;
7. Construct an orthonormal basis using the Gram-Schmidt orthogonalization process;
8. Determine the eigenvalues and the eigenspaces of a square matrix;
9. Decide whether a given square matrix is diagonalizable or not;
10. Diagonalize orthogonally a real symmetric matrix;

## Grading Policy

Exam I	Materials: 1.1-3.1 Date: Sunday, October 23, 2016	Place: TBA Time: 6:30-8:30 PM	25%(100points)
Exam II	Materials: 3.2-5.2 Date : Sunday, December 4, 2016	Place: TBA Time: 6:30-8:30 PM	25%(100points)
Final	Material: Comprehensive Date: Wednesday, January 18, 2017	Place: TBA Time:7:00-10:00 PM	35%(140points)
Class Work	Class Activities: It is based on homeworks, and quizzes, or other class activities determined by the instructor.	5% for homeworks 10% for quizzes	15% (60 points)

**Missing one of the Two Common Major Exams-I or II:** No makeup exam will be given under any circumstance. When a student misses Exam-I or Exam-II for a valid reason (such as medical emergencies), his grade for this exam will be determined based on the existing formula which depends on his performance in the non-missing exam and in the final exam.

**Attendance:** KFUPM attendance policy will be enforced. A DN grade will be awarded to any student who accumulates 9 unexcused absences.

Wk	Date	Section	Topics	Homework
1	Sep. 18-21	1.1 1.2	Systems of linear equations Row echelon form	1;3; 6;7 1;2; 3(a,c,e);5(a,d,f,i);6(b,d)
Sep. 22 (National Holiday)				
2	Sep. 25-29	1.3 1.4	Matrix arithmetic Matrix algebra	2(a,e);9;10(a,b);11;13 1;2;3; 5;12;14;19;22;24;25
3	Oct. 2-6	1.5 1.6	Elementary matrices Partitioned Matrices	1;3;4;7;8;,11,12(a,d) 1;5;6
4	Oct. 9-13	2.1 2.2 2.3	The determinant of a matrix Properties of determinants Additional topics and applications	3(a;c;d;h);5,9,11 2;4;5;6;7;,9;12;13 1(a,c,d); 2(c,d,e);4;15
5	Oct. 16-20	3.1 3.2	Vector space: Definition and examples Subspaces	3;6;7;8;10;12 1(a,b,c,d);2(b,c,d);4(b);10(b),11(b,c,d);12(a,b,c);13;14;16
Exam I: October 23, 2016 (1.1- 3.2)				
6	Oct. 23-27	3.3 3.4	Linear independence Basis and dimension	1(a,c,d,e);2(a,b,c);4(b,c);5;8(a,b,c); 10;12;16 3;5;7;10;12;14
7	Oct. 30-Nov. 3	3.5 3.6	Change of basis Row space and column space	1(a,b);6;8;9;10 1(a,b):2(a,b,c);4(a,b,c,d):7;9,12
8	Nov. 06-10	4.1 4.2	Linear transformations: definition and examples Matrix representations of linear transformations	1(b,c);3;6(a,b,c);8(a,b);10;12 ;13;16 2(a,b),4(b,c);7;8;12;16
Nov. 13 – 17 Midterm Break				
9	Nov. 20 -24	4.3 5.1	Similarity Orthogonality: The scalar product in $\mathbb{R}^n$	2;3;4;6;8;14 1(a,c,d);3(a,b,c);6;8(a,b);11;16;18
10	Nov. 27-Dec 1	5.2 5.4	Orthogonal subspaces Inner product spaces	1(a,c);4;7;8;9;12;13 2;4;7(a,b);10;12;24
Exam II: December 4, 2016 (3.3-5.2)				
11	Dec. 4-8	5.5	Orthonormal sets	1(c,d);2;4;8;10;14;20;22,30;32;34
12	Dec. 11-15	5.6 5.7	The Gram-Schmidt orthogonalization process Orthogonal polynomials	1;4;5;6;8;12;16 1;2;3
13	Dec. 18-22	6.1 6.2	Eigenvalues and eigenvectors System of linear differential equations	1(e,f,g,h);4;5;8;13 1;2
14	Dec. 25-29	6.3	Diagonalization	1(a,b,c,f);2;7;8(a,b,g);9
15	Jan. 1-5	6.6	Quadratic forms	1(a,b);3(a,b,c);6(a,b,d);7(a,b,c);8;10
Final Exam: January 18, 2017, Time: 7-10pm (Comprehensive)				