

**King Fahd University of Petroleum and Minerals**  
**Department of Mathematics and Statistics**  
**Syllabus of Math 225 (181)**

**(Introduction to Linear Algebra)**  
**Instructor: Prof. Dr. O. Echi**

**Textbook:** Linear Algebra with Applications, Steven J. Leon, 9th edition, Pearson, 2015.

**Catalogue Description:** Matrices and systems of linear equations. Vector spaces and subspaces. Linear independence. Basis and dimension. Inner product spaces. The GramSchmidt process. Linear transformations. Determinants. Diagonalization. Real quadratic forms. (Co-requisite: Math 201).

**Objective:** This course introduces students to the basic concepts and techniques of elementary linear algebra.

**Learning Outcomes:** Upon 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 systems of linear equations 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 set using the Gram-Schmidt orthogonalization process.
8. Determine the eigenvalues and eigenspaces of a square matrix.
9. Decide whether a given square matrix is diagonalizable or not.
10. Diagonalize orthogonally a real symmetric matrix.

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

**Instructor:** Prof. Dr. O. Echi

**Office:** Bldg. 5, Room 201-4

**Phone:** 860-1802

**Email address:** [echi@kfupm.edu.sa](mailto:echi@kfupm.edu.sa)

**Office Hours:** Sunday –Tuesday – Thursday

12:20 – 14:00

**Exams and Distribution of Marks:**

**Homework (15%), Attendance (5%)**

**Exam I (15%):** Material: From Sections: from 1.1 to 2.3, Sunday, September 30, 2018

**Exam II (15%):** Material: From Section 3.1 To Section 4.2, Sunday, October 28, 2018

**Exam III (15%):** Material: From Section 4.3 To Section 5.6, Sunday, November 25, 2018

**(Time and location TBA)**

**Final Exam 35% (Comprehensive):** Saturday, December 22, 2018 (7:00 PM)

<b>Week</b>	<b>Sections</b>	<b>Material</b>
<b>1</b>	<b>1.1</b> <b>1.2</b>	Systems of linear equations Row Echelon Form
<b>2</b>	<b>1.3</b> <b>1.4</b>	Matrix Arithmetic Matrix Algebra
<b>3</b>	<b>1.5</b> <b>2.1</b>	Elementary Matrices The Determinant of a Matrix
<b>4</b>	<b>2.2</b> <b>2.3</b>	Properties of Determinants Additional topics and Applications
<b>5</b>	<b>3.1</b> <b>3.2</b>	Vector Spaces: Definition and Examples Subspaces
<b>6</b>	<b>3.3</b> <b>3.4</b>	Linear Independence Basis and Dimension
<b>7</b>	<b>3.5</b> <b>3.6</b>	Change of Basis Row Space and Column Space
<b>8</b>	<b>4.1</b> <b>4.2</b>	Linear Transformations Matrix Representations of Linear Transformations
<b>9</b>	<b>4.3</b> <b>5.1</b>	Similarity Orthogonality
<b>10</b>	<b>5.2</b> <b>5.4</b>	Orthogonal Subspaces Inner Product Spaces
<b>11</b>	<b>5.5</b> <b>5.6</b>	Orthonormal Sets The Gram-Schmidt Orthogonalization Process
<b>12</b>	<b>5.7</b>	Orthogonal Polynomials
<b>13</b>	<b>6.1</b>	Eigenvalues and Eigenvectors
<b>14</b>	<b>6.3</b>	Diagonalization
<b>15</b>	<b>6.6</b>	Quadratic Forms