

King Fahd University of Petroleum and Minerals  
 Department of Mathematics and Statistics  
**SYLLABUS**  
 Semester II, 2015-2016 (152)  
 (Prof. Jawad Abuhlail)

<b>Course #:</b>	Math 355
<b>Title:</b>	Linear Algebra
<b>Instructor</b>	Jawad Abuhlail   <a href="mailto:abuhlail@kfupm.edu.sa">abuhlail@kfupm.edu.sa</a>
<b>Office Hours</b>	UTR: 13:10 – 12:00   Building: 4; Room: 100
<b>Textbook:</b>	Serge Lang, <i>Linear Algebra</i> , 3 <sup>rd</sup> Edition (Springer), 1987.
<b>Description:</b>	Theory of vector spaces and linear transformations. Direct sums. Inner product spaces. The dual space. Bilinear forms. Polynomials and matrices. Triangulation of matrices and linear transformations. Hamilton-Cayley theorem.
<b>Prerequisite:</b>	MATH 280 (Introduction to Liner Algebra)
<b>Passing Grade</b>	50%
<b>Grading Policy</b>	First Major: 25%; Second Major: 25%; Class Work: 10%; Final Exam 40%
<b>Learning Outcomes:</b>	Upon successful completion of this course, a student should be able to: <ul style="list-style-type: none"> <li>• find a base of a given vector space</li> <li>• represent a liner transformation between finite dimensional vector spaces with a matrix</li> <li>• determine whether a given linear transformation is symmetric or unitary</li> <li>• find the eigenvectors and eigenvalues of a given linear transformation</li> <li>• determine with a given linear transformation is triangulable or not</li> </ul>

Week	Date(s)	Topics	
1	September 18 – 20	<b>Vector Spaces:</b> 1.1. Definitions	1.2 Bases
2	Sep. 25 – 29	1.3 Dimension of a Vector Space	1.4 Sums and Direct Sums
3	Oct. 2 – 6	<b>Linear Mappings:</b> 3.2 Linear Mappings	3.3 The Kernel and Image of a Linear Map
4	Oct. 9 – 13	3.4 Composition and Inverse of Linear Mappings	<b>Linear Maps and Matrices:</b> 4.1 Linear Map Associated with a Matrix
5	Oct. 16 – 20	4.2 Matrix Associated with a Linear Map	<b>Scalar Products and Orthogonality</b> 5.1 Scalar Products
<b>First Major Exam, Material: [1.1, 4.2], Tuesday 18.10.2016, 7:00 – 9:00 PM; Room 4-100</b>			
6	Oct. 23 – 27	5.2 Orthogonal Bases, Positive Definite Case	5.4 Bilinear Maps and Matrices
7	Oct. 30 – Nov. 3	5.5 General Orthogonal Bases	5.6 The Dual Space and Scalar Products
8	Nov. 6 - 10	5.7 Quadratic Forms	5.8 Sylvester's Theorem
<b>November 13-17, 2016 Mid-Term Break</b>			
9	Nov. 20 – 24	<b>Symmetric, Hermitian, and Unitary Operators:</b> 7.1 Symmetric Operators	7.2 Hermitian Operators
10	Nov. 27 – Dec. 1	7.3. Unitary Operators	<b>Eigenvectors and Eigenvalues</b> 8.1 Eigenvalues and Eigenvectors
11	Dec. 4 – 8	8.2 The Characteristic Polynomial	
<b>Second Major Exam, Material: [5.1, 7.3] Tuesday 6.12.2016, 7:00 – 9:00 PM; Room 4-100</b>			
12	Dec. 11 – 15	8.3 Eigenvalues and Eigenvectors of Symmetric Matrices	8.4. Diagonalization of a Symmetric Linear Map
13	Dec. 18 – 22	8.5 The Hermitian Case	8.6. Unitary Operators
14	Dec. 25 – 29	<b>Polynomials and Matrices</b> 9.1 Polynomials	9.2 Polynomials of Matrices and Linear Maps
15	Jan. 1 – Jan. 5	<b>Triangulation of Matrices and Linear Maps</b> 10.1 Existence of Triangulation	10.2 Theorem of Hamilton-Cayley
16	Jan 8	<i>Revision</i>	
<b>Final Exam (Comprehensive): Thursday 19.1.2017, 7:00 – 10:00 PM</b>			

## Math 355 Homework Problems

<b>Section</b>	<b>Problems</b>
1.1	2, 4, 8b, 9b, 10, 12
1.2	1g, 5b, 5f, 10
1.4	1, 2
3.2	1c, 1e, 1f, 1g, 3, 5, 15, 18b
3.3	2, 5, 12, 14, 17, 18
3.4	2, 7, 10, 17, 19
4.2	1d, 1f, 6, 8, 9
5.1	1, 2, 3
5.2	2b, 5, 6a, 9, 10
5.4	1, 2, 5b, 5e, 6
5.5	1a, 1b, 3
5.6	1, 3, 4, 6
5.7	2, 3a, 3b, 3c, 3d, 4
5.8	1a, 1c, 3a, 3b
7.1	1, 6, 8, 15
7.2	1, 5, 7, 11
7.3	1, 2, 3, 6
8.1	1, 3, 4, 7
8.2	8a, 8d, 9, 10, 14
8.4	1, 2, 3, 11, 18, 19
8.5	1, 3, 6, 10
9.2	1, 2, 3, 4, 5
10.1	1, 2, 5, 7