A	**Course Title & Number**	ADVANCED LINEAR ALGEBRA: MTH 512
B	**Pre/Co-requisite(s)**	Admission to MSMTH program
C	**Number of credits**	3
D	**Faculty Name**	Ayman Badawi
E	**Term/ Year**	Spring 2015

G **Instructor Information**

Instructor	Office	Telephone	Email
Ayman Badawi	NAB 262	06 515 2573	abadawi@aus.edu

Office Hours: By appointment

H **Course Description from Catalog**

Topics include the proof-based theory of matrices, determinants, vector spaces, linear spaces, linear transformations and their matrix representations, linear systems, linear operators, eigenvalues and eigenvectors, invariant subspaces of operators, spectral decompositions, functions of operators, and applications to science, industry, and business.

I **Course Learning Outcomes**

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

1. Write proofs for propositions and theorems of linear algebra.
2. Analyze properties of vector spaces and subspaces.
3. Solve and analyze matrices using eigenvalues and eigenvectors.
4. Demonstrate an understanding of invariant subspaces.
5. Demonstrate an understanding of canonical forms and Jordan forms.
6. Demonstrate an understanding of inner-product spaces, norms, orthonormal bases, operators on inner-product space.
7. Demonstrate an understanding of spectral theory, singular value decomposition and applications of linear algebra.
8. Apply skills learned in linear algebra in other related mathematical fields

J **Textbook and other Instructional Material and Resources**

First reference: Instructor class notes.

Optional: Sheldon Axler, *Linear Algebra Done Right, 1997. (or current edition).* Any E-text book treats the above concepts will do.

K **Teaching and Learning Methodologies**

The teaching and learning tools used in this course to deliver the subject matter include black board with chocks (if available) but the current white board and markers will do, formal lectures, class discussions, student presentation of proofs on the board..

L **Grading Scale, Grading Distribution, and Due Dates**

Grading Scale

Excellent	
A	Equals 4.00 grade points
Meet Expectation	
A-	Equals 3.80 grade points
B+	Equals 3.30 grade points
B	Equals 3.00 grade points
Below Expectation	

B-	Equals 2.70 grade points
C+	Equals 2.30 grade point
C	Equals 2.00 grade point
Fail	
F	Equals 0.00 grade points
Academic Integrity Violation Fail	
XF	Equals 0.00 grade points
Withdrawal Fail	
WF	Equals 0.00 grade points

Grading Distribution

Assessment	Weight	Date
Homework	20 %	
Exam 1	22 %	
Exam 2	22 %	
Final Exam	36 %	
Total	100 %	

M **Explanation of Assessments**

Exams, homework assignments will include proofs. So students are expected to master some of the techniques that are commonly used in linear algebra.

N **Student Academic Integrity Code Statement**

Student must adhere to the Academic Integrity code stated in the graduate catalog.

SCHEDULE

Note: ***Tests and other graded assignments due dates are set.*** *No addendum, make-up exams, or extra assignments to improve grades will be given.*

#	WEEK	CHAPTER/SECTIONS	NOTES
1	1	**Vector Spaces**	Definition Examples
2	2	**Subspaces and Direct Sums**	Definition Examples Proofs of some main results
4	2	**Span, Linear Independence, Bases, Dimension , and Linear Transformation**	Examples Proofs of some main results

6	1	**Review for Midterm Exam 1** **Midterm Exam 1**	Exam 1: Covers all above
7	2	**Eigenvalues, Eigenvectors, and Invariant Subspaces on Real Vector Spaces**	Examples Proofs Using the methods in analyzing some basic facts on matrices
9	2	**Inner Products, Orthonormal Bases, Orthogonal Projections and Minimization Problems**	Definition Examples Proofs Application
11	1	**Operators on Inner-Product Spaces**	Examples Proofs
12	1	**Review for Midterm Exam 2** **Midterm Exam 2**	Exam 2 : Covers all materials after Exam 1
13	1	**The Characteristic polynomial and the minimal polynomial of an operator, and its decomposition**	Examples Proofs
14	1	**Square roots, Canonical forms, and Jordan Forms**	Definition Examples Proofs
15	1	**Block Upper-Triangular Matrices, and Determinant of an Operator**	Examples Proofs
16	1	**Review before a comprehensive final exam**	