



DE LA SALLE UNIVERSITY – MANILA  
COLLEGE OF SCIENCE  
Mathematics Department

## SYLLABUS

COURSE CODE	MTH613M/D
COURSE TITLE	Advanced Linear Algebra 1
CLASS DAY & TIME	
ROOM	
NAME OF FACULTY	
COURSE CREDIT	3 Units
CONTACT NO. (DEPT)	(02) 536-0270, (02) 524-4611 loc. 420/413
TERM/SCHOOL YEAR	

### COURSE DESCRIPTION

This is a one trimester course in advanced linear algebra. The topics include vector spaces, linear transformations and matrices, eigenvalues and similarity transformations, linear functionals, bilinear forms and quadratic forms.

### COURSE OBJECTIVES

The students will:

1. Define and illustrate the concepts of vector space, linear independence, basis of a vector space, linear transformations, linear functionals, dual space, eigenvalues, bilinear and quadratic forms.
2. State and prove fundamental theorems on the properties and interrelationship of the various concepts mentioned above;
3. Construct the matrix representations of linear transformations with respect to a given set of bases and change these representations in accordance with a change in bases;
4. Obtain canonical forms of a given matrix;
5. Solve problem dealing with the structure of a vector space and its dual space and the representations of the various objects in these spaces.
6. At the end of the term, it is hoped that the effort put by the student to meet the requirements of this course and his/her interaction with the teacher have helped him/her to:
  - feel the beauty and usefulness of the language of linear algebra in dealing with linearity properties;
  - develop the capability to think logically and analytically to be able to manipulate abstract concepts for useful end;
  - strengthen his/her character through the enhancement of the values of honesty and courage, industry and perseverance, determination and hard work.

Topic/Subtopic	Learning Strategies/ Activities	Week/Meeting
<b>1. Vector Spaces</b> 1.1 Definitions 1.2 Linear Independence and Linear Dependence 1.3 Bases of Vector Spaces 1.4 Subspaces	Lecture Facilitated group discussion Problem solving	7.5 hrs
<b>LONG TEST 1</b>	1.5 hrs	
<b>2. Linear Transformation and Matrices</b> 2.1 Linear Transformation 2.2 Matrices 2.3 Nonsingular Matrices 2.4 Change of Basis 2.5 Hermite Normal Form 2.6 Elementary Operations and Elementary Matrices 2.7 Linear Problems and Linear Equations 2.8 Other Applications of the Hermite Normal Form 2.9. Normal Forms	Lecture Facilitated group discussion Problem solving Problem Set	10.5 hrs
<b>LONG TEST 2</b>	1.5 hrs	
<b>3. Determinants, Eigenvalues and Similarity Transformations</b> 3.1 Permutations 3.2 Determinants 3.3 Cofactors 3.4 The Hamilton-Cayley Theorems 3.5 Eigenvalues and Eigenvectors 3.6 Similarity 3.7 Jordan Normal Form	Lecture Facilitated group discussion Problem solving Problem Set	10.5 hrs
<b>LONG TEST 3</b>	1.5 hrs	
<b>4. Linear Functionals</b> 4.1 Linear Functionals 4.2 Duality 4.3 Change of Basis 4.4 Annihilators 4.5 Dual of a Linear Transformation	Lecture Facilitated group discussion Problem solving	6 hrs
<b>FINAL EXAMINATION</b>	3 hrs	

### COURSE REQUIREMENTS

- 3 Long Tests
- 3 Problem Sets
- 1 Final Examination

**SOURCES**

## TEXTBOOK

- Nering, E. D., *Linear Algebra and Matrix Theory*, 2nd edition, John Wiley and Sons, Inc., U.S.A., 1970

## REFERENCES

- Bronson, Richard, *Linear Algebra, Algorithms, Applications, and Techniques*, Academic Press, 2013
- Herstein, I.N. and D.J. Winter, *Matrix Theory and Linear Algebra*, Macmillan Publishing Company, U.S.A. 1989
- Kolman, B. and Hill, D.R., *Elementary Linear Algebra with Applications*, Pearson/Prentice Hall, New Jersey, 2008
- Lin, Y., *Geometric Linear Algebra*, World Scientific, New Jersey, 2008
- McMahon, D.N., *Linear Algebra demystified: [a self-teaching guide]*, McGraw-Hill, New York, 2006
- Valenza, R.J., *Linear Algebra: an introduction to abstract mathematics*, Springer-Verlag, New York, 1999

## ONLINE MATERIALS

- <http://linear.ups.edu/>
- <http://ocw.mit.edu/courses/mathematics/18-700-linear-algebra-fall-2013/>
- [www.cs.cornell.edu/courses/cs485/2006sp/linalg\\_complete.pdf](http://www.cs.cornell.edu/courses/cs485/2006sp/linalg_complete.pdf)

Noted by:



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