# AMERICAN UNIVERSITY OF BEIRUT Faculty of Arts and Sciences - Mathematics Department <br> Spring 2010-2011 <br> Syllabus <br> <br> Check moodle for any updates 

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## - Basic Information:

Course Number: Math 218
Course Title: Elementary Linear Algebra with Applications
Prerequisites: Basic mathematical skills. In particular, facility with sets, logic, mathematical induction and some background in mathematical proof.

## Class Meetings:

Section 3: MWF 10:00-10:50 in Nicely 210
Instructor: Sara Abu Diab, e-mail: sara.abu-diab@aub.edu.lb or sa88@aub.edu.lb, website: http://people.aub.edu.lb/~ sa88
Office Hours: Thursday 10:30-11:00, 3:00-3:30, Wednesday and Friday 11:00-12:00 or by appointment in Bliss 112 (entrance through Bliss 110) extension 4279

## - Course Resources:

## Required Textbook:

J. DeFranza and D. Gagliardi, Introduction to Linear Algebra with Applications, McGraw Hill 2009.

## Material to be covered:

Systems of Linear Equations, Matrices, Determinants, Euclidean Vector Spaces, General Vector Spaces, Inner Product Spaces, Eigenvalues, Eigenvectors, Linear Transformations, Applications of Linear Algebra.

## Additional References:

H. Anton and C. Rorres, Elementary Linear Algebra, Applications Version, Wiley 2005.
S. Lang, Linear Algebra.
C. W. Curtis, Linear Algebra.
S. Lipschutz, 3000 Solved Problems in Linear Algebra.

Other resources will be available through moodle.

## - Course Overview and Objectives:

1. This course is intended to be an introduction to linear algebra at a less theoretical level than MATH 219. Systems of linear equations and Gaussian elimination, vectors in $\mathbb{R}^{n}$, matrices, determinants, vector spaces, subspaces and dimension, orthogonal projection and least-squares approximation, eigenvalues, eigenvectors, and selected applications. Students cannot receive credit for both MATH 219 and MATH 218. Annually. (Source: AUB catalogue)
2. The aim of this course is to develop basic understanding of mathematical concepts and techniques within the subject of linear algebra that are used in various scientific domains, and to enhance students' critical thinking and problem solving skills. Its learning outcomes can be summed as:

- Define systems of linear equations and use Gaussian elimination to solve linear systems.
- Find the transpose and inverse of a matrix using elementary row operations
- Evaluate determinants using several techniques and use the properties of determinants to determine if a matrix is non singular
- Determine subspaces, spanning sets and bases of vector spaces and demonstrate linear independence or dependence of a set of vectors
- Relate linear transformations to matrices and compute their rank
- Compute the eigenvalues and eigenvectors of a matrix and learn the diagonalization of matrices
- Define inner product spaces, angles and orthogonality, orthonormal bases
- Apply Gram-Schmidt process to construct orthonormal bases
- Perform orthogonal diagonalization of a symmetric matrix


## - Course grading criteria:

There will be homework sets, two quizzes and a final exam. Question numbers in bold in the homework assignment sheet ought to be handed in every Monday at the start of class. Note that late homework will not be accepted. At the end of the semester, the lowest two homework grades of each student will be discarded.
Course Grade distribution:

- Quiz $1 \quad 25 \%$ Date: Mon, 14th of March at 6.30
- Quiz $2 \quad 25 \%$ Date: Wed, 13th of April at 6.30
- Homework 10\%
- Final $40 \%$

Please take a note from now of the date and time of Quiz 1 and Quiz 2, as given above; make sure that you keep those times free.

- Previous exams and any other material deemed beneficial will be provided through moodle.
- Makeups for quizzes will be given only for a valid medical excuse. Make ups of the final exam are subject to the approval of the dean's office.
- Other course policies and remarks:
- Classes are not a rehearsal of particular notes or of chapters in the book. They are a medium for positive interaction and transmission of skills. Your 'active' attendance is proportional to your 'good' performance. In case you miss a class, please note that you are required to compensate for it and to be informed about any announcements made during your absence.
- Attendance will be recorded at the beginning of each session.
- You should never hesitate to ask questions, give your input and comments, and participate in the progress and development of this course in an orderly manner.
- You are expected to be aware of and to respect AUB's policies. You may want to glance over the following:
$\diamond$ Read the student code of conduct that is applied at AUB if you have not already done so. Some important parts are those dealing with cheating, plagiarism, and class behavior.
$\diamond$ AUB is an equal opportunity employer and educator. Students with learning, physical, or psychological disabilities are provided with the necessary care upon request. AUB is committed to appreciate and foster diversity among its staff, faculty, and students. AUB is also committed to accommodate a multi-cultural environment that promotes tolerance, respect, in addition to academic and intellectual maturity.
- Some ideas may be implemented to help you enjoy the course and study well for it. (worksheets, self assessments, optional workshops, optional projects, readings, discussion sessions, guest lecturers...)
- The course will also be on moodle. Relevant exercises, additional resources and review sheets will be available in due time.


## Section <br> Assigned Exercises:

| 1.1 | $3,10,12,18,21,25,28, \mathbf{2 9}, \mathbf{3 2}, 34,38, \mathbf{4 0}, 43, \mathbf{4 4 .}$ |
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| 1.2 | $8, \mathbf{2 0}, 22,24, \mathbf{2 6}, \mathbf{2 8}, 32,34, \mathbf{3 6}, 40,42, \mathbf{4 6}, 48, \mathbf{5 0}, 51$. |
| 1.3 | $12,16,18, \mathbf{2 0}, 22, \mathbf{2 4}, \mathbf{2 7}, 28,29, \mathbf{3 0}, \mathbf{3 2}, 35, \mathbf{3 6}, 38,40, \mathbf{4 2}, 43, \mathbf{4 4 .}$ |
| 1.4 | $6,11, \mathbf{1 2}, 13,16,18, \mathbf{1 9}, 20, \mathbf{2 4}, \mathbf{2 6}, 27,28, \mathbf{3 0}, 32,34,37, \mathbf{3 8}, 40$. |
| 1.5 | $6,12,16,22, \mathbf{2 6}, 28, \mathbf{3 2}$. |
| 1.6 | $2,3, \mathbf{4}, 18,20, \mathbf{2 3}, 25, \mathbf{2 8}, \mathbf{3 0}, 32, \mathbf{3 6}, 40,43, \mathbf{5 2}, \mathbf{5 3}, 54$. |
| 2.1 | $16,21, \mathbf{2 2}, 28, \mathbf{3 0}, 34,36,38$. |
| 2.2 | $9, \mathbf{1 0}, 12,15, \mathbf{1 6}, 19, \mathbf{2 0}, 22, \mathbf{2 4}, \mathbf{2 7}, 28,33,37, \mathbf{3 8}, 39$. |
| 2.3 | $7, \mathbf{8}, 9,10, \mathbf{1 3}, 14,20, \mathbf{2 1}, \mathbf{2 4}, 27, \mathbf{2 8}, 31,32,37, \mathbf{3 8}, 42$. |
| 3.1 | $3, \mathbf{4}, 7, \mathbf{8}, 9, \mathbf{1 0}, 12, \mathbf{1 4}, 15,16, \mathbf{1 7}, 25,28,31$. |
| 3.2 | $\mathbf{2}, 4,7, \mathbf{8}, 9,11,13, \mathbf{1 4}, \mathbf{1 6}, \mathbf{1 8}, \mathbf{2 0}, 23,24,26, \mathbf{3 0}, 32,36, \mathbf{3 8}, 40,43, \mathbf{5 0}$. |
| 3.3 | $3, \mathbf{4}, 6, \mathbf{1 0}, 11,12,16,19, \mathbf{2 0}, \mathbf{2 2}, 24,28,36,41, \mathbf{4 2}, 44$. |
| 3.4 | $3,4, \mathbf{8}, 11, \mathbf{1 6}, \mathbf{2 2}, 24$. |
| 4.1 | $2,3, \mathbf{4}, 5,10, \mathbf{1 1}, 12, \mathbf{1 4}, 16,18,22, \mathbf{2 6}, 28,30,32, \mathbf{3 4}, \mathbf{3 6}, 38,42$. |
| 4.2 | $4, \mathbf{6}, 7, \mathbf{1 0}, 12,14,16, \mathbf{1 8}, 20, \mathbf{2 6}, 28,29,30, \mathbf{3 2}, 34,40,43$. |
| 4.3 | $\mathbf{2}, \mathbf{8}, 10,12, \mathbf{1 6}, 19,20, \mathbf{2 2}, \mathbf{2 6}, 27,29,30,31, \mathbf{3 2}$. |
| 4.4 | $2, \mathbf{6}, 10, \mathbf{1 4}, \mathbf{1 6}, 17, \mathbf{2 0}, 24, \mathbf{3 2}$. |
| 4.5 | $\mathbf{2}, 4, \mathbf{6}, 8, \mathbf{1 0}, 12, \mathbf{1 6}, 17, \mathbf{1 8}$. |
| 5.1 | $\mathbf{2}, 4,8,12, \mathbf{1 4}, \mathbf{1 7}, 18, \mathbf{1 9}, 20,21,23,24, \mathbf{2 8}, 29, \mathbf{3 2}, 35$. |
| 5.2 | $2, \mathbf{4}, 6,8, \mathbf{1 2}, \mathbf{1}, 20,22, \mathbf{2 4}, 27,28,30,31, \mathbf{3 2}, 33,34, \mathbf{3 5}, 38$. |
| 6.1 | $2,3, \mathbf{4}, \mathbf{1 1}, \mathbf{1 2}, \mathbf{1 3}, \mathbf{1 4}, \mathbf{1 5}, \mathbf{1 6}, 18,24, \mathbf{3 0}$. |
| 6.2 | $2, \mathbf{6}, 8, \mathbf{1 0}, 12, \mathbf{1 8}, 20,22, \mathbf{2 8}, \mathbf{3 0}$. |
| 6.3 | $4, \mathbf{8}, \mathbf{1 2}, 14, \mathbf{1 6}, 18, \mathbf{2 0}, 24,31, \mathbf{3 4}, \mathbf{3 6}, 37$. |
| 6.4 | $4, \mathbf{6}, \mathbf{1 0}, \mathbf{1 4}, \mathbf{1 6}, \mathbf{1 8}, \mathbf{2 2}, 27,29$. |
| 6.5 | $\mathbf{2}, 4, \mathbf{6}, \mathbf{8}$. |
| 6.6 | $2,4,6, \mathbf{8}, 10, \mathbf{1 2}, 14,20, \mathbf{2 2}, \mathbf{2 4}$. |

