MATH 221 Introduction to Linear Algebra
Section 02 Spring 2014

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- Lectures: Tue and Thu, 2:30–3:45 pm, at MP 103
- Office hours: Tue and Thu, 1:30–2:30 pm or by appointment
- Course web-page: http://www.math.umbc.edu/~shenj
- Prerequisites: Math 140, 151 or 155
- Textbook: *Linear Algebra and Its Applications* by David C. Lay, 4th Edition, Addison-Wesley, text web-page: http://www.laylinalgebra.com
- Other references:
  - *Introduction to Linear Algebra with Applications*, by J. DeFranza and D. Gagliadi, McGraw-Hill Inc., 2009.
  - *Linear Algebra and Its Applications*, by G. Srang, 4th Edition, Thomson Learning Inc., 2006.
- Schedule:
  - No class in the week of March 17-21 (spring break).
  - Final exam will be on May 15 (Thu).

Course Description Linear algebra deals with multi-variable linear equations/functions and their fundamental properties as well as transformations of vector spaces, extensions of three-dimensional spaces which we are familiar with. The basic objects are vectors and matrices. The course starts from linear equations and then treats matrix operations, vector spaces, and eigenvalues/eigenvectors, with a final exposition on orthogonality and orthogonal projections.

Linear algebraic techniques are widely used in numerous areas, such as mathematics, sciences, computer science, engineering, economics, and finance. They are cornerstones for a variety of advanced classes in sciences and engineering. This course will equip you with basic concepts and tools of linear algebra that you will find useful in the future.

Objectives One should learn the following three aspects from this course: the algebra of linear equations and matrices, the geometry of vector spaces, and the algorithms for solving linear equations and performing matrix operations. Specifically, by the end of this class, one should be able to know how to: (i) characterize existence, uniqueness and solution sets of linear equations in a vector or matrix form via the row reduction algorithm; (ii) perform matrix operations, including computation of matrix inverse and determinant, and understand the implications of matrix inverse and the determinant properties; (iii) characterize vector spaces or subspaces and determine their dimensions and matrix ranks; (iv) compute eigenvalues and eigenvectors for a given matrix and perform diagonalization; and (v) understand the concepts of orthogonality and orthogonal bases, carry out orthogonal projections and orthonormal transformations for a vector set.

Tentative Schedule and Topics *(subject to change, depending on class progress)*

No.	Week	Topic	Section(Lay)
1	Jan. 27–Jan. 31	Introduction, linear equations	1.1
2	Feb. 3–Feb. 7	Row reduction, vector equations	1.2, 1.3
3	Feb. 10–Feb. 15	Matrix eqns., solution sets of linear eqns.	1.4, 1.5
4	Feb. 17–Feb. 22	Linear independence, linear transformation	1.7, 1.8
5	Feb. 24–Feb. 28	Matrix operations, Exam I	2.1
6	Mar. 3–Mar. 7	Matrix inverse and its characterizations	2.2, 2.3
7	Mar. 10–Mar. 14	Vector spaces and subspaces, Null spaces and column spaces	4.1, 4.2
8	Mar. 17–Mar. 21	No class (spring break)	
9	Mar. 24–Mar. 28	Bases, coordinate systems	4.3, 4.4
10	Mar. 31–Apr. 4	Dimension, rank	4.5, 4.6
11	Apr. 7–Apr. 11	Determinants, Exam II	3.1
12	Apr. 14–Apr. 18	Properties of determinants, Eigenvalues and eigenvectors	3.2, 5.1
13	Apr. 21–Apr. 25	Characteristic equation, diagonalization	5.2, 5.3
14	Apr. 28– May 2	Inner products, length & orthogonality, Orthogonal sets	6.1, 6.2
15	May 5–May 9	Orthogonal proj., Gram-Schmidt process	6.3, 6.4
16	May 12–May 16	Review	

Homework Weekly homework will be assigned. Each homework set contains some calculation problems and/or conceptual questions. The homework is usually collected in Tuesday's classes unless a due date change is announced. *No late homework will be accepted.* Please present your answers neatly and show all your work; answers without supporting work may not receive full credit.

Exams There will be two (2) in-class mid-term exams, and one (1) final exam. Each mid-term exam mainly focuses on topics covered in that month, but the final exam will be comprehensive. Please be aware that

- there will be *no* optional final exam, and all the exams are closed-book;
- calculators and other computing devices are *not* allowed for mid-term exams and final exam.

Grading Policy The grading scheme is as follows:

- homework: 20%
- mid-term exams: 50% (25% for each)
- final exam: 30% (the final is comprehensive)

The letter grade will be computed based upon the numerical grade:

$A : \geq 90; \quad B : 89 - 80; \quad C : 79 - 65; \quad D : 64 - 50; \quad F :< 50$

Academic Integrity

- The UMBC Academic Integrity Statement:

  "*By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the Faculty Handbook, or the UMBC Policies section of the UMBC Directory.*"

- All work in a homework or an exam must be your own; collaborating on an exam is *not* permitted. Discussions with other students on homework problems are allowed, but you should present your own work in the final turn-in; simply copying other people's work is a violation of UMBC's academic integrity code.
- If you wish to contest a graded exam, you must make an appeal within *one week* of the return date to the class. All appeals should be made in writing to the instructor with a signed and dated note on the exam. End of the semester appeals for earlier exams will be ignored.

- Make-up tests: if you must miss an exam due to a prior obligation, you must speak to the instructor *in advance* of the exam. If you must miss an exam due to an unforseen but valid reason (e.g. illness), you must submit a written excuse. Failing to do so may result in loss of substantial points off the top in your make-up.

Some Suggestions This course contains a vast number of topics, ranging from basic techniques for solving linear equations to a variety of matrix operations and fundamental properties of vector spaces as well as important transformations between these spaces. You will be exposed to many new notions and new tools in each class, some of which are abstract. Here are a few suggestions that will help you grasp materials efficiently:

- Read the scheduled materials before going to class. If you have difficulty in understanding any concepts or results, bring them to the class.
- Review lecture notes and the textbook before doing homework. Although discussions are allowed for homework problems, try your best to solve them with your own effort.
- If you have already done your best but sill have questions about materials, do not put them aside. Either see the instructor at office hours or get helps from other sources right away. If you are left behind at a certain point, it could take you much more time and effort to catch up, since we will move in a relatively fast pace in this class.