# MATH 411 Linear Algebra Section 0101
# Spring 2016

- Instructor: Dr. Jinglai Shen
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- Office: Math/Psyc 417
- Phone: (410) 455–2402
- Lectures: Tue and Thu, 2:30 pm–3:45 pm, at SOND 112
- Office hours: Tue and Thu, 1:30 pm–2:30 pm or by appointment
- Course web-page: http://www.math.umbc.edu/~shenj
- Prerequisites: Math 301 (and Math 221 is preferred but not required)
- Textbook: *Linear Algebra Done Right* by Sheldon Axler, 3rd Edition, Springer, 2015.
- Other references:
  - *Finite Dimensional Vector Spaces*, by Paul R. Halmos, 2nd Printing, Springer, 1993
  - *Linear Algebra*, by Kenneth M. Hoffman and Ray Kunze, 2nd Ed., Pearson, 1971
- Important dates:
  - No class on March 14–18 (Spring break)
  - Last class: May 10, Tue
  - Final Exam: May 12, Thu

**Course Description** This course is a continuation of Math 221 (*Introduction to Linear Algebra*). It is concerned with general vector spaces or inner-product spaces and linear mappings on these spaces. The course provides an axiomatic and in-depth coverage of abstract vector spaces, and focuses on rigorous, logically sound approaches for understanding concepts and solving problems. The mathematical knowledge developed in this class will prepare you for many advanced courses, such as functional analysis, and will benefit you in a wide range of pure and applied mathematics.

We will cover most of Chapters 1–9 of the textbook. Specific topics are:

- Vector Spaces (Chapter 1)
  - Definition and properties of vector spaces
  - Subspace, sum and direct sum
- Finite-dimensional Vector Spaces (Chapter 2)
  - Span and linear independence
  - Basis and dimension
- Linear Maps (Chapter 3)
  - Definition, null space, and range
  - The matrix of linear map, invertibility
- Polynomials (Chapter 4)
- Eigenvalues and Eigenvectors (Chapter 5)
  - Invariant subspaces
  - Upper triangular matrices, diagonal matrices
- Inner Product Spaces (Chapter 6)
  - Inner product and norm
  - Orthogonal basis, orthogonal projection
- Operators on Inner Product Spaces (Chapter 7)
  - Self-adjoint and normal operators, the Spectral Theorem
  - Positive operators, isometry
- Operators on Complex/Real Vector Spaces (Chapters 8-9)
  - Eigenvalue/eigenvector, characteristic polynomial
  - Decomposition of an operator, Jordan form

Please note that these topics are subject to change, depending on class progress.

**Homework** Weekly homework will be assigned. Homework is usually collected in Tuesday's class 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. And please staple your homework if it has multiple pages.

**Exams** There will be two (2) mid-term exams, and one (1) final exam. Each mid-term exam mainly focuses on topics covered in the month before the exam, but the final exam will be comprehensive. Please be alerted that calculators and other computing devices are *not* needed and allowed for mid-term exams and final exam.

**Grading Policy** The grading scheme is as follows:

- homework: 30%
- mid-term exams: 40% (20% 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 and an exam must be on 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 a test 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 in your make-up.