DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Department of Mathematics and Statistics

Math 2040, Matrix Theory and Linear Algebra II
Winter 2018

Instructor: Peter Selinger, Chase 303
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Lectures: MWF 8:35-9:25, LSC C236

Course Description

This course is a continuation of MATH 2030. Topics include: vector spaces and linear transformations, complex numbers, inner product spaces, orthogonal and unitary transformations, quadratic forms, diagonalization of symmetric and hermitian matrices, the solution of linear differential equations, and various applications in mathematics, physics and computer science.

Course Prerequisites

MATH 2030, and MATH 1000 or MATH 1500 or MATH 1215.

Course Objectives/Learning Outcomes

Students will learn advanced concepts of linear algebra, including real and complex vector spaces, inner product spaces, linear transformations, and orthogonality. We will discuss the use of vectors in representing and manipulating data, including image data, audio data, and statistical data. We will discuss many applications, including compression, coding theory, and cryptographic applications.

Course Materials

- *Textbook: We will use an open source textbook, "Matrix Theory and Linear Algebra", which will be made available on Brightspace as the course progresses.*
- *Course website on Brightspace is accessed through dal.brightspace.com*

Course Assessment

Homework	*15%*	*Online, accessed via Brightspace.*
Midterm 1	*20%*	***Friday, February 16**, in class.*
Midterm 2	*20%*	***Friday, March 23**, in class.*
Final Exam	*45%*	*3 hours – Scheduled by the Registrar. Must pass final exam to pass the course.*

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ [90-100]	**B+** [77-80)	**C+** [65-70)	**D** [50-55)
A [85-90)	**B** [73-77)	**C** [60-65)	**F** [0-50)
A- [80-85)	**B-** [70-73)	**C-** [55-60)	

Course Policies

1. Students can get help with this course in the Math Learning Centre which is located in Room 119 on the 1st floor of the Chase Building. A tutor will normally be available Mondays-Wednesdays 10am-6pm and Thursdays and Fridays 10am-5pm on a first come, first served basis, free of charge (with additional hours near exam time). The schedule is subject to change; check online (https://www.dal.ca/faculty/science/math-stats/about/learning-centre.html) for up-to-date information. The Learning Centre also has large tables where you can work together.
2. You will also be given reading assignments from the textbook.

3. Calculators, textbooks, and notes are not allowed for Midterm Tests or the Final Examination.
4. Late homework will not be accepted except with the instructor's prior permission.
5. A missed midterm cannot be written at another time. If you miss the midterm without prior permission, then it will count as a 0. Exceptions are made in two cases: (1) if you obtain the instructor's prior permission to miss a midterm, or (2) if you have an officially valid excuse such as a medical doctor's note. In these cases, the weight of the missed midterm will be shifted to the final exam (e.g., the final exam will then count 60% instead of 40%). There is no make-up option for the final exam except in cases of an officially valid excuse such as a medical doctor's note.
6. The so-called "Student Declaration of Absence" forms will **not, under any circumstances**, be accepted in this course. If you miss course work for medical reasons, you **must always produce a doctor's note** signed by a medical professional.
7. Students are encouraged to study in groups, but each student must complete their own online homework, quizzes, and exams.

Course Content (dates are approximate, applications may vary)

January 8-12	Complex numbers. Vector spaces.
January 15-19	Applications: Hamming codes, authentication, secret sharing.
January 22-26	Linear transformations.
January 29-31	Applications: transformations in 2d and 3d geometry. Perspective. FEBRUARY 2 – MUNRO DAY (NO CLASS)
February 5-9	FEBRUARY 5 – LAST DAY TO DROP WITHOUT "W" Inner product spaces, orthogonal and orthonormal bases. Gram-Schmidt procedure, projections.
February 12-16	QR-decomposition. Applications: Least square approximation, principal components analysis. FEBRUARY 16 - FRIDAY – FIRST MIDTERM, IN CLASS
February 19-23	STUDY BREAK (NO CLASS)
Feb 26-Mar 2	Orthogonal and unitary transformations. Fourier transform. Wavelets.
March 5-9	Applications: signal processing, audio compression, image compression.
March 12-16	Diagonalization of symmetric and hermitian matrices. MARCH 12 – LAST DAY TO DROP WITH "W"
March 19-23	Quadratic forms. MARCH 23 – FRIDAY - SECOND MIDTERM, IN CLASS
March 26-28	Jordan normal form. MARCH 30 – GOOD FRIDAY (NO CLASS)
April 2-6	Applications: machine learning.
April 9-10	MONDAY AND TUESDAY FOLLOW FRIDAY SCHEDULE Review

University Policies and Statements

See Brightspace for Section B of this syllabus, "University Policies and Statements".