

MATH 2T03

NUMERICAL LINEAR ALGEBRA

(Winter 2008)

Time & Place:

- Lectures — 9:30–10:20 on Mondays & Thursdays, 10:30–11:20 on Tuesdays in ABB/271
- Computer Labs — 12:30–13:20 on Thursdays in BSB/248

Instructor: Dr. Bartosz Protas

Office HH 326, Ext. 24116, Email: bprotas@mcmaster.ca
Office Hours: 13:30-14:30 on Tuesdays and Thursdays

Teaching Assistant: Masahiro Oishi

Office ITB 115, Email: oishim@mcmaster.ca
Office Hours: 12:30-13:30 on Tuesdays

Course Webpage: <http://www.math.mcmaster.ca/~bprotas/MATH2T03a>

Outline of the Course: The main focus of this course will be on the use of numerical computation to solve problems in linear algebra. Following an introduction to MATLAB, we will discuss relevant properties of the finite-precision arithmetic. Then we will introduce various techniques, both direct and iterative, for efficient solution of systems of linear equation. We will also study numerical computation of eigenvalues and eigenvectors, as well as some other useful decompositions and factorizations. In addition to discussing theoretical aspects such as conditioning, computational complexity and convergence, for every problem we will also present an implementation of the actual solution method using MATLAB. As a motivation, we will be using examples taken from various areas of numerical mathematics complemented with some ideas from abstract algebra.

Topics:

Dates	Topics	Chapters from Ref 1
Jan 7 — Jan 24	introduction, MATLAB, finite-precision arithmetic	1
Jan 28 — Feb 28	review of linear algebra, linear systems, direct and iterative solution methods	2
Mar 3 — Mar 20	orthogonal projections, QR factorizations	3
Mar 24 — Apr 8	eigenvalues and eigenvectors, singular value decomposition	4

Course Objectives: By the end of the course students should be able to develop MATLAB codes for the numerical solution of some standard problems in linear algebra.

Primary Reference:

1. M. Grasselli and D. Pelinovsky, “Numerical Mathematics”, Jones and Bartlett, (2008)

Secondary References:

2. K. Atkinson & W. Han, “Elementary Numerical Analysis”, Wiley & Sons, (2004).

Software: All of the computational examples will be presented using MATLAB. This software is available on the computers in the computer lab. Lab hours (see above) are reserved for unsupervised work with computer-based assignments. Unless they are reserved for large-class tutorials, students should be able to work in the computer labs in BSB also outside the allocated time-slots. Students are as well encouraged to purchase “The Student Edition of MATLAB” to be able to work with MATLAB at home.

Prerequisites: Linear Algebra II (MATH2R03)

Assignments: Five homework assignments will be posted on the course website on the dates indicated in the table below. The assignments will be due by midnight on Tuesday the following week. Solutions of the assignments should be submitted by e-mail to math2t03@math.mcmaster.ca using the template provided. Late submissions will not be accepted. Only four best assignments are counted towards the final mark. The assignments and solutions will be posted on the course webpage.

Homework Post & Due Dates:

#	Post Date	Due Date
HW1	January 22	January 29
HW2	February 5	February 12
HW3	February 26	March 4
HW4	March 18	March 25
HW5	April 1	April 8

Class Quiz: There will be two in-class quizzes on February 5 and March 18 in T29-101. They will last 50 minutes and will cover analytical issues only (no programming). Only the McMaster standard calculator Casio fx-991 will be allowed during the quizzes.

Final Exam: The course will be completed by a three-hour final examination. The date and location of the final exam will be announced by the Registrar's office in mid-term.

Marking scheme:

- Final exam (3 hrs) — 50%
- Tests (2×50 min) — 20%
- Four best homework assignments — 30%

The instructor reserves the right to alter the grade in justified cases. In such situations, however, the grade can only be increased.

Excused Absences: Exemptions from the assignments or tests for valid reasons are possible, but must be requested through the office of the Associate Dean of the Faculty that you are registered with. In the event of an exemption, no make up test or assignment will be administered, but your course grade will be re-weighted by increasing the weight of the final examination to compensate for the missed test or assignment.

Senate Policy Statement: The course is regulated by the following documents: *Statement on Academic Ethics* and *Senate Resolutions on Academic Dishonesty*. Any student who infringes one of these resolutions will be treated according to the published policy. In particular, academic dishonesty includes: (1) plagiarism, e.g. the submission of work that is not one's own, (2) improper collaboration in group work on home assignments, (3) copying or using unauthorized aids tests and examinations. It is your responsibility to understand what constitutes academic dishonesty, referring to *Academic Integrity Policy*.

Important Notice: The instructor reserves the right to modify elements of the course and will notify students accordingly (in class and post any changes to the course website).