MATH 1104-F: Linear Algebra for Engineering or Science, Winter 2021, Course Outline

Alexander Bors

1 Basic information on the course

- **Instructor:** Alexander Bors

- **E-mail:** `AlexanderBors (at) cunet (dot) carleton (dot) ca`

- **Textbook:** Linear Algebra and Its Applications (with MyLab Access Code), Sixth Edition, David C. Lay, Stephen R. Lay, and Judi J. McDonald. E-textbook with MyLab Access Code is available from the university bookstore.

- **Prerequisite:** Ontario Grade 12 Mathematics: Advanced Functions, or MATH 0005, or equivalent, or permission of the School.

- **Calendar description:** Systems of Linear Equations; Matrix Algebra; Determinants; Invertible Matrix Theorem; Cramer's Rule; Vector space R^n; Subspaces; Bases; Eigenvalues; Diagonalization; Linear Transformations; Kernel; Range; Complex Numbers (including De Moivre's Theorem); Inner Product Spaces and Orthogonality; Applications.

- **Synchronicity vs. Asynchronicity:** This course offers a flexible hybrid model. In the lectures, new material is presented to the students, who are not expected to study the material (the relevant sections of the textbook and lecture notes) themselves. However, lecture notes will be posted on cuLearn ahead of time (on Friday for the lectures of the following week), so students can read through the material before the lectures (and are encouraged to do so, to be able to follow the lectures more easily). Additionally, lectures will be recorded, so students can watch them again at a later point.

- **Lectures (online via Zoom):** Tuesdays and Thursdays, 11:30am-1pm. The first lecture is on Tuesday, January 12, 2021, and the last is on Tuesday, April 13, 2021.

- **Tutorials (online via Zoom):** Tuesdays, 2:30pm-3:30pm. Tutorials start on January 26, 2021.

- **Office hours (online via Zoom):** Wednesdays, 1pm-2pm.

- **Class conduct:** Students are expected to behave in a professional manner at all times. Disrupting a class is considered to be an Instructional Offence (see University Calendar). Please adhere to the same standards of behavior online that you follow in a real classroom.

- **Evaluation:**

  - 8 online weekly quizzes (best 5 out of 8): 10%
  - 2 assignments: 25%
  - 1 online midterm exam: 25%
  - 1 online final exam: 40%

- The weekly quizzes, midterm and final exam will all be in MyLab.

- Quizzes are released on Thursdays and are due by Sunday of that same week.

- Each assignment is released on a Thursday, along with a quiz, but is only due on Sunday of the following week. Moreover, the week after an assignment is released, there is no quiz in order to give students time to work on the assignment.

- **Online midterm exam:** There will be an 80-minute online midterm exam during the class time on Tuesday, February 23, at 11:30pm-1pm. No make-up, early or late midterm exam will be given. Missing midterm exam will be counted as zero. If you miss the midterm exam for medical reasons, an official medical note (written in English) must be presented.

- **Online final exam:** There will be a 3-hour online final exam scheduled during the exam period (April 16–27). It is the responsibility of each student to be available at the time of the final examination.

2   Important notes

- Instructions on how to join the Zoom sessions will be posted on cuLearn, as will all important course-related information.

- You are responsible for keeping up with information announced during the lectures and tutorials, or sent to your Carleton e-mail account, or announced on cuLearn.

- Be sure that you know the academic integrity standards at Carleton, which can be found at https://carleton.ca/secretariat/wp-content/uploads/Academic-Integrity-Policy.pdf.

- Please use your Carleton e-mail account for all course-related e-mails.

- Whenever possible, I will answer course-related e-mails within one workday. In case I get lots of e-mails with similar questions or questions of general interest, I may answer them by sending an e-mail to all course participants.

- If you are physically in a different time zone, please e-mail me (using your Carleton e-mail account) during the first week of classes with the details of your time zone to discuss suitable accommodation.

3   Policies regarding academic accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

- **Academic accommodations for students with disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or https://carleton.ca/pmc/ for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test requiring accommodation. After requesting accommodation from PMC, we can have a talk to ensure accommodation arrangements are made. For the deadline to request accommodations for the formally-scheduled exams, visit the PMC website, https://carleton.ca/pmc/.

- **Religious obligations and/or accommodation for pregnancy:** Write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see the student guide at https://carleton.ca/equity/accommodation/academic/students/.

4   Course schedule

The following is an overview of the course, listing important events and deadlines on a weekly basis. The section numbers in parentheses after each lecture title refer to the relevant sections of the textbook.

- **Week 1 (Jan 11–17):**

    - Tu, Jan 12: Lecture 1: Systems of Linear Equations (Section 1.1).
    - Th, Jan 14: Lecture 2: Matrices and Echelon Forms (Section 1.2).

- **Week 2 (Jan 18–24):**

  - Tu, Jan 19: Lecture 3: The Row Reduction Algorithm (Section 1.2)
  - Th, Jan 21: Lecture 4: Vector Equations, and the Matrix Equation $Ax = b$ (Sections 1.3 and 1.4).

- **Week 3 (Jan 25–31):**

  - Tu, Jan 26: Lecture 5: Solution Sets of Linear Systems (Section 1.5); Tutorial 1.
  - Th, Jan 28: Lecture 6: Linear Independence (Section 1.7); Quiz 1 released.
  - Su, Jan 31: Quiz 1 due.

- **Week 4 (Feb 1–7):**

  - Tu, Feb 2: Lecture 7: Applications of Linear Systems (Sections 1.6 and 1.10); Tutorial 2.
  - Th, Feb 4: Lecture 8: Introduction to Linear Transformations, and the Matrix of a Linear Transformation (Sections 1.8 and 1.9); Quiz 2 and Assignment 1 released.
  - Su, Feb 7: Quiz 2 due.

- **Week 5 (Feb 8–14):**

  - Tu, Feb 9: Lecture 9: Matrix Operations (Section 2.1); Tutorial 3.
  - Th, Feb 11: Lecture 10: The Inverse of a Matrix (Section 2.2).
  - Su, Feb 14: Assignment 1 due.

- **Week 6 (Feb 15–21):** Winter break (no classes).

- **Week 7 (Feb 22–28):**

  - Tu, Feb 23: Midterm; Tutorial 4.
  - Th, Feb 25: Lecture 11: Characterizations of Invertible Matrices (Section 2.3); Quiz 3 released.
  - Su, Feb 28: Quiz 3 due.

- **Week 8 (Mar 1–7):**

  - Tu, Mar 2: Lecture 12: Subspaces of $\mathbb{R}^n$ (Section 2.8); Tutorial 5.
  - Th, Mar 4: Lecture 13: Dimension of a Subspace, and Rank of a Matrix (Section 2.9); Quiz 4 released.
  - Su, Mar 7: Quiz 4 due.

- **Week 9 (Mar 8–14):**

  - Tu, Mar 9: Lecture 14: Introduction to Determinants, and Properties of Determinants 1 (Sections 3.1 and 3.2); Tutorial 6.
  - Th, Mar 11: Lecture 15: Properties of Determinants 2, and Cramer's Rule (Sections 3.2 and 3.3); Quiz 5 released.
  - Su, Mar 14: Quiz 5 due.

- **Week 10 (Mar 15–21):**

  - Tu, Mar 16: Lecture 16: Eigenvectors and Eigenvalues, and the Characteristic Equation 1 (Sections 5.1 and 5.2); Tutorial 7.
  - Th, Mar 18: Lecture 17: The Characteristic Equation 2, and Diagonalization (Sections 5.2 and 5.3); Quiz 6 released.
  - Su, Feb 21: Quiz 6 due.

- **Week 11 (Mar 22–28):**

  - Tu, Mar 23: Lecture 18: Introduction to Complex Numbers (Appendix B, and the lecture notes); Tutorial 8.
  - Th, Mar 25: Lecture 19: Complex Eigenvalues (Section 5.5); Quiz 7 and Assignment 2 released.
  - Su, Mar 28: Quiz 7 due.

- **Week 12 (Mar 29–Apr 4):**

  - Tu, Mar 30: Lecture 20: Inner Product, Length and Orthogonality (Section 6.1); Tutorial 9.
  - Th, Apr 1: Lecture 21: Orthogonal Sets (Section 6.2).
  - Su, Apr 4: Assignment 2 due.

- **Week 13 (Apr 5–11):**

  - Tu, Apr 6: Lecture 22: Orthogonal Projections (Section 6.3); Tutorial 10.
  - Th, Apr 8: Lecture 23: The Gram-Schmidt Process (Section 6.4); Quiz 8 released.
  - Su, Apr 11: Quiz 8 due.

- **Week 14 (Apr 12–18):**

  - Tu, Apr 13: Lecture 24: Least-Squares Problems (Section 6.5); Tutorial 11.

- **Exam period (Apr 16–27):** Final exam (exact date and time to be announced).