Department of Mathematics  
University of Toronto  

MAT223H1S - Linear Algebra I  
Winter 2006  
website: http://ccnet.utoronto.ca/20061/mat223h1s/  

<table>
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<tr>
<th>Section</th>
<th>Instructor</th>
<th>Office</th>
<th>Phone</th>
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<tbody>
<tr>
<td>L0101</td>
<td>V. Jurdjevic</td>
<td>ES4142</td>
<td>416-978-4952</td>
</tr>
<tr>
<td>L0201</td>
<td>S. Uppal</td>
<td>UC45</td>
<td>416-978-7481</td>
</tr>
<tr>
<td>L0202</td>
<td>A. Esterov</td>
<td>BA6119</td>
<td>416-978-4328</td>
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<tr>
<td>L5101</td>
<td>J. Adler</td>
<td>TBA</td>
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Course Coordinator  
S. Uppal. Office hours TBA.  

Brief Course Description  
This is the first undergraduate course in linear algebra taken by students from a variety of disciplines. The course covers: matrix arithmetic and linear systems, finite dimensional vector spaces (in particular the vector space $\mathbb{R}^n$), determinants, diagonalization, orthogonality in $\mathbb{R}^n$, least squares, introduction to linear mappings. Students will be required to understand all theoretical concepts involved, be able to solve the standard problems in each section and be able to do simple, short proofs of particular statements.  

Textbook  
W.K. Nicholson: *Linear algebra with Applications*, 4th edition. The book comes bundled with Lyryx which is an on-line computer support package for the text. If you already own the text, you can either buy the standalone passcode from the bookstore or on-line but this requires a credit card.  

Supplementary Texts  
Note: The Nicholson texts are available at the UofT Bookstore. Stanczak’s Study Manual may be purchased at Discount Textbooks, 229 College St.  

Tutorials  
Every student must be registered in one tutorial section. You may register in one of the tutorial time slots through ROSI before the end of the second week of classes. Registration
or any changes to your tutorial time after the second week of classes must be done in person through S. Uppal during his office hours. By the end of the third week of classes you will be enrolled in one tutorial section. Once your designated tutorial has been posted on the website, you will not be allowed to switch sections.

Tutorials begin the 4th week of classes. During your tutorials the TA will discuss some problems from the list below. Feel free to ask questions about the problems you have most difficulty with. Tutorials are an integral part of the course and should be regarded as just as important as lectures.

There will be one 45 minute quiz given in tutorials during the 11th week of classes. The quiz will consist of 4 questions based on the suggested homework problems given below and will be graded out of 20. You must write your quiz in the tutorial section you are registered in otherwise you will receive a grade of zero for the quiz. There will be no make-up quiz.

**On-line Assignments**

These can be found on-line at the Lyryx website for this course and will be graded electronically. The assignments will consist of the 23 Labs which accompany the 23 sections of the textbook that we will be covering (see Schedule and Suggested Problems below). The Labs may be attempted as many times as you like when they are available. In addition to the Labs, Lyryx offers lessons, narration and animations for the whole textbook which may be helpful but in no way should be considered a substitute for lectures and tutorials. To use Lyryx, you must first register on-line (using your passcode) for the course at

http://lila.lyrx.com

You may visit this website using the computers on campus should you not have access to one at home.

**Note:** The labs covering sections 1.1-1.3, 2.1-2.4, 4.1-4.3, 5.1-5.2 are available beginning January 9, 2006 until February 28, 2006. The labs covering sections 7.1, 7.8, 4.4, 5.4, 3.1-3.3, 5.3, 6.2-6.4 are available beginning February 28, 2006 until April 13, 2006.

**Midterm Exam**

There will be one 110 minute midterm exam common to all students during the seventh week of classes. The exact date and time will be posted on the website roughly two weeks before the test date. If you have a time conflict contact the course coordinator as soon as possible. There will be no make-up exams. The exam will be graded out of 60 and will consist of a mixture of true/false questions and short-answer questions. For the true/false questions only your final answer will be graded. Your mark for the short-answer questions will depend on the clarity of your presentation and correctness of your solution.

**Remarking Procedure**

Your exam/quiz will be returned to you in the tutorial section in which you are registered usually within one week of being written. If you have any questions about the grading of the short-answer questions on the exam/quiz you must return your paper to your TA within
10 minutes indicating on the front page which question you want to have remarked. If you take your exam/quiz with you it will not be regarded. You should collect your exam/quiz submitted for remarking from the course coordinator within three weeks otherwise your mark will not be changed. No exam/quiz will be remarked unless the original answer(s) were written in ink.

**Missed Term Work**
If you miss the midterm for a legitimate reason which you can document, your grading scheme will be adjusted by increasing the final exam component of your mark. However under no circumstances can the final exam count for more than 80% of your final mark. The documentation should be submitted to the course coordinator no later than 7 days after the date of the exam.

**Marking Scheme**
The format of the final exam will be similar to the format of the midterm and will be graded out of 100. Your final grade will be determined as follows:

<table>
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<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>On-line Assignments</td>
<td>10%</td>
</tr>
<tr>
<td>Quiz</td>
<td>10%</td>
</tr>
<tr>
<td>Midterm</td>
<td>30%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>50%</td>
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**Schedule and Suggested Problems**
You should solve at the very minimum the problems on the list below. As extra preparation for the midterm and final exam you may solve the problems from Stanczak’s Linear Algebra I Study Manual. Your instructor may be slightly ahead or behind this schedule but the topics covered on the quiz and midterm will be the same for all sections.

**Week 1** beginning January 9.
**Lecture:** Matrices. Systems of Linear Equations.
**Section 1.1:** 1(b), 2(d), 4, 6, 8(b), 11, 12, 16.
**Section 1.2:** 1, 3(d), 5(a)(e)(g), 7(b), 8(a)(d), 9(c)(d)(e)(f), 11(e), 12, 13, 15, 21.
**Section 2.1:** 3, 5, 9(b), 10, 13, 14, 15, 17, 18, 19.
**Section 2.2:** 1, 2(b), 4, 5, 6.

**Week 2** beginning January 16.
**Lecture:** Matrices and Systems of Linear Equations (continued).
**Section 1.3:** 1, 2(b)(d), 3, 4, 5, 6, 8.
**Section 2.2:** 8(b), 9, 10(a), 11, 12, 13, 14, 17, 20, 25, 26, 28, 33, 34, 35, 36, 37.
Week 3 beginning January 23.
Lecture: The Inverse of a Matrix. Elementary Matrices.
Section 2.3: 4, 5, 9, 10, 12, 16, 22, 25, 27, 29, 31, 32, 33, 34, 35, 36, 37, 38(a)(b), 40.
Section 2.4: 1, 2, 3, 6(b), 7(b). 8, 13, 18.

Week 4 beginning January 30. Tutorials begin.
Lecture: Vector Geometry.
Section 4.1: 4, 9, 10, 11, 13, 16, 18.
Section 4.2: 7, 10, 14, 15, 16, 23, 25, 29.
Section 4.3: 6(a)(b), 9, 11.

Week 5 beginning February 6.
Lecture: The Vector Space \( \mathbb{R}^n \).
Section 5.1: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 18, 20, 21, 22, 24, 25, 26.
Insert A: All problems.

Week 6 beginning February 13.
Lecture: Rank. Introduction to Euclidean \( n \)-space.
Section 5.2: 1, 2, 3, 4, 5, 7, 10, 11, 12, 13, 14, 16, 17.
Section 7.1: 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 24, 25, 29, 30, 31.

Week 7 beginning February 27. Midterm Exam covers 1.1-3, 2.1-4, 4.1-4.3, 5.1-2, Insert A.
Section 7.1: 1, 2, 3, 4(b), 5(a), 6, 7, 8(a), 9(d)(f), 10, 11, 14.

Week 8 beginning March 6.
Lecture: Least Squares. Introduction to Linear Transformations.
Section 7.8: 1, 5, 7(a).
Section 4.4: (d), 2(b), 3. Note: You do not need to read Section 4.4.
Section 5.4: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 19, 20, 22, 23.

Week 9 beginning March 13.
Lecture: Linear Transformations (continued). The Determinant.
Insert B: All problems.
Section 3.1: 1, 6, 7, 10, 11, 12, 13, 14, 18, 24.

Week 10 beginning March 20.
Lecture: The Determinant (continued).
Section 3.2: 2, 3, 4, 5, 6, 8, 9, 10, 12, 14, 16, 17, 18, 21, 22, 23, 24, 25, 28, 30.
Week 11 beginning March 27. Quiz covers 7.1, 7.8, 4.4, 5.4, 3.1-3.2
Section 3.3: 1, 3, 4, 6, 8, 9, 11, 12, 13, 14, 16, 17, 20, 21, 23, 25.
Section 5.3: 1, 2, 3, 4, 7, 8, 9, 10.

Week 12 beginning April 3.
Lecture: Finite Dimensional Vector Spaces.
Note: Having covered the vector space $\mathbb{R}^n$ (all proofs here mimic the proofs in $\mathbb{R}^n$) you need only read: Section 6.1, the definition of a vector space and Examples 5, 6; Section 6.2, Examples 4, 5, 6, 7, 8, 9; Section 6.3, Examples 7, 9; and Section 6.4, Examples 1, 3.
Section 6.2: 1(b)(c)(f), 3, 6, 7(a)(b), 8, 9(b).
Section 6.3: 2(a)(e)(f), 3, 5(d), 6(c)(d), 11(a), 12(a)(b)(c).
Section 6.4: 2(b), 3(d), 6.

Week 13 beginning April 10.
Lecture: Catch Up/Review.