SYLLABUS

Course Title: Math235, Introduction to Linear Algebra
Sections and Instructors:

1	**LEC**	**MWF 1:25 - 2:15**	**Jennifer Li**
2	**LEC**	**MWF 11:15 - 12:05**	**Jonathan Simone**
3	**LEC**	**TuTh 11:30 - 12:45**	**Tina Kanstrup**
4	**LEC**	**TuTh 10:00 - 11:15**	**Alexei Oblomkov**
5	**LEC**	**MWF 12:20 - 1:10**	**Martina Rovelli**
6	**LEC**	**MW 4:00 - 5:15**	**Robert Kusner**
7	**LEC**	**TuTh 1:00 - 2:15**	**Tina Kanstrup**
9	**LEC**	**TuTh 8:30 - 9:45**	**Alexei Oblomkov**

Office: [all-remote during COVID pandemic, so please email your instructor]

Remote learning: synchronous–optional

Prerequisites: MATH 132, or 136, or consent of instructor. (Gen.Ed. R2). [Note: Because this course presupposes knowledge of basic math skills, it will satisfy the R1 requirement upon successful completion.]

Required materials: *Linear algebra and its applications* (5th edition) by David Lay, Steven Lay, and Judi McDonald is our main textbook (a hard-cover copy of the book could be purchased through www.umass.ecampus.com);

MyLab Math from Pearson (https://mlm.pearson.com/northamerica/mymathlab/) is used for homework, the electronic version of the book comes for free with MyLab Math;

Gradescope is used for the midterm and final exams (https://www.gradescope.com**)**

Course Description: Basic concepts of linear algebra. Matrices, determinants, systems of linear equations, vector spaces, linear transformations, and eigenvalues.

Learning Objectives:

* Learn the Gauss-Jordan elimination algorithm for reduction of a matrix to echelon form
* Apply the elimination algorithm to solve linear systems, and compute rank of a matrix
* Learn about abstract vector spaces and methods for computing vector space bases
* Learn about eigenvectors, eigenvalues and methods for computing high powers of a matrix
* Learn about inner product and orthogonal projection
* Master the language of abstract linear algebra and thus provide an intro to reasoning and proofs
* Become familiar with the geometric meaning of the solution to a linear system

SYLLABUS

Course Requirements:

Any student enrolled in the course is expected to

* Attend weekly meeting with instructors (consult Spire for exact times).
* Complete weekly online homework (MyLab Math, see above).
* Take 2 Midterm exams and the Final exam.

Class prep videos (to be watched BEFORE each class):
https://people.umass.edu/jsimone/videolinks.html

Weekly assignments/topics/exams:

2/1–2/5: 1.1 Systems of linear equations; 1.2 Row reduction and echelon forms; 1.3 Vector equations.

2/8-2/12: 1.3 (continued); 1.4 The matrix equation Ax=b; 1.5 Solution sets of linear systems.

2/15-2/19: 1.7 Linear independence; 1.8 Introduction to linear transformations.

2/22-2/26: 1.9 The matrix of a linear transformation; 2.1 Matrix operations.

3/1-3/5: 2.2 The inverse of a matrix; 2.3 Characterizations of invertible matrices.

3/4: Midterm 1

3/8-3/12: 3.1 Introduction to determinants; 3.2 Properties of determinants.

3/15-3/19: 3.2 (continued); 3.3 Cramer's rule, volume, and linear transformations; 4.1 Vector spaces and subspaces.

3/22-3/26 4.2 Null spaces, column spaces, and linear transformations; 4.3 Linearly independent sets and bases.

3/29-4/2: 4.4 Coordinate systems; 4.5 The dimension of a vector space.

4/5-4/9: 4.6 Rank; 5.1 Eigenvectors and eigenvalues.

4/8: Midterm 2

4/12-4/16: 5.1 (continued); 5.2 The characteristic equation.

4/19-4/23: 5.3 Diagonalization; 5.5 Complex eigenvalues.

SYLLABUS

4/26-4/30: 6.1 Inner product, Length, and Orthogonality; 6.2 Orthogonal sets, 6.3 Orthogonal projections.

5/3-5/5: 6.3 (continued), 6.4 The Gram-Schmidt process.

TBA: Final Exam

Course information and communication:
Course materials for your section will be posted at on the Moodle page of your section instructor.

Weights of Course Components towards Final Course Grade:

Homework (30%) + Midterm 1 (20%) + Midterm 2 (20%) + Final (20%) + Participation (10%)

Participation component is decided by the individual instructors. The course is optional synchronous. However, students are expected to participate in the synchronous activities organized by the instructors.

The exams and midterms are synchronous and open-book. Instructors are available by email or Zoom during the exams.

Additional time periods are available for students with special accommodations or other documented conflicts. Please contact your instructor by email AT LEAST **ONE WEEK BEFORE** THE EXAM DAY to discuss your particular situation.

Grading Scale:

A : 90-100
A-: 86-89
B+: 82-85
B : 76-81
B-: 72-75
C+: 68-71
C : 62-67
C-: 58-61
D+: 54-57
D : 48-53
F : Below 48

Make-up Policy: If you have a documented conflict for one of the exams, in order to take the make-up exam you must give the course chair Alexei Oblomkov oblomkov@math.umass.edu at least one weeks' written notice for a midterm exam and at least two weeks' written notice for the

final exam. Other make-up exams (for example due to medical emergencies) will be handled by your section instructor. Make-up exams will *not* be given to accommodate travel plans.

Electronic submissions: It is each student's responsibility to make sure any electronic submissions go through successfully (uploaded, no blurry images, the questions and answers match) and to check with the instructor that the submission was successful.

Contingency plan: Instructors or students may have difficulties with their own technology or internet access, the university may experience technology issues with campus technology, or there may be national or world-wide technology outages related to our communication tools, including Zoom.

Accommodation Statement: The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.

Academic Honesty Statement: Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent (http://www.umass.edu/dean_students/codeofconduct/acadhonesty/).

Chegg, Discord and other online help resources: Seeking answers from any website is a clear violation of the academic honesty policy, while submitting course materials to these sites or similar ones is a violation of the instructor's copyright. Instructors may be monitoring such websites throughout the semester.

General Education statement:
MATH 235 is a three-credit GenEd course that satisfies the R1 (Basic Math Skills) and R2 (Analytic Reasoning) general education requirements for graduation.

SYLLABUS

The General Education Program at the University of Massachusetts Amherst offers students a unique opportunity to develop critical thinking, communication, and learning skills that will benefit them for a lifetime. For more information about the General Education Program, please visit the GenEd web page.

Learning Outcomes for all GenEd courses like Math 235 satisfy the following general education objectives:

Content: Know fundamental questions, ideas, and methods of inquiry/analysis used in mathematics: Students will learn to analyze linear systems, transformations, and spaces using matrices. In learning Linear Algebra, students will develop abstract reasoning skills to understand higher dimensional systems and spaces that we cannot directly visualize.

Critical Thinking: Students demonstrate creative, analytical, quantitative, & critical thinking through inquiry, problem solving, & synthesis: Students will use critically thinking skills to develop and understand the theory of matrices and the linear systems, transformations, and spaces that they represent, as well as computational skills to analyze these matrices efficiently.

Communication: Develop informational and technological literacy: Students will develop their writing skills by articulating their reasoning of computations made and writing formal proofs during the course.

Demonstrate capacity to apply disciplinary perspectives and methods of analysis to real world problems (the larger society) or other contexts: Real-world and theoretical applications across all fields can be represented, or estimated, in Linear Algebra by matrices. Students will learn logical and computational methods to analyze these matrices.

Learning Outcomes for the R1 and R2 Designations:

Because Math 235 presupposes basic math skills, it carries the designation for the Basic Math Skills requirement (R1). In addition, the course satisfies the following objectives of the Analytic Reasoning requirement (R2):

Advance a student's formal or mathematical reasoning skills beyond the level of basic competence: In learning Linear Algebra in Math 235, students will think critically and advance their mathematical reasoning skills by analyzing matrices and the linear systems, transformations, and spaces that they represent.

Increase the student's sophistication as a consumer of numerical information: Linear Algebra provides an efficient, yet abstract, way to analyze numerical information from concepts across mathematics. Applications across all fields can be represented, or estimated, by matrices. Students will form these connections between mathematical theories and linear algebra, as well as learn methods within linear algebra to make related formal computations.