MTH 342: Linear Algebra II (4 credits)
Section 010 - CRN 34717

Winter 2020

Instructor: Dr. Filix Maisch, maischf@math.oregonstate.edu

Instructor Office Hours: Kidder 368C, MWF 9:30-10:20am (Wed. hrs in MSLC – KIDD 108)

Teaching Assistant (TA): Matthias Merzenich, merzenim@science.oregonstate.edu

TA Office Hours: Kidder 264, TBAD

*** Please take advantage of our office hours to get help!! We are here for you. ***

Lecture Meetings: MWF 3-3:50 PM in Bexell Hall 412

Recitation Meetings: Th 3-3:50 PM in Kidder Hall 108H

Prerequisites: Math 341 with a C- or better.

Textbooks: Linear Algebra Done Wrong by Treil and Linear Algebra Done Right by Axler (Both available for free! – Links on web page)

Catalog Course Description: We will cover abstract vector spaces, linear transformations, inner product spaces, orthogonality, eigenspaces, diagonalization, spectral theorems, and singular value decomposition.

Course Content: Abstract vector spaces, with an emphasis on the spaces of matrices and functions, and their subspaces. We will then discuss linear maps (maps between two vector spaces) and spectral theory of linear maps. From here, we will discuss the notion of an inner product and distance (norm) in vector spaces. We will also discuss orthogonality of vectors and singular value decomposition. An important element of this course is to practice writing detailed proofs.
**Course Specific Learning Outcomes:** A successful student in Math 342 will be able to:

1. Identify abstract vector spaces and write arguments (proofs) about them using the main definitions regarding linear independence, bases, linear transformations and their matrix representations, change of bases, subspaces, spectral theory, etc.

2. Identify inner product spaces and write arguments regarding orthogonality, norms, adjoint linear transformations, unitary transformations, isometries, etc.

3. Utilize the Gram-Schmidt algorithm to convert a system of vectors to an orthogonal system.

4. Find the characteristic polynomial, eigenvalues, and eigenvectors of square matrices and write arguments using the concepts in general, including diagonalizability, as they apply to square matrices of any size.

5. Find singular value decompositions of square matrices.

**Grading:** Your grade is determined by a syllabus quiz, recitation activities, unannounced lecture discussion quizzes, written homeworks, a midterm and a final.

The course will be graded as follows

- Syllabus quiz 2%
- Written homework 20%
- Recitation activities 12%
- Unannounced lecture discussion quizzes 10%
- Midterm 24%
- Final 32%

Your grade in the course will not be harder than:

A-/A 90% - 100%, B-/B/B+ 80% - 89.99%, C/C+ 70% - 79.99%, D 60%-69.99%, F 0%-59.99%.

**Syllabus Quiz:** A short (canvas) quiz testing your knowledge of this syllabus will be available during weeks 1 and 2. It’s due on Sunday, Jan. 19th. It is a quiz in the sense that you get 1 attempt per problem to get it right (just like as if you turned it in on paper).

**Exams:** There will be one midterm and a cumulative final exam. Calculators are NOT allowed on these exams. You may have one handwritten 4 inch by 6 inch note card for each exam. The final does NOT replace the midterm. Tests are not allowed to be made-up on an alternate date unless the circumstances are truly exceptional and contact requesting the accommodation is made PRIOR to the test. **Gradescope will be used to grade exams.** There will be an access link through Canvas (and an email sent out after the midterm for you to review your performance). Through this online platform you will be able to see your graded midterm exam and be able to request a regrade on any of the problems. In order to review your final performance, please make an appointment with me at the start of the next term.

- Midterm: Mon. Feb. 10th, 3:00-3:50 PM, Bexell Hall 412
- Final Exam: Fri. March 20th, 9:30-11:20 AM, Bexell Hall 412 (unless otherwise announced)
Mathematical Software: Matlab is a helpful program, however it is not required for this course. Nevertheless, you are encouraged to learn how to use Matlab during the course by working on some bonus homework problems. You can download Matlab with OSUs license to your personal computer here:

https://is.oregonstate.edu/service/software/matlab.

If you are unable to install it on your computer, you can use the online version through Citrix Receiver (see the course web page for instruction). Or you can use computers at the lab room Kidder Hall 108J almost anytime from 9 AM to 4 PM, Monday through Friday.

Recitation Activities: During Thursday’s recitation meeting, you will be asked to work on an activity, which is to be collected and graded according to policies and procedures set forth by the teaching assistant leading the recitation.

Written Homework Assignments: There will be 8 written homework assignments, due at the beginning of class (3PM) at the end (Fridays) of weeks 2, 3, 4, 6, 7, 8, 9 and 10. The bonus problems are optional. Doing them correctly can give you up to 6 bonus points (adding up to a maximum of 36 points/HW). If you do a Matlab problem, you should print your code(s) and attach them to your homework. You are encouraged to work together in groups, however, homework must be written individually in your own words and reflect your own understanding. Late homework will not be accepted, so turn-in whatever you have completed by the due time. Only a few selected problems will be graded in detail. The rest will be given credit based on completion.

Lecture Discussion Quizzes: Given (unannounced) during many of the lectures are questions to be answered through a Canvas quiz, which will open and close during lecture. During the window of time the quiz is open you are given unlimited chances to answer. You are encouraged to work with your fellow classmates, ask me for help and to share your work/answers. No make-ups are allowed unless you can prove you missed class due to an OSU-based obligation. The lowest 4 of these will be dropped.

Student Conduct Code: Students are expected to be familiar with Oregon State University’s Expectations for Student Conduct. Please review these at the following web link:

http://studentlife.oregonstate.edu/code

Students With Disabilities: Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

MSLC: The Math and Statistics Learning Center (MSLC) is in Kidder 108. You can go there for free drop-in tutoring. The hours are MTWTh 9-5, Fri 9-4, and Sunday through Thursday evenings 7-10.

Reach Out for Success: University students encounter setbacks from time to time. If you encounter difficulties and need assistance, its important to reach out. Consider discussing the situation with an instructor or academic advisor. Learn about resources that assist with wellness and academic success at oregonstate.edu/ReachOut. If you are in immediate crisis, please contact the Crisis Text Line by texting OREGON to 741-741 or call the National Suicide Prevention Lifeline at 1-800-273-TALK (8255).
**Inclusion Statement:** It is my intent that students from all diverse backgrounds and perspectives be well-served by this course, that students’ learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender identity, sexual orientation, disability, age, socioeconomic status, ethnicity, race, religion, culture, perspective, and other background characteristics. Your suggestions about how to improve the value of diversity in this course are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups.

**Student Evaluation of Courses:** The online Student Evaluation of Teaching system opens to students the Monday of dead week and closes the following Sunday. Students will receive notification, instructions and the link through their ONID. They may also log into the system via Online Services. Course evaluation results are extremely important and used to help improve courses and the learning experience of future students. Responses are anonymous (unless a student chooses to sign their comments agreeing to relinquish anonymity) and unavailable to instructors until after grades have been posted. The results of scaled questions and signed comments go to both the instructor and their unit head/supervisor. Anonymous (unsigned) comments go to the instructor only.

**Course (Tentative) Calendar:**

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<thead>
<tr>
<th>Week</th>
<th>Mon.</th>
<th>Wed.</th>
<th>Fri.</th>
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<tbody>
<tr>
<td>1</td>
<td>Vector Spaces</td>
<td>Linear Dependence and Bases</td>
<td>Linear Transformations</td>
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<tr>
<td>2</td>
<td>Linear Transformations</td>
<td>Isomorphisms</td>
<td>Subspaces (HW 1 due)</td>
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<tr>
<td>3</td>
<td>MLK JR DAY (no class)</td>
<td>Linear Equations</td>
<td>Dimension, null space and range (HW 2 due)</td>
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<td>4</td>
<td>Change of Basis</td>
<td>Polynomial background</td>
<td>Spectral Theory (HW 3 due)</td>
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<tr>
<td>5</td>
<td>Spectral Theory</td>
<td>Spectral Theory</td>
<td>Review</td>
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<tr>
<td>6</td>
<td>Midterm Exam</td>
<td>Inner Product Spaces</td>
<td>Inner Product Spaces (HW 4 due)</td>
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<td>7</td>
<td>Inner Product Spaces</td>
<td>Inner Product Spaces</td>
<td>Operators in IPS (HW 5 due)</td>
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<td>8</td>
<td>Operators in IPS</td>
<td>Operators in IPS</td>
<td>Singular Value Decomposition (HW 6 due)</td>
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<td>9</td>
<td>Singular Value Decomposition</td>
<td>Singular Value Decomposition</td>
<td>Selected Topics (HW 7 due)</td>
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<td>10</td>
<td>More Selected Topics (if time)</td>
<td>Catch-up/Review</td>
<td>Final Review (HW 8 due)</td>
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<td>Finals</td>
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Note: Syllabus Quiz due Sun. 1/19/2020.

A note on course credits: *This course expects approximately 120 hours of your effort for 4 credits.*