MTH 443/543: Abstract Linear Algebra

Catalog Description: Abstract vector spaces. Linear transformations, eigenvalues and eigenvectors, the Jordan canonical form, inner product spaces.

Credits: 3
Terms offered: F
Prerequisite for MTH 443: MTH 342 and MTH 343.
Prerequisite for MTH 543: MTH 342 and MTH 343 or equivalent undergraduate coursework.
Meets: Three 50 minute lectures weekly.
Fall 2013 Instructor: Thomas Schmidt
Course Content: The content of this course includes the following.

1. Abstract vector spaces.
2. Bases.
3. Dimension.
4. Inner product spaces.
5. Linear transformations, eigenvalues, diagonalization.
6. Characteristic polynomials.
7. Minimal polynomials.
8. Jordan Canonical Form.

Learning Resources: The following text book is required:
The following text book is optional:

Learning Outcomes for MTH 443: Upon completing MTH 443 a successful student is expected to be able to do the following.

1. Develop drafts of mathematical proofs using mathematical language together with standard English.
2. State and use the definitions of the main objects of study: field, vector space, linear dependence, spanning set, basis, linear transformation, linear operator, matrix of a linear transformation, characteristic polynomial, minimal polynomial, dual space, invariant subspace.
3. Understand and discuss the standard examples of vector spaces, such as the space of polynomials over a field.

4. State, prove, and apply the Rank-Nullity Theorem and the Cayley-Hamilton Theorem.

5. Find Jordan bases for linear operators.

**Differentiated Learning Outcomes for MTH 543:** Upon completing MTH 543 a successful student is expected to be able to do the following.

1. Write concise proofs using mathematical language together with standard English.

2. State and apply the definitions of the main objects of study: field, vector space, linear dependence, spanning set, basis, linear transformation, linear operator, matrix of a linear transformation, characteristic polynomial, minimal polynomial, dual space and dual basis, invariant subspace, Jordan bases, and inner products.

3. Understand and discuss the standard examples of vector spaces, such as the space of polynomials over a field and the space of linear transformations on a vector space.

4. Understand and compose a basic argument that uses Zorn’s Lemma.

5. State, prove, and apply the main theorems of the course: the Rank-Nullity Theorem, the Cayley-Hamilton Theorem, and the Spectral Theorem.

6. Find Jordan bases for linear operators.

**Evaluation of Student Learning:** (Approximate percentages given.) Evaluation of students enrolled in MTH 443 will be based on the following.

- Homework problems: 35 %
- Midterm : 30 %
- Final Exam: 35 %

**Students with Disabilities:** Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098.

**Student Conduct:** All students are expected to obey OSU’s student conduct regulations. Here is the link to OSU’s Statement of Expectations for Student Conduct: http://oregonstate.edu/admin/stucon/achon.htm

Course revised Spring 2013, syllabus submitted July 15, 2013