Department of Mathematics

Course Profile

Course Number: MATH 343	**Course Title: Advanced Linear Algebra**
Required / Elective: Elective	**Prerequisite:** none
Catalog Description: Vector spaces, subspaces, bases and dimension, quotient spaces, linear independence, orthonormal basis, and Gram-Schmidt orthogonalization. Linear transformations; kernel, image, rank, invertibility, diagonalization, matrix of a linear transformation. Determinants. Canonical forms: eigenvectors, eigenvalues, characteristic polynomial, minimal polynomial, symmetric matrix, direct sum decomposition, invariant subspaces, Jordan canonical forms of a matrix, the Cayley-Hamilton theorem	**Textbook / Required Material:** GELFAND I.M. *Lectures on linear algebra,* Dover Publications, 1989 .
Course Structure / Schedule: (3+0+0) 3 / 7 ECTS	
Extended Description: Real vector spaces: i) definition; ii) subspaces; iii) span and linear independence; iv) basis and dimensions; Linear spaces with inner product: i) definition of the inner product; ii) Gram-Schmidt Process iii) orthonormal basis. Linear transformation in linear spaces and their matrix representations: i) kernel and range of a linear transformation; ii) matrix of a linear transformation. Determinants: i) definition and properties of determinants; ii) cofactor expantion; iii) finding inverses by using cofactors. Eigenvalues and eigenvectors: i) characteristic polynomial and equation of a linear operator; ii) the Cayley-Hamilton theorem iii) eigenvalues and eigenvectors; iv) invariant subspaces; v) diagonalization of symmetric matrices. Jordan cells and Jordan canonical form. Other canonical forms. Minimal polynomial. Resolvent matrix.	
Design content: None	**Computer usage:** No particular computer usage required.

Course Outcomes: By the end of the course the students should be able to:

1. recognize the basic ideas and main computational techniques of advanced linear algebra. **[3,6],**
2. work with abstract concepts of modern mathematics and to read and write proofs of mathematical statements. **[3,6],**
3. apply methods of advanced linear algebra such as linear space, invariant subspace, canonical forms and so on in other fields of mathematics, engineering and science. **[2,3,6].**

[2] demonstrate knowledge of mathematics to construct, analyze and interpret mathematical models,
[3] demonstrate the ability to apply mathematics to the solutions of problems,
[6] have a basic knowledge of the main fields of mathematics, including analysis, algebra, differential equations, differential geometry.

Recommended reading: Any textbook on advanced linear algebra
Teaching methods: Pre-readings and lectures.
Assessment methods: Midterm exams, final exam
Student workload: Preparatory reading ..... 70 hrs Lectures, workshop, discussions ……. 45 hrs Homework ……... 35 hrs Midterm Exams ……15 hrs Final Exam ……10 hrs **TOTAL …… 175 hrs … to match 25 x 7 ECTS**

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