

Linear Algebra

Course Administrative Details

Course Title	Linear Algebra		
Instructor(s)	Yaroslav Kholodov	Instructor's e-mail	kholodov@crec.mipt.ru
Course #	XXX	Course Type	Core
Faculty	Computer Science and Engineering	Major	All
Academic year	2016-2017	Semester Offered	Spring
No. of Credits	6 ECTS	Total workload on average	[Ex: 12 hrs. per week inc. 8 hrs. of self-study]
Lecture Hours	2 per week	Seminar Hours	2 per week
Language	English (Russian)	Frequency	Weekly
Target Audience	Bachelors	Anticipated Enrollment	129 students
Studying year	1		
Grading Mode	A, B, C, D	Keywords	Graph of a function, Limit, Differentiation, Taylor formula, L'Hospital's rule, Integration, Convergence, Divergence, Taylor series

Course outline

This course covers matrix theory and linear algebra, emphasizing topics useful in other disciplines. Linear algebra is a branch of mathematics that studies systems of linear equations and the properties of matrices. The concepts of linear algebra are extremely useful in physics, computer sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in high-level mathematics.

Course Delivery

The course will be given over spring semester, one day per week. There will be two 2-hour classes per day one lecture and one seminar. There are ten assignments. Tutorial exercises will be set. There is a mid-term exam and a final examination.

Prerequisite courses

There is no course which is a prerequisite for this course.

Required background knowledge

To succeed in this course, you will need to be comfortable with vectors, matrices, and three-dimensional coordinate systems. This material is also presented in the first few lectures. The basic operations of linear algebra are those you learned in high school – addition and multiplication to produce "linear combinations." But with vectors, we move into four-dimensional space and n -dimensional space.

Course structure

[Example: IA – Individual Assignment, RQ – reading questions, GA – group assignment etc.]

Week#	Topic	Assignments
Week 1	The geometry of linear equations. Elimination with matrices.	
Week 2	Matrix operations, including inverses. LU and LDU factorization.	
Week 3	Transposes and permutations. Vector spaces and subspaces.	IA-1 out
Week 4	The null space: Solving $Ax = 0$. Rectangular $PA = LU$ and $Ax = b$.	IA-2 out
Week 5	Row reduced echelon form. Basis and dimension.	IA-3 out
Week 6	The four fundamental subspaces. Orthogonality.	IA-4 out
Week 7	Projections and subspaces. Least squares approximations.	IA-5 out
Week 8	Mid-term Exam	

Week 9	Gram-Schmidt and $A = QR$. Properties of determinants.	
Week 10	Formulas for determinants. Applications of determinants.	IA-6 out
Week 11	Eigenvalues and eigenvectors. Diagonalization	IA-7 out
Week 12	Differential equations.	IA-8 out
Week 13	Symmetric matrices. Positive definite matrices.	IA-9 out
Week 14	Similar matrices. Singular value decomposition (SVD).	
Week 15	Linear transformations. Diagonalization and the pseudoinverse.	IA-10 out

Textbook

- Gilbert Strang. *Linear Algebra and Its Applications*, 4th Edition, Brooks Cole, 2006. ISBN: 9780030105678

Reference Materials

- Gilbert Strang. *Introduction to Linear Algebra*, 4th Edition, Wellesley, MA: Wellesley-Cambridge Press, 2009. ISBN: 9780980232714.
- Gilbert Strang, Brett Coonley, Andrew Bulman-Fleming. *Student Solutions Manual for Strang's Linear Algebra and Its Applications*, 4th Edition, Thomson Brooks, 2005. ISBN-13: 9780495013259.

Computer Resources

No computer resources are required for this course

Laboratory Exercises

There are no laboratory exercises for this course

Laboratory Resources

No laboratory resources are required for this course

Grading criteria

Assignments (10%), Two intermediate tests (15% each), Mid-term Exam (30%), and Final Exam (30%)

Late Submission Policy

This policy will be strictly applied in this course. If a personal emergency should arise that affects your ability to turn in an assignment in a timely fashion, you must contact the course instructor *BEFORE* the deadline to get a "Special Late Submission Approval" from the course instructor. Without the "Special Late Submission Approval" submissions will be still accepted up to 3 days late, but with a 25% penalty for each delay day. No "Special Late Submission Approval" will be granted after the deadline. All submissions should be submitted directly to the instructors.

Cooperation Policy and Quotations

We encourage vigorous discussion and cooperation in this class. You should feel free to discuss any aspects of the class with any classmates. However, we insist that any written material that is not specifically designated as a Team Deliverable be done by you alone. This includes answers to reading questions, individual reports associated with assignments, and exams. We also insist that if you include verbatim text from any source, you clearly indicate it using standard conventions of quotation or indentation and a note to indicate the source.