ECTS catalog with learning outcomes
University of Montenegro

Faculty of Science and Mathematics / MATHEMATICS / LINEAR ALGEBRA 1

Course:	LINEAR ALGEBRA 1			
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
3967	Mandatory	1	8	4+3+0
Programs	MATHEMATICS			
Prerequisites	no			
Aims	Standard course of Linear algebra for students of mathematics. Includes theory of finite-dimensional vector spaces, matrices, systems of linear equations and linear mappings in finite-dimensional vector spaces (including spectral theory).			
Learning outcomes				
Lecturer / Teaching assistant	Vladimir Jaćimović, Dušica Slović			
Methodology	lectures, seminars, consultations			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	Groups and fields. Vector spaces. Definition. Examples. Vector subspaces. Linear span.			
I week exercises	Groups and fields. Fields of real and complex numbers. Geometric vectors in the plane.			
II week lectures	Linearly dependent and independent vectors. Base and dimension of vector spaces. Isomorfism of vector spaces.			
II week exercises	Vector spaces. R^n and C^n. Vector subspaces. Linear span.			
III week lectures	Matrices. Gauss method for solving linear systems of equations. Matrices of elementary transforms.			
III week exercises	Linearly dependent and independent vectors. Base and dimension of vector spaces. Problems and examples in R^n. Subspaces in R^n. Systems of linear equations.			
IV week lectures	Determinants of square matrices. Rank of matrix.			
IV week exercises	Gauss method for solving systems of linear equations. Matrices. Matrices of elementary transforms.			
V week lectures	Inverse matrix. Regular and singular matrices. Matrices of change of bases. Equivalent matrices.			
V week exercises	Determinant and rank of matrix.			
VI week lectures	Systems of linear equations. Existence and uniqueness of solution. General solution. Kronecker Capelli theorem. Cramers' rule.			
VI week exercises	Inverse matrix. Regular and singular matrices. Matrices of coordinate change.			
VII week lectures	1st test			
VII week exercises	1st test			
VIII week lectures	Empty week.			
VIII week exercises	Empty week.			
IX week lectures	Linear mappings in vector spaces. Definition. Examples. Kernel and image of linear mapping.			
IX week exercises	Homogeneous and nonhomogeneous systems of linear equations. Methods of solving. Existence and uniqueness of solution. Cramers' rule.			
X week lectures	Matrix of linear mapping. Similar matrices. Inverse mapping. Rank of linear mapping.			
X week exercises	Linear mappings in vector spaces. Kernel and image of linear mapping. Examples: operators of projection, rotation and differentiation of polynomials.			
XI week lectures	Invariant subspaces of linear mapping. Eigenvalues and eigenvectors. Eigenspaces.			
XI week exercises	Matrix of linear mapping. Inverse mapping. Rank of linear mapping.			
XII week lectures	Fundamental theorem of algebra. Characteristic polynomial of linear mapping. Polynomials of matrices/operators. Hamilton-Cayley theorem.			
XII week exercises	Eigenvalues and eigenvectors of linear mapping. Characteristic polynomial of linear mapping.			
XIII week lectures	Jordan form and cannonical base of nilpotent linear mapping.			
XIII week exercises	Method of calculation of eigenvectors. Eigenspaces.			

XIV week lectures	Jordan form of linear mapping. Examples.
XIV week exercises	Jordan form of linear mapping. Similar matrices.
XV week lectures	2nd test
XV week exercises	2nd test
Student workload	4 hours/week lectures + 3 hours/week seminars + 4 hours/week homework = 11 hours/week. Total: 11 hours/week x 16 weeks = 176 hours

Per week	**Per semester**
8 credits x 40/30=10 hours and 40 minuts 4 sat(a) theoretical classes 0 sat(a) practical classes 3 excercises **3 hour(s) i 40 minuts** of independent work, including consultations	Classes and final exam: **10 hour(s) i 40 minuts x 16 =170 hour(s) i 40 minuts** Necessary preparation before the beginning of the semester (administration, registration, certification): **10 hour(s) i 40 minuts x 2 =21 hour(s) i 20 minuts** Total workload for the subject: **8 x 30=240 hour(s)** Additional work for exam preparation in the preparing exam period, including taking the remedial exam from 0 to 30 hours (remaining time from the first two items to the total load for the item) **48 hour(s) i 0 minuts** Workload structure: **170 hour(s) i 40 minuts (cources), 21 hour(s) i 20 minuts (preparation), 48 hour(s) i 0 minuts (additional work)**
Student obligations	
Consultations	1 hour/week (lectures) + 1 hour/week (seminars)
Literature	M. Jaćimović, I. Krnić „Linearna algebra, teoreme i zadaci“ (skripta) E. Shikin „Lineinie prostranstva i otobrazheniya“, Moskva 1987. S. Friedberg, A. Insel, L. Spence „Linear algebra, 4th edition“ Pearson, 2002.
Examination methods	attendance (5 points), homework (5x1 points), 2 tests (2x30 points), one corrective test, final exam (30 points), corrective final exam, 2 brief oral exams (optional – 2x5 points)
Special remarks	The language of instruction is Serbo-Croat. Lectures can be given in English or Russian language.
Comment	

Grade:	F	E	D	C	B	A
Number of points	less than 50 points	greater than or equal to 50 points and less than 60 points	greater than or equal to 60 points and less than 70 points	greater than or equal to 70 points and less than 80 points	greater than or equal to 80 points and less than 90 points	greater than or equal to 90 points