COURSE NAME	LINEAR ALGEBRA						
Code	PMM714	Year of study	1st year of undergraduate study				
Course teacher	TANJA VUČIČIĆ BORKA JADRIJEVIĆ	Credits (ECTS)	8				
Associate teachers		Type of instruction (number of hours)	L	S	E		
			45		45		
Status of the course	COMPULSORY	Percentage of application of e-learning	10%				

COURSE DESCRIPTION

Course objectives	Presentation of a standard undergraduate Linear algebra course material in a way which helps students to master subjects like linear maps, matrices, determinants, eigenvalues and eigenvectors, Gaussian reduction etc. The course focuses both on theory and on calculating using a developmental approach. Many carefully chosen examples serve to emphasize motivation and naturalness. Towards the end of the course the subject is advanced by being developed for richer, inner product space structure and the corresponding unitary maps.
Course enrolment requirements and entry competences required for the course	An acquaintance with the algebraic structure of vector space gained from a one-semester introductory mathematical course. In internal case: taken course "Introduction to Algebra with Analitic Geometry".
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Upon successful completion of the course student should 1) understand why it suffices to define a linear map on a basis of the vector space (v.s. for short); 2) gain skills in matrix calculus and in evaluating determinants; 3) be able to associate a matrix with a linear transformation with respect to different bases and understand the relationship between two such matrices; 4) distinguish consistent from inconsistent linear systems of equation; 5) be able to effectively solve a system of linear equations with several unknowns using different methods/algorithms; 6) recognize an eigenvalue problem and be able to compute eigenvalues and eigenvectors; 7) understand in what way both an inner product and a norm enrich the structure of v.s.; 8) be able to construct an orthonormal basis by means of the Gram-Schmidt orthonormalization process.
Course content broken down in detail by weekly class schedule (syllabus)	1. Linear maps and their characteristic features. Examples. Isomorphism of vector spaces. (3 hours) 2. Image and inverse image of a vector subspace under linear transformation. Image and kernel of a linear map. Rank and nullity of a linear map. (3 hours) 3. Algebraic structure of the sets Hom(U,V) and HomV. Linear functional, examples. Dual space. (3 hours) 4. Definition of a matrix. Matrix adition, scalar multiplication and matrix multiplication. V.s. M_{mxn} and algebra M_n. General linear group. Orthogonal group. (3 hours)

	5. Rank of a matrix and its practical evaluation. Elementary transformations. Canonical matrix. 6. Determinant and its basic properties. Binet-Cauchy theorem. (3 hours) 7. Laplace's expansion. Adjoint matrix. Determinant and matrix regularity. Coordinatization of v.s. and transformation of coordinates. (3 hours) 8. Representing linear maps (transformations) with matrices. Matrix similarity. Characteristic polynomial. Hamilton-Cayley theorem. (3 hours) 9. Minimal polynomial. Invariant subspace. Eigenvalue and the associated eigenspace. (3 hours) 10. Diagonalizability of a matrix (a transformation). System of linear equations – the notion and consistency problem. (3 hours) 11. Cramer's rule. Description of the solution set to a (non)homogeneous system of linear equations. 12. Elementary reduction operations on system of equations (matrix rows). Gauss's method. Inner product space; examples. (3 hours) 13. Cauchy-Schwarz inequality. Norm on inner product space, angle, orthogonality. Gram matrix. Gram-Schmidt orthonormalization process. (3 hours) 14. Fourier coefficients. Calculation in an orthonormal basis. Orthogonal complement. Orthogonal projection. Unitary maps preserving inner product, examples and properties. (3 hours) 15. Characterizations of a unitary map (without proof). Unitary group. Diagonalizability of a unitary and orthogonal transformation (without proof). Orthogonal transformations of R^3. (3 hours)		
Format of instruction	Lectures and exercises		
Student responsibilities	Attending classes and taking exams.		
Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Attending classes: 2,5 ECTS Written test: 2,5 ECTS Oral exam: 3 ECTS		
Grading and evaluating student work in class and at the final exam	During the semester students write two partial tests. Final exam consists of a written and an oral part due for completion within one exam term. Both parts are equally weighted in the final grade. Passing written test (score ≥50%) is a necessary condition for taking up an oral exam. At the end of the semester, students who passed both partial tests are admitted directly to the oral exam in an exam term (June/July) of their choice.		
Required literature (available in the library and via other media)	**Title**	**No of copies in the library**	**Availability through other media**
	K. Horvatić, *Linearna algebra*, Golden marketing, Tehnička knjiga, Zagreb, 2004.	sufficient	
Optional literature (at the time of submission of study	1. S.H. Friedberg, A.J. Insel and L.E. Spence, *Linear Algebra*, Prentice Hall, 2003. 2. J. Hefferon, *Linear Algebra*, http://joshua.smcvt.edu/linearalgebra/		

programme proposal)	
Quality assurance methods that ensure the acquisition of exit competences	Exam results statistics. Students' quality assessment at the end of the semester carried out by the University authorized committee through anonymous polls.
Other (as the proposer wishes to add)	