<table>
<tr><td>COURSE NAME</td><td colspan="7">Linear Algebra and Matrix Calculus</td></tr>
<tr><td>Code</td><td>PMM10A</td><td>Year of study</td><td colspan="5">1st year of undergraduate study</td></tr>
<tr><td>Course teacher</td><td>Borka Jadrijević</td><td>Credits (ECTS)</td><td colspan="5">8</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td></td></tr>
<tr><td>45</td><td></td><td>45</td><td></td></tr>
<tr><td>Status of the course</td><td>Compulsory course</td><td>Percentage of application of e-learning</td><td colspan="5">30%</td></tr>
<tr><td colspan="8">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="7">The objective of the undergraduate course Linear Algebra and Matrix Calculus is to introduce physics students to basic concepts of linear algebra including linear maps, matrices, determinants, eigenvalues and eigenvectors, Gaussian reduction, etc. The course focuses both on theory and on calculation techniques.</td></tr>
<tr><td>Prerequisites</td><td colspan="7">None</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="7">Upon successful completion of the course, the student is able to:
- recognize the basic mathematical structures, in particular the structure of a vector space;
- understand why it suffices to define a linear transformation on a basis of a vector space;
- gain skills in matrix calculus and in evaluating determinants;
- associate a matrix to linear transformation with respect to different bases and understand the relationship between two such matrices;
- distinguish consistent from inconsistent linear systems of equations;
- effectively solve a system of linear equations with several unknowns using different methods/algorithms;
- compute eigenvalues and eigenvectors of an eigenvalue problem;
- find the Jordan canonical form of a matrix;
- understand in what way both an inner product and a norm enrich the structure of vector space;
- construct an orthonormal basis by means of the Gram-Schmidt orthonormalization process.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="7">1. Review of basic mathematical structures. Basic mathematical structures. Vector space. Basis, subspace, quotient space of a vector space. (6 hours)
2. Linear maps. Linear maps, examples. Isomorphism of vector spaces. Rank and nullity of a linear map. Algebraic structure of the sets Hom (U,V) and Hom V. Linear functionals, examples. (6 hours)
3. Matrices and determinants. Vector space M_{mxn} and algebra M_n. General linear group. Orthogonal group. Rank of a matrix. Elementary transformations. Determinant. Binet-Cauchy theorem. Laplace's expansion. Adjoint matrix. (8 hours)
4. Invariants of a linear operator. Coordinatization of a vector space and transformation of coordinates. Matrix representation of a linear map. Characteristic and minimal polynomials. Hamilton-Cayley theorem. Invariant subspaces. Eigenvalue and the associated eigenspace. Diagonalizability of matrix (transformation). Jordan canonical form. (10 hours)
5. Systems of linear equations. System of linear equations - consistency problem. Cramer's rule. Description of the solution set to a (non)homogeneous system of linear equations. Elementary reduction operations on system equations (matrix rows). Gauss' method. (7 hours)
6. Inner product space. Inner product space, examples. Cauchy-Schwarz-Bunyakovsky inequality. Norm on inner product space, angle, orthogonality. Gram matrix. Gram-Schmidt orthonormalization process. Calculation in an orthonormal basis. Unitary maps preserving the</td></tr>
</table>

	inner product, examples and properties. Unitary group. (8 hours)		
Format of instruction	Lectures, tutorial sessions		
Student responsibilities	Attendance of lectures and tutorial sessions is obligatory.		
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	The exam is taken in written and oral form. The passing grade of the written exam is a requirement for the oral exam. Both parts of the exam are equally weighted in the final grade. There are two partial written exams during the semester. Passing both partial written exams allows students to take the oral exam. In case of failure of the partial exams or the oral exam, the student must retake the written exam before taking the oral exam again.		
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 program proposal)	S.H. Friedberg, A.J. Insel and L.E. Spence, *Linear Algebra*, Prentice Hall, 2003. J. Hefferon, *Linear Algebra*, http://joshua.smcvt.edu/linearalgebra/		
Quality assurance methods that ensure the acquisition of exit competences	Statistics of test results and anonymous student evaluations at the end of the semester according to the regulations of the University of Split.		
Other (as the proposer wishes to add)			