M010	Obligatory - Semester 1	**Geometry of Plane and Space**	L+P+S 2+3+0	ECTS 7

Course objectives. The objective of the course at the introductory level based on geometry of plane and space is to make students familiar with fundamentals of linear algebra.

Course prerequisites. None.

Syllabus:

1. Operations with vectors. Linear dependence and independence of vectors. Basis of vector spaces. Coordinate system. Norm of vectors. Distance between two points. Cauchy - Schwarz - Buniakowsky inequality. Vector dot/scalar product. Direction cosine. Projection of vector to the line and plane. Gramm - Schmidt orthonormalzation process.
2. Square matrix of the second and third order and their determinants. Orientation – right and left basis and coordinate systems. Vector cross product. Algebraic properties of the vector product. Geometrical properties of the cross product. Scalar triple product. Vector triple product. Jacobi identity. Straight line and plane in space. Hesse normal form of line and plane.
3. Linear operators in plane. Examples of operators: axial symmetry, central symmetry, homothety, orthogonal projection, rotation. Basic properties of the linear operator. Operations with linear operators – vector space $L(X(M))$. Products and power of the linear operator. Matrix of the linear operator. Algebra of the matrix of the second order. Contraction and dilatation of the plane – eigenvectors and eigenvalues of the linear operator. Symmetric linear operator in the plane. Orthogonal linear operator in the plane. Diagonalization of the symmetric linear operator. Quadratic forms. Curves of the second order.
4. Linear operators in space $X_0(E)$. Examples. Transfer of all definitions from plane. Symmetric linear operator in the plane. Surfaces of the second order.

Teaching methods and student assessment. Lectures and exercises are obligatory. The exam is taken upon the completion of lectures and exercises, and it consists of a written and an oral part. There are 2-4 midterm exams during the semester that cover the entire syllabus. There is a possibility of taking one make-up mid-term exam. Once a student has successfully passed all mid-term exams, he/she does not have to take the written part of the exam. The highest grade achievable in this way is very good (4). Students may increase their grade by doing extra-credit assignments throughout the semester. The assignments expand upon course topics, and students are expected to work independently and creatively. Assignments are written using LaTeX and in given form.

Can the course be taught in English: No.

Basic literature:

1. R.Scitovski, Geometrija ravnine i prostora, reviewed course materials available on the course website, Odjel za matematiku, Sveučilište u Osijeku, 2011.
2. S. Kurepa, Uvod u linearnu algebru, Školska knjiga, Zagreb, 1978.

Recommended literature:

1. D. Bakić, Linearna algebra, Školska knjiga, Zagreb, 2008.
2. N. Elezović, Linearna algebra, Element, Zagreb, 2001.
3. J. Hefferon, Linear Algebra, Saint Michael's College, Colchester, Vermont, USA, 2011 – freely available at: http://joshua.smcvt.edu/linearalgebra/book.pdf
4. D. Jukić, R.Scitovski, Matematika I, Odjel za matematiku, Sveučilište u Osijeku, Osijek, 2004.
5. G. Strang, Linear algebra and its applications, Saunders College Publishing, 1986.