UČNI NAČRT PREDMETA / COURSE SYLLABUS			
Predmet:	Algebra 1		
Course title:	Algebra 1		

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Enoviti magistrski študijski program Pedagoška matematika	ni smeri	1	prvi in drugi
Integrated Master's study programme Pedagogical Mathematics	none	1	first and second

Vrsta predmeta / Course type	obvezni
Univerzitetna koda predmeta / University course code:	M0501

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**	**ECTS**
90		**90**			**240**	**14**

Nosilec predmeta / Lecturer:	doc. Klemen Šivic, prof. Peter Šemrl

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski/Slovene
	Vaje / Tutorial:	slovenski/Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vsebina:	**Content (Syllabus outline):**

Realni trirazsežni prostor. Geometrijska in algebrska struktura prostora, vektorji. Skalarni, vektorski, in mešani produkt. Analitična geometrija, ravnine in premice. Osnovne algebrske strukture. Relacije. Operacije in homomorfizmi. Grupe. Permutacijske grupe. Kolobarji in obsegi. Vektorski prostori in linearne preslikave. Algebre. Končno razsežni prostori. Baza in razsežnost. Kvocientni prostor in direktna vsota podprostorov. Dualni prostor in dualna preslikava. Linearne preslikave. Prostor linearnih preslikav in matrik. Sprememba baz, ekvivalentnost in rang. Sistemi linearnih enačb. Endomorfizmi. Algebra endomorfizmov in kvadratnih matrik. Podobnost. Determinante. Lastne vrednosti. Karakteristični in minimalni polinom. Jordanova matrika endomorfizma. Spektralna razčlenitev in funkcije matrik. Prostori s skalarnim produktom. Skalarni produkt in norma. Gram-Schmidtova ortogonalizacija. Rieszov izrek o reprezentaciji linearnih funkcionalov. Hermitsko adjungirana preslikava. Normalni endomorfizmi. Diagonalizacija. Sebi adjungirani endomorfizmi. Unitarni endomorfizmi. Unitarna podobnost endomorfizmov in matrik. Pozitivno definitni endomorfizmi in matrike. Kvadratni funkcionali. Bilinearni funkcionali. Kongruentnost in Sylvestrov izrek o vztrajnosti. Krivulje in ploskve drugega reda.	Real three-dimensional space. Geometric and algebraic structure of space, vectors. Inner, cross, and triple product. Analytic geometry, planes and lines. Basic algebraic structures. Relations. Operations and homomorphisms. Groups. Permutation groups. Rings and fields. Vector spaces and linear maps. Algebras. Finite dimensional spaces. Basis and dimension. Quotient space and direct sum of subspaces. Dual space and dual map. Linear maps. Space of linear maps and matrices. Change of basis, equivalence and rank. Systems of linear equations. Endomorphisms. Algebra of endomorphisms and quadratic matrices. Similarity. Determinants. Eigenvalues. Characteristic and minimal polynomial. Jordan form of an endomorphism. Spectral decomposition and functions of matrices. Inner product spaces. Inner product and norm. Gram-Schmidt orthogonalization. Riesz representation theorem. Hermitian adjoint map. Normal endomorphisms. Diagonalization. Self-adjoint endomorphisms. Unitary endomorphisms. Unitary similarity of endomorphisms and matrices. Positive definite endomorphisms and matrices. Quadratic functionals. Bilinear functionals. Congruence and Sylvester's inertia theorem. Second order curves and surfaces.

Temeljni literatura in viri / Readings:

F. Križanič: Linearna algebra in linearna analiza, DZS, Ljubljana, 1993.

J. Grasselli: Linearna algebra, 1. pogl. v I. Vidav: Višja matematika II, DZS, Ljubljana, 1981.

I. Vidav: Algebra, DMFA-založništvo, Ljubljana, 2003.

M. Dobovišek, D. Kobal, B. Magajna: Naloge iz algebre I, DMFA-založništvo, Ljubljana, 2005.

Cilji in kompetence:

Študent spozna osnovne pojme iz linearne algebre, ki jih potrebuje pri nadaljnjem študiju matematike. Ob tem se uči matematičnega načina razmišljanja in se spoznava s strogim matematičnim jezikom. Na vajah si pridobiva praktično, delovno znanje z obravnavanega področja.

Objectives and competences:

Student gets familiar with the basic concepts of linear algebra that are needed for the further study in mathematics. He learns to think mathematicaly and practices the rigorous mathematical language. At tutorials the student acquires practical applied knowledge of the subject.

Predvideni študijski rezultati:

Znanje in razumevanje: Poznavanje in razumevanje osnovnih pojmov in definicij iz linearne algebre.
Uporaba: Uporaba teorije pri reševanju problemov.

Refleksija: Razumevanje teorije na podlagi uporabe.

Prenosljive spretnosti – niso vezane le na en predmet: Spretnost prenosa teorije v prakso.

Intended learning outcomes:

Knowledge and understanding: Knowledge and understanding of basic concepts and definitions in linear algebra.
Application: Solving problems using the theory.

Reflection: Understanding of the theory from the applications.

Transferable skills: The skill to transfer the theory into practice.

Metode poučevanja in učenja:

predavanja, vaje, domače naloge, konzultacije

Learning and teaching methods:

Lectures, exercises, homework, consultations

Delež (v %) /

Načini ocenjevanja:	Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt): 4 kolokviji namesto izpita iz vaj, izpit iz vaj, izpit iz teorije ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50% 50%	Type (examination, oral, coursework, project): 4 midterm exams instead of written exam, written exam oral exam grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

Peter Šemrl:

– CHEBOTAR, M. A., ŠEMRL, Peter. Minimal locally linearly dependent spaces of operators. Linear Algebra and its Applications, ISSN 0024-3795. [Print ed.], 2008, vol. 429, iss. 4, str. 887-900 [COBISS.SI-ID 14810969]

– MBEKHTA, Mostafa, ŠEMRL, Peter. Linear maps preserving semi-Fredholm operators and generalized invertibility. Linear and Multilinear Algebra, ISSN 0308-1087, 2009, vol. 57, no. 1, str. 55-64 [COBISS.SI-ID 15058521]

– RODMAN, Leiba, ŠEMRL, Peter. Neutral subspaces of pairs of symmetric/skewsymmetric real matrices. The electronic journal of linear algebra, ISSN 1081-3810, 2011, vol. 22, str. 979-999 [COBISS.SI-ID 16067929]

Klemen Šivic:

– KUZMA, Bojan, OMLADIČ, Matjaž, ŠIVIC, Klemen, TEICHMANN, Josef. Exotic one-parameter semigroups of endomorphisms of a symmetric cone. Linear Algebra and its Applications. [Print ed.]. 2015, vol. 477, str. 42-75. ISSN 0024-3795. [COBISS.SI-ID 17257561] [COBISS.SI-ID 17257561]

– KANDIĆ, Marko, ŠIVIC, Klemen. On the dimension of the algebra generated by two positive semi-commuting matrices. Linear Algebra and its Applications. [Print ed.]. 2017, vol. 512, str. 136-161. ISSN 0024-3795. [COBISS.SI-ID 17776985] [COBISS.SI-ID 17776985]

– KLEP, Igor, MCCULLOUGH, Scott, ŠIVIC, Klemen, ZALAR, Aljaž. There are many more positive maps than completely positive maps. International mathematics research notices. June 2019, vol. 2019, iss. 11, str. 3313-3375. ISSN 1073-7928. [COBISS.SI-ID 18670425] [COBISS.SI-ID 18670425]