UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2016/17)			
Predmet:	Linearna algebra		
Course title:	Linear algebra		
Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Visokošolski strokovni študijski program Praktična matematika	ni smeri	1	prvi in drugi
First cycle professional study programme Practical Mathematics	none	1	first and second

Vrsta predmeta / Course type	obvezni / compulsory
Univerzitetna koda predmeta / University course code:	M0445

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
90		**90**			**210**	**13**

Nosilec predmeta / Lecturer:	prof. dr. Tomaž Košir, prof. dr. Boris Lavrič

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v letnik študija.	Enrolment in the programme.
Vsebina:	**Content (Syllabus outline):**

Vektorji v ravnini in trirazsežnem prostoru.	Plane vectors and three-dimensional space vectors.
Skalarni produkt, vektorski produkt, mešani produkt.	Dot product, cross product, box product.
Premice in ravnine, razdalje med točkami, premicami in ravninami.	Lines and planes, distances between points, lines and planes.
Matrike, algebraične operacije z matrikami.	Matrices, algebraic operations with matrices.
Elementarne transformacije, vrstična kanonična forma.	Elementary transformations, row echelon form.
Sistemi linearnih enačb, Gaussova eliminacija.	Systems of linear equations, Gauss elimination.
Determinanta.	Determinant.
Prirejenka in inverz matrike, Cramerjevo pravilo.	Classical adjoint and inverse of a matrix, Cramer's rule.
Realni in kompleksni vektorski prostori.	Real and complex vector spaces.
Linearna neodvisnost, baza in dimenzija.	Linear independancy, basis and dimension.
Linearne preslikave.	Linear transformations.
Matrike linearnih preslikav.	Matrices of linear transformations.
Rang in prehod na novo bazo.	Rank and change of basis.
Karakteristični polinom, lastne vrednosti, lastni vektorji.	Characteristic polynomial, eigenvalues, eigenvectors.
Cayley-Hamiltonov izrek, minimalni polinom.	Cayley-Hamilton theorem, minimal polynomial.
Diagonalizacija, Schurov izrek.	Diagonalization, Schur theorem.
Spektralni razcep, funkcije matrik.	Spectral decomposition , functions of matrices.
Vektorski prostor s skalarnim produktom.	Scalar product vector spaces.
Ortonormirana baza, Gram-Schmidtova ortogonalizacija.	Orthonormal basis, Gram-Schmidt orthogonalization.
Linearni funkcionali, adjungirana preslikava.	Linear functionals, adjoint transformation.
Sebi-adjungirane preslikave, simetrične in hermitske matrike.	Self-adjoint transformations, symmetric and hermitian matrices.

Normalne, ortogonalne in unitarne matrike. Pozitivno definitne matrike. Kvadratne forme, Sylvestrov izrek. Krivulje in ploskve drugega reda.	Normal, orthogonal and unitary matrices. Positive definite matrices. Quadratic forms, Sylvester theorem. Second order curves and surfaces.

Temeljni literatura in viri / Readings:

J. Grasselli, A. Vadnal: Linearna algebra, linearno programiranje, DMFA založništvo, Ljubljana, 1986.

T. Košir: Zapiski s predavanj iz Linearne algebre (spletna učilnica)

E. Kramar: Rešene naloge iz linearne algebre, DMFA založništvo, Ljubljana, 1994.

S. I. Grossman: Elementary linear algebra with applications, McGraw-Hill, 1994.

D. C. Lay: Linear algebra and its applications, Reading: Addison-Wesley, 1994.

The linear algebra problem solver : a complete solution guide to any textbook. Piscataway: Research and Education Association, 1993.

Cilji in kompetence:	**Objectives and competences:**
Študentje spoznajo osnovne pojme iz linearne algebre, potrebne pri nadaljnjem študiju: osnove dvo- in tro-razsežne evklidske geometrije, matrično algebro, reševanje sistemov linearnih enačb, računanje s polinomi in osnovne elemente abstraktne algebre. Naučijo se matematičnega načina razmišljanja in pridobijo praktično in delovno znanje s področja linearne algebre.	Students get familiar with the basic concepts of linear algebra, necessary for further study: basics of two and three-dimensional euclidean geometry, matrix algebra, solving systems of linear equations, calculating with polynomials and basic elements of abstract algebra. They learn a mathematical way of thinking and achieve practical and working knowledge from the field of linear algebra.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Poznavanje in razumevanje osnovnih pojmov in postopkov linearne algebre. Uporaba pridobljenega znanja.	Knowledge and understanding: Knowledge and understanding of the basic concepts and methods of linear algebra. Application of the achieved knowledge.

Uporaba: Linearna algebra sodi med temeljne predmete pri študiju naravoslovja, tehnike, družboslovja in večine drugih področij znanosti. Refleksija: Povezovanje teoretičnih in praktičnih postopkov za reševanje osnovnih uporabnih problemov. Prenosljive spretnosti – niso vezane le na en predmet: Matematično korektna formulacija problemov, izbira primernih metod, zmožnost natančnega reševanja problemov ter analize dobljenih rezultatov.	Application: Linear algebra is one of the fundamental subjects in the study of natural, technical, social and almost all other science fields. Reflection: Integrating theoretical and practical procedures for solving basic practical problems. Transferable skills: Mathematically correct formulation of problems, the choice of appropriate methods, capability of acurate solving of problems and analysis of obtained results.

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanja, vaje, domače naloge, konzultacije	Lectures, exercises, homeworks, consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge): izpit iz vaj (4 kolokviji ali pisni izpit) ustni izpit Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	 50% 50%	Type (examination, oral, coursework): 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:

Tomaž Košir:

BERNIK, Janez, DRNOVŠEK, Roman, KOKOL-BUKOVŠEK, Damjana, KOŠIR, Tomaž, OMLADIČ, Matjaž, RADJAVI, Heydar. On semitransitive jordan algebras of matrices. Journal of algebra and its applications, ISSN 0219-4988, 2011, vol. 10, iss. 2, str. 319-333. [COBISS.SI-ID 15908697]

KOŠIR, Tomaž, OBLAK, Polona. On pairs of commuting nilpotent matrices. Transformation groups, ISSN 1083-4362, 2009, vol. 14, no. 1, str. 175-182. [COBISS.SI-ID 15077977]

BERNIK, Janez, DRNOVŠEK, Roman, KOŠIR, Tomaž, LIVSHITS, Leo, MASTNAK, Mitja, OMLADIČ, Matjaž, RADJAVI, Heydar. Approximate permutability of traces on semigroups of matrices. Operators and matrices, ISSN 1846-3886, 2007, vol. 1, no. 4, str. 455-467. [COBISS.SI-ID 14492761]

Boris Lavrič:

LAVRIČ, Boris. The isometries of certain maximum norms. Linear Algebra and its Applications, ISSN 0024-3795. [Print ed.], 2005, vol. 405, str. 249-263. [COBISS.SI-ID 13679961]

LAVRIČ, Boris. The isometries and the G-invariance of certain seminorms. Linear Algebra and its Applications, ISSN 0024-3795. [Print ed.], 2003, vol. 374, str. 31-40. [COBISS.SI-ID 12751193]

LAVRIČ, Boris. Monotonicity properties of certain classes of norms. Linear Algebra and its Applications, ISSN 0024-3795. [Print ed.], 1997, let. 259, str. 237-250. [COBISS.SI-ID 7388761]