



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Linearna algebra
Course title:	Linear Algebra

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika		1.	2.
Mathematics		1.	2.

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
60		60			150	9

Nosilec predmeta / Lecturer:

Jeziki / Languages:	Predavanja / Lectures:	SLOVENSKO/SLOVENE
	Vaje / Tutorial:	SLOVENSKO/SLOVENE

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

Vsebina:

Vektorski prostori: prostori in podprostori; baza; dimenzija; vsote in direktne vsote.

Linearne preslikave: primeri in osnovne lastnosti; jedro in slika; prostori linearnih preslikav; izomorfizmi vektorskih prostorov.

Linearne preslikave in matrike: matriki prirejena preslikava; preslikavi prirejena matrika; sprememba baze in podobne matrike.

Lastne vrednosti in lastni vektorji: osnovne lastnosti; zgornje trikotne matrike; minimalni

Content (Syllabus outline):

Vector spaces: spaces and subspaces; base; dimension; sums and direct sums.

Linear transformations: examples and basic properties; kernel and image; spaces of linear transformations; isomorphisms.

Linear transformations and matrices: transformation of a matrix; matrix of a transformation; base change and similar matrices.

polinom; karakteristični polinom; Cayley-Hamiltonov izrek; diagonalizacija; Jordanova kanonična forma.

Prostori s skalarnim produktom: Evklidski prostori; unitarni prostori; pravokotnost in ortogonalne baze; ortogonalni komplementi; dualni prostor in Rieszov izrek.

Preslikave v Evklidskih in unitarnih prostorih: adjungirane; normalne; sebi-adjungirane; ortogonalne in unitarne; pozitivno (semi)definitne.

Eigenvalues and eigenvectors: basic properties; upper triangular matrices; minimal polynomial; characteristic polynomial; Cayley-Hamilton theorem; diagonalization; Jordan canonical form.

Spaces with inner product: Euclidean spaces; unitary spaces; orthogonality and orthogonal bases; orthogonal complement; dual spaces and Riesz theorem.

Transformations in Euclidean and unitary spaces: adjoint; normal; self-adjoint; orthogonal and unitary; positive (semi)definite.

Temeljni literatura in viri / Readings:

T. Košir, Linearna algebra (spletna skripta)
<http://www.fmf.unilj.si/~kosir/poucevanje/0607/linalg.html>
<http://www.fmf.uni-lj.si/~kosir/poucevanje/0809/alg1-fm.html>
 M. Kolar, B. Zgrablič, Več kot nobena, a manj kot tisoč in ena rešena naloga iz linearne algebre, Pedagoška fakulteta Ljubljana, Ljubljana, 1996.
 C. Scheiderer, Lineare Algebra I und II (spletna skripta)
<http://www.uni-duisburg.de/FB11/LEHRE/LINALG/LA.public.pdf>
 M. Dobovišek, D. Kobal, B. Magajna, Naloge iz algebre I, DMFA založništvo, Ljubljana, 2005.
 R. Kaye, R. Wilson, Linear Algebra, Oxford University Press, Oxford, 1998.

Cilji in kompetence:

Temeljito spoznati vektorske prostore in linearne preslikave.

Objectives and competences:

To know thoroughly vector spaces and linear transformation.

Predvideni študijski rezultati:

Znanje in razumevanje:

- Razumevanje vektorskih prostorov in linearnih transformacij.
- Povezovanje teorije s predmetov »Vektorji in matrike«.

Prenosljive/ključne spretnosti in drugi atributi:

- Pridobljena znanja so podlaga za večino predmetov v nadaljevanju študija.

Intended learning outcomes:

Knowledge and Understanding:

- Be able to understand vector spaces and linear transformations.
- Be able to connect the theory with the subject »Vectors and Matrices«.

Transferable/Key Skills and other attributes:

- The obtained knowledge is a basis for most of the later subjects.

Metode poučevanja in učenja:

Learning and teaching methods:

<ul style="list-style-type: none"> • Predavanja • Teoretične vaje 	<ul style="list-style-type: none"> • Lectures • Theoretical exercises
Načini ocenjevanja:	Assessment:
<p><u>Izpit:</u></p> <p>Pisni izpit – problemi, Ustni izpit – teorija.</p> <p>Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.</p> <p>Opravljen pisni izpit – problemi je pogoj za pristop k ustnemu izpitu – teorija.</p> <p>Pisni izpit – problemi se lahko nadomesti z dvema delnima testoma (sprotne obveznosti).</p>	<p>Delež (v %) / Weight (in %)</p> <p>50% 50%</p>
	<p><u>Exams:</u></p> <p>Written exam – problems, Oral exam – theory.</p> <p>Each of the mentioned assessments must be assessed with a passing grade.</p> <p>Passing grade of written exam – problems is required to take the oral exam – theory.</p> <p>Written exam – problems can be repalced with two mid-term tests.</p>

Reference nosilca / Lecturer's references:

1. EREMITA, Daniel. Biderivations and commuting linear maps on current Lie algebras. *Journal of Lie theory*. 2021, vol. 31, no. 1, str. 119-126. ISSN 0949-5932. <http://www.heldermann.de/JLT/JLT31/JLT311/jlt31006.htm>. [COBISS.SI-ID 100444419],
2. EREMITA, Daniel. Biderivations on tensor products of algebras. *Communications in algebra*. 2018, vol. 46, iss. 4, str. 1722-1726. ISSN 0092-7872. <http://doi.org/10.1080/00927872.2017.1355375>, DOI: 10.1080/00927872.2017.1355375. [COBISS.SI-ID 18192217],
3. EREMITA, Daniel. Behfar, Roonak (IR-UKURDS-M); Ghahramani, Hoger (IR-UKURDS-M): Lie maps on triangular algebras without assuming unity. (English summary). - *Mediterr. J. Math.* 18 (2021), no. 5, Paper No. 215, 28 pp. MathSciNet : Mathematical Reviews on the Web. [Spletna izd.]. 2022, 1 spletni vir (mr4309523). ISSN 2167-5163. <http://www.ams.org/mathscinet/pdf/MR4309523.pdf>. [COBISS.SI-ID 132959235]
4. EREMITA, Daniel. Jabeen, Aisha (6-JMI-SHU); Ahmad, Musheer (6-JMI-SHU): Multiplicative Lie triple derivation of triangular 3-matrix rings. (English summary). - *Ann. Univ. Ferrara Sez. VII Sci. Mat.* 67 (2021), no. 2, 293–308. MathSciNet : Mathematical Reviews on the Web. [Spletna izd.]. 2022, 1 spletni vir (mr4334719). ISSN 2167-5163. <http://www.ams.org/mathscinet/pdf/MR4334719.pdf>. [COBISS.SI-ID 132953347]
5. EREMITA, Daniel. Di Vincenzo, Onofrio M. (I-BASI-MIE); Nardoza, Vincenzo (I-BARI): Differential polynomial identities of upper triangular matrices under the action of the two-dimensional metabelian Lie algebra. (English summary). - *Algebr. Represent. Theory* 25 (2022), no. 1, 187–209. MathSciNet : Mathematical Reviews on the Web. [Spletna izd.]. 2022, 1 spletni vir (mr4368582). ISSN 2167-5163. <http://www.ams.org/mathscinet/pdf/MR4368582.pdf>. [COBISS.SI-ID 132949763]

