UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Linearna algebra in optimizacija
Course title:	Linear Algebra and Optimization

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Podatkovne znanosti, magistrski študijski program druge stopnje	-	Prvi	Prvi
The second cycle masters study programme Data Sciences	-	First	First

Vrsta predmeta / Course type	Obvezni/ Obligatory
Univerzitetna koda predmeta / University course code:	2-PZ-MAG-LAO-2020-06-30

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**	**ECTS**
30	-	40	-	-	110	6

Nosilec predmeta / Lecturer:	Izr. prof. dr. Vesna Andova

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski / Slovenian, Angleški / English
	Vaje / Tutorial:	Slovenski / Slovenian, Angleški / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Specifičnih pogojev za vključitev v delo ni. Priporočeno je poznavanje osnovnih matematičnih pojmov in računanja z matrikami. Pogoj za pristop k pisnemu izpitu je pravočasna oddaja in pozitivna ocena domačih nalog.	There are no specific requirements for this subject. Knowledge of basic mathematical notions and matrix computations is recommended. Student has to submit homework assignments within the due time. If the assignments are positively graded, he/she is allowed to write the exam.

Vsebina:	**Content (Syllabus outline):**
• Ponovitev osnovnih pojmov linearne algebre (matrike in determinante). • Vektorji. • Vektorski prostori. • Linearna odvisnost in neodvisnost.	• Repetition of basic concepts of linear algebra (matrices and determinants). • Vectors. • Vector spaces.

- Baze in dimenzije.
- Linearne kombinacije in razponi.
- Inverz matrik.
- Rang matrik.
- Lastne vrednosti in lastni vektorji.
- Linearne transformacije.
- Norme, notranji produkti in ortogonalnost.
- Matrične dekompozicije.
- Psevdoinverz.
- Računanje z velikimi matrikami.
- Konveksnost in Newtonova metoda.
- Lagrangevi multiplikatorji.

- Linear dependence and independence.
- Basis and dimension.
- Linear combinations and spans.
- Matrix inversion.
- Rank.
- Eigenvalues and eigenvectors.
- Linear transformations.
- Norms, inner products and orthogonality.
- Matrix decomposition.
- Pseudoinverse.
- Computations with large matrices.
- Convexity and Newton's method.
- Lagrange multipliers.

Temeljni literatura in viri / Readings:

- B. Magajna, Linearna algebra, metrični prostor in funkcije več spremenljivk, DMFA-založništvo, 2011.
- I. Vidav, Algebra, DMFA-založništvo, 2003.
- P. Lancaster, M. Tismenetsky, The Theory of Matrices, Academic Press, 2007.
- G. Strang, Introduction to Linear algebra, Wellesley-Cambridge Press, 2016.
- G. Strang, Linear Algebra and Learning from Data, Wellesley-Cambridge Press, 2019.
- S. Axler, Linear Algebra Done Right, Springer, 1997.

Cilji in kompetence:

Učna enota prispeva k razvoju naslednjih splošnih in predmetno-specifičnih kompetenc:

Splošne kompetence:

- Sposobnost analitičnega in algoritmičnega razmišljanja.
- Sposobnost fleksibilne uporabe znanja v praksi.

Predmetno-specifične kompetence:

- Sposobnost reševanja problemov z uporabo linearne algebre.
- Razumevanje logičnih dokazov in aksiomatskih metod, ki se uporabljajo v linearni algebri.
- Sposobnost povezovanja linearne algebre z drugimi področji.
- Poznavanje programskega jezika Matlab ali R.

Objectives and competences:

The instructional unit contributes to the development of the following general and subject-specific competences:

General competences:

- The ability of analytical and algorithmic thinking.
- The ability of flexible usage of knowledge in practice.

Subject-specific competences:

- Ability to solve problems using linear algebra.
- Understanding logical proofs and the axiomatic method as applied to linear algebra.
- Ability to connect linear algebra to other fields both within and without mathematics.
- Ability to use programming language Matlab or R.

Predvideni študijski rezultati:

Intended learning outcomes:

Znanje in razumevanje:	Knowledge and understanding:
• Študentje bodo spoznali zahtevnejše pojme in principe linearne algebre. • Študentje bodo sposobni prepoznati praktične probleme in jih reševati z orodji linearne algebre. • Poznali in razumeli bodo poglavitne izreke linearne algebre. • Spoznali bodo metode matematične optimizacije. • Spoznali se bodo s programskih jezikom Matlab ali R. Prenosljive spretnosti: • Pridobljeno znanje bo prenosljivo na druga področja, predvsem na področji statistike in strojnega učenja.	• Students will get acquainted with advanced notions and principles of linear algebra. • Students will be able to recognize practical problems and solve them with linear algebra tools. • They will know and understand fundamental theorems of linear algebra. • They will learn methods from mathematical optimization. • They will learn to use programming languages Matlab or R. Transferable skills: • Acquired knowledge will be transferable to other areas, mainly to statistics and machine learning.

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri). • Vaje (reševanje problemov).	• Lectures with active students' participation (explanations, discussion, questions, examples) • Exercises (problem solving).

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
• Domače naloge • Pisni izpit	30 % 70 %	• Homework assignments • Written exam

Reference nosilca / Lecturer's references:

- V.Andova, M. Knor, R. Škrekovski, Distances based indices on nanotubical graphs: part 2, J. Math. Chem. 56 (2018) 3076-3088.
- V.Andova, M. Knor, R. Škrekovski, Distances based indices on nanotubical graphs: part 1, J. Math. Chem. 56 (2018) 2801-2815.
- V.Andova, B. Lidický, B. Lužar, R. Škrekovski, On facial unique-maximum (edge-)coloring, Discrete Applied Math. 237 (2018) 26-32.
- V. Andova, S. Atanasova, E. Jovcevska, V. Jordanova, I. Tolovski, M.Rizov, Projecting a hydrographic map of Republic of Macedonia, J. Electrical Engineering and Information Technologies, 1-2 (2016) 93-100.
- V.Andova, D. Orlić, R. Škrekovski, Leapfrog fullerenes and Wiener index, Appied Math. Comp. 309 (2017) 281-288.
- V.Andova, M. Knor, R. Škrekovski, Distances on nanotubical graphs, J.Math. Chem. 54(8) (2016) 1575-1584.
- V. Andova, F. Kardoš, R. Škrekovski, Mathematical aspect on fullerenes, Ars Mathematica Contemporanea, 11 (2016) 353-379.

- V.Andova, D. Blenkuš, T. Došlić, F. Kardoš, R. Škrekovski, On diameter of nanotubical fullerene graphs, MATCH Commun. Math. Comput. Chem. 73 (2015) 529–542.
- V. Andova, F. Kardoš, R. Škrekovski, Sandwiching saturation number of fullerene graph, MATCH Commun. Math. Comput. Chem. 73 (2015) 501–517.
- Y. Alizadeh, V. Andova, S. Klavžar, R. Škrekovski, Wiener Dimension: Fundamental Properties and (5,0)-Nanotubical Fullerenes, MATCH Commun. Math. Comput. Chem. 72 (2014) 279–294.