UČNI NAČRT PREDMETA / COURSE SYLLABUS			
Predmet:	Optimizacija 1		
Course title:	Optimization 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	3 ali 4	prvi
Integrated Master's study programme Pedagogical Mathematics	none	3 or 4	first

Vrsta predmeta / Course type	izbirni
Univerzitetna koda predmeta / University course code:	M0533

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**	**ECTS**
30		**30**			**90**	**5**

Nosilec predmeta / Lecturer:	prof. Arjana Žitnik, prof. Marko Petkovšek, prof. Riste Škrekovski

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):**

Vrste optimizacijskih problemov. Lokalna optimizacija. Linearni programi, standardna oblika in pretvorbe. Metoda simpleksov, splošni korak, začetna dopustna rešitev, končnost metode, geometrijski opis. Dualnost pri linearnem programiranju, šibka in krepka dualnost. Matrične igre. Problem razvoza, celoštevilske rešitve. Problem maksimalnega pretoka. Algoritem Forda in Fulkersona. Izrek o maksimalnem pretoku in minimalnem prerezu. Prirejanja in pokritja v dvodelnih grafih. Razporejanje opravil in madžarska metoda.	Types of optimization problems. Local search. Linear programming, standard form, conversions. Simplex method, basic step, initial feasible solution, finiteness of the method, geometric interpretation. Duality in linear programming, weak and strong duality. Matrix games. Transshipment problem, integer solutions. Maximum flow problem. Ford-Fulkerson algorithm. Max-flow min-cut theorem. Matchings and vertex covers in bipartite graphs. Job scheduling and Hungarian method.

Temeljni literatura in viri / Readings:

V. Chvátal: Linear Programming, Freeman, New York, 1983.

B. H. Korte, J. Vygen: Combinatorial Optimization : Theory and Algorithms, 3. izdaja, Springer, Berlin, 2006.

R. J. Vanderbei: Linear Programming : Foundations and Extensions, 2. izdaja, Kluwer, Boston, 2001.

Cilji in kompetence:	**Objectives and competences:**
Študent spozna pojem optimizacijskega problema, se nauči zapisati probleme iz prakse v obliki optimizacijskih problemov in se natančneje seznani z reševanjem linearnih optimizacijskih problemov.	Students get familiar with the concept of optimization problem, learns how to formulate problems which appear in practice as optimization problems and learns in detail how to solve linear optimization problems.
Predvideni študijski rezultati:	**Intended learning outcomes:**

Znanje in razumevanje: Slušatelj je sposoben z matematičnim modelom dobro opisati različne probleme iz vsakdanjega življenja. Poudarek je na problemih, ki vodijo do linearnih modelov. Pozna osnovne prijeme za učinkovito reševanje dobljenih optimizacijskih problemov. Uporaba: Reševanje optimizacijskih problemov iz vsakdanjega življenja. Refleksija: Pomen predstavitve praktičnih problemov v formalizirani obliki za njihovo učinkovito in pravilno reševanje. Prenosljive spretnosti – niso vezane le na en predmet: Modeliranje nalog iz vsakdanjega življenja v obliki matematičnih optimizacijskih nalog, zmožnost razločevanja med računsko obvladljivimi in neobvladljivimi problemi.	Knowledge and understanding: Using a mathematical model a student can describe well a variety of problems from real life. The emphasis is on the problems that lead to linear models. Students get familiar with basic approaches for efficient solving of the obtained optimization problems. Application: Solving real-life optimization problems. Reflection: A meaning of presentation of practical problems in a formalized form for efficient and correct solving. Transferable skills: Modeling of problems from practice in the form of mathematical optimization problems, ability to distinguish between computationally manageable and unmanageable problems.

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

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt): 2 kolokvija 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): 2 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:

Marko Petkovšek:

– PETKOVŠEK, Marko. Letter graphs and well-quasi-order by induced subgraphs. Discrete Mathematics, ISSN 0012-365X. [Print ed.], 2002, vol. 244, no. 1-3, str. 375-388 [COBISS.SI-ID 11414873]

– ABRAMOV, Sergei A., PETKOVŠEK, Marko. Dimensions of solution spaces of H-systems. Journal of symbolic computation, ISSN 0747-7171, 2008, vol. 43, iss. 5, str. 377-394 [COBISS.SI-ID 14679897]

– PETKOVŠEK, Marko. Symbolic computation with sequences. Programming and computer software, ISSN 0361-7688, 2006, vol. 32, no. 2, str. 65-70 [COBISS.SI-ID 15287129]

– ABRAMOV, Sergei A., PETKOVŠEK, Marko. On the bottom summation. Programming and computer software, ISSN 0361-7688, 2008, vol. 34, no. 4, str. 187-190 [COBISS.SI-ID 15287385]

Riste Škrekovski:

– ŠKREKOVSKI, Riste. A Grötzsch-type theorem for list colourings with impropriety one. Combinatorics, probability & computing, ISSN 0963-5483, 1999, let. 8, št. 5, str. 493-507 [COBISS.SI-ID 9275225]

– GREGOR, Petr, ŠKREKOVSKI, Riste. Long cycles in hypercubes with distant faulty vertices. Discrete mathematics and theoretical computer science, ISSN 1365-8050, 2009, vol. 11, no. 1, str. 185-198 [COBISS.SI-ID 15521113]

– DIMITROV, Darko, DVOŘÁK, Tomáš, GREGOR, Petr, ŠKREKOVSKI, Riste. Gray codes avoiding matchings. Discrete mathematics and theoretical computer science, ISSN 1365-8050, 2009, vol. 11, no. 2, str. 123-148 [COBISS.SI-ID 15521369]

Arjana Žitnik:

– ŽITNIK, Arjana. Series parallel extensions of plane graphs to dual-eulerian graphs. Discrete Mathematics, ISSN 0012-365X. [Print ed.], 2007, vol. 307, iss. 3-5, str. 633-640 [COBISS.SI-ID 14183769]

– PISANSKI, Tomaž, ŽITNIK, Arjana. Representing graphs and maps. V: BEINEKE, Lowell W. (ur.), WILSON, Robin J. (ur.). Topics in topological graph theory, (Encyclopedia of mathematics and its applications, ISSN 0953-4806, 128). Cambridge [etc.]: Cambridge University Press, cop. 2009, str. 151-180 [COBISS.SI-ID 15227481]

– MILANIČ, Martin, PISANSKI, Tomaž, ŽITNIK, Arjana. Dilation coefficient, plane-width, and resolution coefficient of graphs. Monatshefte für Mathematik, ISSN 0026-9255, 2013, vol. 170, no. 2, str. 179-193 [COBISS.SI-ID 1024499540]