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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Operacijske raziskave | | | | | | | | | | | | | | |
| **Course title:** | | | Operations research | | | | | | | | | | | | | | |
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| **Študijski program in stopnja**  **Study programme and level** | | | | | **Študijska smer**  **Study field** | | | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| doktorski študijski program tretje stopnje Elektrotehnika | | | | | Ni smeri | | | | | | | | 1 | |  | | |
| 3rd cycle: doctoral study programme Electrical Engineering | | | | |  | | | | | | | |  | |  | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Izbirni / Elective | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64873 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| **30** |  | | |  | | |  | | | |  | | | **95** | |  | **5** |
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| **Nosilec predmeta / Lecturer:** | | | | | Prof. dr. Andrej Košir | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | **Slovenski / English** | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | **Slovenski / English** | | | | | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | | |  | **Prerequisits:** | | | | | | | |
| Vpis v doktorski študij | | | | | | | | |  | Enrolment in the program | | | | | | | |
| **Vsebina:** | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | |
| Algoritmi, računska in spominska zahtevnost, podatkovne strukture. Teorija grafov (predstavitev, lastnosti, osnovni algoritmi).  Uvod v operacijske raziskave in optimizacijo. Optimizacijska naloga (formulacija, kriterij, množice rešitev). Linearno in celoštevilsko programiranje (simpleksna metoda, pomembni primeri). Analiza omrežij (maksimalni pretok, minimalna cena, najkrajše poti), Nelinearna optimizacija (gradientne in Newtonove metode, optimizacija pri pogoju). Kombinatorična optimizacija. Teorija iger. Markovske verige (klasifikacija stanj, ergodičnost). Teorija časovnih vrst. Teorija čakalnih vrst. Hevristična optimizacija. Merjenja mnenja uporabnikov in kvaliteta storitev. Osnove poslovne inteligence v TK. Izbrani optimizacijski problemi v TK (načrtovanje topologije, optimalno dodeljevanje virov, optimalno usmerjanje, določanje cenovne politike) | | | | | | | |  | | Algorithms, time and memory complexity, data structures. Graph theory (representation, selected graph properties, basic graph algorithms).    Introduction to operations research and optimization. Optimization task (formulation, objective function, and set of solutions). Linear and integer programming (simplex method, selected known problems). Network analysis (maximal flow, minimal cost, shortest path). Nonlinear optimization (gradient and Newton method, constraint optimization). Combinatorial optimization. Game theory. Markov chains (classification of states, ergodicity). Time series. Queuing theory. Heuristic optimization techniques. Measuring QoE and user opinion. Basics of business intelligence in TC. Selected optimization problems in telecommunications (topology design, optimal resource assignment, optimal routing, yield management). | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| [1] P. Saengudomlert: Optimization for Communications and Networks, CRC Press, 2012.  [2] A. Dutta, H. Schulzrinne: Mobility Protocols and Handover Optimization: Design, Evaluation and Application, John Wiley & Sons, 2014.  [3] R. Srikant, L. Ying: Communication Networks: An Optimization, Control and Stochastic Networks Perspective, Cambridge university press, 2014.  [4] M. W. Carter, C. C. Price: Operations Research, A Practical Introduction, CRC Press, 2000.  [5] M. G.C. Resende and P. Pardalos: Handbook of Optimization in Telecommunications, Springer, 2006.  [6] A. Košir: Operacijske raziskave v telekomunikacijah, Založba FE in FRI, 2013. | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Razumevanje formulacije in reševanja optimizacijskih nalog. Razumevanje povezave med formulacijo problema in računalniško podprtim reševanjem. Prepoznavanje tipa optimizacijskega problema v zvezi z izbiro računalniškega reševanja. Razumevanje zadovoljstva uporabnikov in poslovne inteligence kot optimizacijske funkcije. | |  | | Basic understanding of optimization problem formulation and solving. Understanding the relationship between problem formulation and computer aided solving. Recognizing the optimization problem type related to existing computer solvers. Understanding end user satisfaction together with business model in term of optimization objective function. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Razvoj in uporaba spretnosti izvedbe optimizacije praktičnih problemov. Formulacija, prepoznava tipa in reševanje kompleksne optimizacije. Izbira ustrezne formulacije optimizacijskega problema in izbira najustreznejše obstoječih računalniških orodij reševanja optimizacije. | | |  | Develop and apply the conceptual basis and the practical skills in problem solving. Formulate, recognize and solve complex optimization problems. Select the appropriate optimization problem formulation and the select the optimal existing computer tool to solve it. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, konzultacije, mentorirano projektno delo. | | |  | Auditorium lectures, consultations, supervised project work | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Projekt  Ustni zagovor projekta | 70%  30% | | | | Project report  Oral defence of the project |
| **Reference nosilca / Lecturer's references:** | | | | | |
| Droftina U, Šular M, Košir A (2015) A diffusion model for churn prediction based on sociometric theory. Advances in data analysis and classification, vol. 9, iss. 3, pp 341-365  Vodlan T, Tkalčič N, Košir A (2014) The impact of hesitation, a social signal, on a user’s quality of experience in multimedia content retrieval. Multimedia Tools and Applications, vol. 74, no. 17, pp 6871-6896  Odić A, Tkalčič M, Tasič J, Košir A (2013) Predicting and detecting the relevant contextual information in a movie-recommender system. Interact. comput., vol. 25, no. 1, pp 74-90  Tkalčič M, Tasič J, Košir A (2012) The need for affective metadata in content-based recommender systems for images. In: Maybury M T (ed) Multimedia information extraction : advances in video, audio, and imagery analysis for search, data mining, surveillance, and authoring, Wiley, Los Alamitos, pp 305-319  Tkalčič M, Odić A, Košir A (2013) The impact of weak ground truth and facial expressiveness on affect detection accuracy from time-continuous videos of facial expressions. Information sciences, vol. 249, pp 13-23 | | | | | |