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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Analiza in optimizacija vezij | | | | | | | | | | | | | | |
| **Course title:** | | | Circuit Analysis and Optimisation | | | | | | | | | | | | | | |
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| **Študijski program in stopnja**  **Study programme and level** | | | | | **Študijska smer**  **Study field** | | | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| Podiplomski magistrski študijski program druge stopnje Elektrotehnika | | | | | Elektronika | | | | | | | | 1 | | 1 | | |
| 2nd cycle masters study programme in Electrical Engineering | | | | | Electronics | | | | | | | | 1 | | 1 | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Obvezni-strokovni / Compulsory professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64225 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| **45** |  | | | **30** | | |  | | | |  | | | **75** | |  | **6** |
|  | | | | | | | | | | | | | | | | | |
| **Nosilec predmeta / Lecturer:** | | | | | Tadej Tuma | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | **slovenski / slovenian** | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | **slovenski / slovenian** | | | | | | | | | | | |
| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | | | | | | | | |  | **Prerequisits:** | | | | | | | |
| Vpis v letnik. | | | | | | | | |  | Enrolment in the year of the course. | | | | | | | |
| **Vsebina:** | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | |
| 1) Numerične metode sodobnih programskih orodij za analizo vezij: Modificirane vozliščne enačbe, LU razcep, Newton Raphsonova iteracijska metoda za nelinearna vezja, integracijski algoritmi za dinamična vezja, postopki za izkanje polov in ničel v kompleksnem prostoru.  2) Optimizacijski postopki: Sestavljanje kriterijske funkcije, neomejeni direktni optimizacijski postopki, kazenske funkcije.  3) Praktično laboratorijsko delo na realnih vezijh s programskim orodjem SPICE OPUS: uporaba vseh vrst analiz, ki jih ponuja orodje. | | | | | | | |  | | 1) Contemporary numerical methods for analog circuit analysis: Modified nodal equations, LU decomposition, Newton Raphson iteration for nonlinear circuits, integration algorithms for dynamic circuits, pole zero analysis.  2) Optimization algorithms: setting up cost functions, direct optimization methods, penalty functions.  3) Hands-on laboratory work on real circuits with the SPICE OPUS tools: competent analyses. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. TUMA, Tadej, BÜRMEN, Arpad. Circuit simulation with SPICE OPUS : theory and practice, (Modeling and simulation in science, engineering and technology). Boston; Basel; Berlin: Birkhäuser, cop. 2009. 2. Spletna stran fakultetnega orodja [www.spiceopus.si](http://www.spiceopus.si) 3. BRATKOVIČ, Franc. Računalniško načrtovanje vezij, Občutljivost in optimizacija. 2. dopolnjena izd. Ljubljana: Fakulteta za elektrotehniko in računalništvo, 1994. VII, 273 str. | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Razumeti numerične metode za analizo analognih elektronskih vezij. Razumeti osnovna teoretična načela parameterske optimizacije. Spoznati splošnonamensko orodje za analizo in optimizacijo analognih elektronskih vezij SPICE OPUS in pridobiti ustrezne izkušnje v okviru laboratorijskega dela. | |  | | Understanding numerical methods for analog circuit analysis. Understanding basic principles of parameter optimization. Practical hands-on laboratory work experience with SPICE OPUS analog circuit design tools. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Sposobnost načrtovanje analognih integriranih vezij. | | |  | Integrated analog circuit design. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, vodena diskusija, laboratorijsko skupinsko delo, samostojno seminarsko delo. | | |  | Lectures, discussion groups, laboratory project work (group and individual). | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Način: laboratorijske vaje, ustni izpit.  Ocene od 1 do vključno 5 so negativne,  ocene od vključno 6 do 10 so pozitivne.  Pozitivna ocena laboratorijskih vaj je pogoj za pristop k ustnem izpitu.  Prispevki k oceni:   * laboratorijske vaje * ustni izpit | 50%  50% | | | | Type: laboratory exercises, oral exam. Negative grades: from 1 to 5, positive grades: from 6 to 10. Positive evaluation of laboratory exercises is a prerequisite for the oral exam.  Contributions to the final grade:   * laboratory exercises * oral examination |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. TUMA, Tadej, BÜRMEN, Arpad. Circuit simulation with SPICE OPUS : theory and practice, (Modeling and simulation in science, engineering and technology). Boston; Basel; Berlin: Birkhäuser, cop. 2009. 2. PUHAN, Janez, BÜRMEN, Arpad, TUMA, Tadej, FAJFAR, Iztok. Teaching assembly and C language concurrently. Int. J. Electr. Eng. Educ., Apr. 2010, vol. 47, no. 2, str. 120-131, 3. OLENŠEK, Jernej, BÜRMEN, Arpad, PUHAN, Janez, TUMA, Tadej. Automated analog electronic circuits sizing. V: QING, Anyong. Differential evolution : fundamentals and applications in electrical engineering. [Piscataway]: IEEE Press; Singapore: J. Wiley & Sons, cop. 2009, str. [353]-367. 4. BÜRMEN, Arpad, OLENŠEK, Jernej, TUMA, Tadej. Mesh adaptive direct search with second directional derivative-based Hessian update. Computational optimization and applications, ISSN 0926-6003. [Print ed.], Dec. 2015, vol. 62, no. 3, str. 693-715. 5. KORINŠEK, Gašper, DERLINK, Maja, VIRANT-DOBERLET, Meta, TUMA, Tadej. An autonomous system of detecting and attracting leafhopper males using species- and sex-specific substrate borne vibrational signals. Computers and electronics in agriculture, ISSN 0168-1699. [Print ed.], 2016, vol. 123, str. 29-39. | | | | | |