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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Nelinearna elektronska vezja | | | | | | | | | | | | | | |
| **Course title:** | | | Non-Linear Electronic Circuits | | | | | | | | | | | | | | |
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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:** | | | | | | | | | | | | 64224 | | | | | |
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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** |
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| **Nosilec predmeta / Lecturer:** | | | | | Marko Topič | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | **Slovenščina / Slovene** (English possible) | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | **Slovenščina / Slovene** (English possible) | | | | | | | | | | | |
| **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):** | | | | | | | |
| I. Vezja za preoblikovanje signalov  • Uporovna vezja z enim vhodom  a) ohmski usmerniki  b) rezalniki  c) napetostni regulatorji  d) tokovni regulatorji  e) komparatorji (obravnavani že pri EV-1)  f) nelinearni ojačevalniki  g) močnostni ojačevalniki  • Dinamična vezja z enim vhodom  a) RC in RL usmerniki (zmanjšan obseg, poudarek le na načrtovanju RC usmernika)  b) množilniki napetosti (tudi preklopni)  c) detektorji  d) pripenjalnik  II. Vezja za generiranje signalov  • Monostabilni multivibrator, bistabilni multivibrator, astabilni multivibrator  (poudarek na realizaciji z logičnimi gradniki)  III. Preklopni napetostni stabilizatorji  • DC/DC pretvorniki (poudarek na principu delovanja in na realizaciji)  • preklopni usmerniki (poudarek na principu delovanja in na realizaciji)  • preklopni razsmerniki (poudarek na principu delovanja in na realizaciji)  IV. Fazno sklenjena zanka (poudarek na principu delovanja in na realizaciji)  V. Analogno-digitalni in digitalno-analogni pretvorniki | | | | | | | |  | | 1. Circuits for reshaping the signal forms    * + Resistive circuits    1. Ohmic rectifiers    2. Voltage limiters    3. Voltage regulators    4. Current regulators    5. Comparators    6. Non-linear amplifiers    7. Power amplifiers       * Dynamic circuits    8. RC rectifiers    9. Voltage multipliers    10. Signal detectors    11. Clampers 2. Circuits for generating signals    1. Monostable, bistable and astable multivibrators 3. Switching regulators    1. DC/DC regulators    2. AC/DC (power supplies)    3. DC/AC (inverters) 4. Phase-locked loops    1. Basic principles and components    2. Applications 5. A/D and D/A conversion circuits    1. Sample/Hold circuits    2. Anti-aliasing filters    3. A/D circuits    4. D/A circuits | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. James W Nilsson and Susan Riedel: Electric Circuits (8th Edition) (2007) 2. Roland E. Thomas: The Analysis and Design of Linear Circuits (2006) 3. Donald O. Pederson and Kartikeya Mayaram: Analog Integrated Circuits for Communication: Principles, Simulation and Design (2007) 4. M. Topič, A. Levstek in M. Jankovec: Zbirka rešenih nalog iz nelinearnih elektronskih vezij, 2006. 5. M. Topič: Nelinearna elektronska vezja (učbenik v pripravi). | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Predmet nagrajuje znanja analognih elektronskih vezij in podaja temeljna znanja s področja nelinearnih elektronskih vezij, ki so osnova za inženirje elektrotehnike. Predmet opisuje temeljne principe, ki so vezani na primere in znanja iz prakse. Snov predstavlja zaključeno celoto s področja nelinearnih elektronskih vezij in predstavlja nadgradnjo predmeta Analogna elektronska vezja na študijski smeri Elektronika, hkrati pa je podlaga za strokovne predmete v višjih letnikih študija elektronike. | |  | | The subject extends the knowledge of analog electronic circuits and provides foundations of non-linear electronic circuits. The subject covers principles of signal reshaping or generation by non-linear circuits and provides practical examples of real world devices. The content is selected as a broad range of non-linear circuit types and is a foundation for advanced concepts in analog electronics. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Poznavanje in razumevanje nelinearnih elektronskih vezij in jih znati uporabiti pri inženirskem delu, v industrijskem okolju in v okviru pridobivanja nadaljnjih znanj v višjih letnikih študija.  Na podlagi temeljnih znanj in primerov dobre prakse se pridobi sposobnost razumevanja, uporabe, vrednotenja, analize in načrtovanja nelinearnih elektronskih vezij in sistemov.  Praktični pristop pri reševanju problemov nudi nadgradnjo temeljnih znanj in povezovanje problematik na sorodnih področjih. | | |  | Understanding of principles and systematic knowledge of non-linear electronic circuits. Capability to use non-linear circuits in engineering design, to integrate them in more complex electronic systems appropriate for variety of environments.  Based on fundamental knowledge and good practice cases to gain capability of understanding, use, evaluation, analysis and design of non-linear electronic circuits and systems.  Practical approach in solving problems of analog electronics offers an upgrade of fundamental knowledge and cross-fertilization to other electronic and electrical engineering fields. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, laboratorijske vaje, delo doma/domače naloge. | | |  | Lectures, laboratory work, work at home/homeworks. | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Uspešno opravljene laboratorijske vaje so pogoj za pristop k izpitu.  **Pisni in ustni izpit:** Kandidat, ki na pisnem izpitu zbere vsaj 50 % možnih točk, lahko pristopi k ustnemu izpitu. Skupna končna ocena se oblikuje na podlagi rezultata pisnega izpita in ustnega zagovora.  Ocene od 1 do vključno 5 so negativne, ocene od vključno 6 do 10 so pozitivne.  Prispevki k oceni:   * pisni izpit * ustni izpit | 40%  60% | | | | Positive evaluation of laboratory assignments is a prerequisite for the exam.  **Written and oral exam:**  A score of at least 50 % on the written exam is a prerequisite for undertaking the oral exam.  Final grade is based on the results of written and oral examination.  Negative grades: from 1 to 5, positive grades: from 6 to 10.  Contributions to the final grade:   * written exam * oral exam |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. ANDREJAŠIČ, Tine, JANKOVEC, Marko, TOPIČ, Marko. Comparison of direct maximum power point tracking algorithms using EN 50530 dynamic test procedure. IET Renew. Power Gener., 2011, Vol. 5, Iss. 4, pp. 281–286. 2. HERMAN, Matic, JANKOVEC, Marko, TOPIČ, Marko. Optimisation of the I–V measurement scan time through dynamic modelling of solar cells. IET Renew. Power Gener., 2013, Vol. 7, Iss. 1, pp. 63–70. 3. JANKOVEC, Marko, TOPIČ, Marko. Intercomparison of temperature sensors for outdoor monitoring of photovoltaic modules. Journal of solar energy engineering, ISSN 0199-6231, Aug. 2013, vol. 135, no. 3, str. 1-7. 4. KIRN, Blaž, BRECL, Kristijan, TOPIČ, Marko. A new PV module performance model based on separation of diffuse and direct light. Solar energy, ISSN 0038-092X, Mar. 2015, vol. 113, str. 212-230. 5. JOŠT, Marko, KRČ, Janez, TOPIČ, Marko. Camera-based angular resolved spectroscopy system for spatial measurements of scattered light. Applied optics, ISSN 1559-128X, Jul. 2014, vol. 53, no. 21, str. 4795-4803. | | | | | |