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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Sodobno načrtovanje radijskih komunikacij | | | | | | | | | | | | | | |
| **Course title:** | | | Modern design of radio communications | | | | | | | | | | | | | | |
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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 | | | | |  | | | | | | | | **1** | |  | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Izbirni/elective | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64875 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| **30** | **15** | | | **30** | | |  | | | |  | | | **50** | |  | **5** |
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| **Nosilec predmeta / Lecturer:** | | | | | Prof. dr. Matjaž Vidmar | | | | | | | | | | | | |
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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 študija,  Priporočeno poznavanje snovi matematike, osnov elektrotehnike, elektromagnetike/ elektrodinamike. | | | | | | | | |  | Registration,  Suggested knowledge of mathematics, electricity fundamentals, electromagnetism/electrodynamics. | | | | | | | |
| **Vsebina:** | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | |
| Uvod v radiokomunikacije. Osnovni sistemi in sklopi radijskih komunikacij: izvori (oddajniki), prenosne poti, ponori (sprejemniki), antene. Sodobno načrtovanje anten s pripadajočimi numeričnimi orodji (2D, 2.5D in 3D). Milimetrske, sub-milimetrske in teraherčne antene. Načrtovanje visokofrekvenčnih električnih vezij. Visokofrekvenčne lastnosti pasivnih in aktivnih elementov. Sodobno modeliranje linearnih in nelinearnih visokofrekvenčnih vezij. Visokofrekvenčne meritve. Zemeljske in satelitske komunikacije. Omejitve, lastnosti in načrtovanje satelitskih komunikacij. | | | | | | | |  | | Introduction to the radio communications. Basic radio communication systems and sub-systems: sources (transmitters), media, drains (receivers), antennas. Modern antenna design with the appropriate numerical tools (2D, 2.5D and 3D). Millimetre, sub-millimetre and terahertz antennas. High-frequency electrical circuit design. High-frequency properties of passive and active devices. Modern modelling of linear and nonlinear high-frequency circuits. High-frequency measurements. Ground-based and satellite communications. Limitations, properties and design of satellite communications. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. Belov LA, Smolskiy SM, Kochemasov VN (2012) Handbook of RF, Microwave, and Millimeter-Wave Components. Artech House, London 2. Rogers JWM, Plett C, Marsland I (2013) Radio Frequency System Architecture and Design. Artech House, London 3. Vidmar M (2005) Radiokomunikacije. Založba Fakultete za elektrotehniko in računalništvo, Ljubljana 4. Izbrani prispevki iz zbornikov seminarja Radijske komunikacije (2010-2014). Založba Fakultete za elektrotehniko in računalništvo, Ljubljana | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Spoznavanje osnovnih sestavnih delov radijske zveze. Spoznavanje delovanja, lastnosti in načrtovanja anten. Spoznavanje z numeričnimi orodji za načrtovanje anten. Spoznavanje anten v milimetrskem in teraherčnem področju. Spoznavanje visokofrekvenčnih lastnosti osnovnih električnih gradnikov. Načrtovanje in modeliranje visokofrekvenčnih vezij s sodobnimi orodji. Spoznavanje z osnovnimi visokofrekvenčnimi meritvami. Spoznavanje in načrtovanje komunikacijske zveze za majhne satelite. | |  | | Learning basic radio-communication building blocks. Learning the operation, properties and the design of antennas. Learning about numerical antenna-design tools. Learning millimetre and terahertz antennas. Learning high-frequency properties of basic electronic devices. Learning the design and modelling of radio-frequency circuits. Learning high-frequency measurements. Learning design of the communication link between a small satellite and a ground station. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Poznavanje in razumevanje osnovnih sestavnih delov radijske zveze, anten, visokofrekvenčnih lastnosti gradnikov in vezij, visokofrekvenčnih meritev. Seznanitev s sodobnimi orodji za načrtovanje anten in visokofrekvenčnih vezij. | | |  | Knowledge and understanding of the basic radio-communication building blocks, antennas, high-frequency properties of devices and circuits, high-frequency measurements. Familiarization with modern numerical tools for antenna and circuit design. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, na katerih se študent seznani s tematiko in teoretskim ozadjem. Samostojno in skupinsko seminarsko delo ter laboratorijske vaje z numeričnimi orodji ter praktičnimi poskusi. | | |  | Lectures for theoretical background. Sole and team seminar work with laboratory exercises (numerical tools and practical experiments). | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Sprotno ocenjevanje znanja preko seminarskih nalog (60% ocene). Sprotno ocenjevanje znanja preko poročil laboratorijskih vaj (40% ocene).  Na željo kandidata lahko z ustnim izpitom poskuša popraviti oceno. | **60%**  **40%** | | | | Several seminar reports (60% of the final grade). Reports from laboratory exercises (40% of the final grade). Oral examination is also available for candidates that want to improve their grade. |
| **Reference nosilca / Lecturer's references:** | | | | | |
| Pavlovič L, Vidmar M, Tomažič S (2012) 10 Gb/s 215-1 pseudo-random binary sequence generator (Psevdonaključni podatkovni izvor z bitno hitrostjo 10 Gbit/s in dolžino zaporedja 215-1). Informacije MIDEM 42-2:104-108  Steed RJ, Pavlovič L, Naglič L, Vidmar M (2011) Hybrid integrated optical phase-lock loops for photonic terahertz sources. IEEE journal of selected topics in quantum electronics 17-1:210-217  Naglič L, Pavlovič L, Batagelj B, Vidmar M (2008) Improved phase detector for electro-optical phase-locked loops. Electronics letters 44-12:758-760  Pavlovič L, Vidmar M (2010) Postopek generiranja psevdonaključnih podatkov in naprava za izvedbo postopka. Urad Republike Slovenije za intelektualno lastnino, patent št. 23082, Ljubljana  Vidmar M, Pavlovič L, Ritoša P, Tratnik J, Batagelj B (2010) Optični sistem za prenos signala časovne reference. Urad Republike Slovenije za intelektualno lastnino, SI 23045 (A), Ljubljana | | | | | |