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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Digitalne komunikacije | | | | | | | | | | | | | | |
| **Course title:** | | | Digital Communications | | | | | | | | | | | | | | |
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| **Študijski program in stopnja**  **Study programme and level** | | | | | **Študijska smer**  **Study field** | | | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| Univerzitetni študijski program prve stopnje Elektrotehnika | | | | | Informacijsko komunikacijske tehnologije | | | | | | | | 3. | | letni | | |
| 1st cycle academic study programme Electrical Engineering | | | | | Information and communications technologies | | | | | | | | 3. | | summer | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Obvezni - strokovni/ compulsory professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64175 | | | | | |
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| **Predavanja**  **Lectures** | **Seminar**  **Seminar** | | | **Vaje**  **Tutorial** | | | **Klinične vaje**  **work** | | | | **Druge oblike študija** | | | **Samost. delo**  **Individ. work** | |  | **ECTS** |
| 45 |  | | | 45 | | |  | | | |  | | | 85 | |  | 7 |
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|  | | | | | Sašo Tomažič | | | | | | | | | | | | |
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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):** | | | | | | | |
| Osnovni telekomunikacijski model. Vzorčenje. Prenos v osnovnem pasu (prenos impulzov, močnostni spekter kodiranega signala, sinhronizacija, optimalno sprejemno sito, intersimbolna interferenca). Adaptivni sistemi (adaptivna sita, adaptacijski algoritmi, izravnalnik, izločevalnik intersimbolne interference). Modulacije (amplitudna modulacija, frekvenčna modulacija, fazna modulacija, kvadraturna modulacija, digitalni modulacijski postopki, spektralna učinkovitost, modulacija z več nosilci). Kapaciteta prenosnega kanala. Sodostop (naključni sodostop, frekvenčni sodostop, časovni sodostop, razširjen spekter in kodni sodostop, celična omrežja). Kodirni postopki (linearne blokovne kode, konvolucijske kode, mrežne kode, produktne kode). Dekodirni postopki (mehko in trdo odločanje, detekcija in popravljanje napak, dekodiranje na osnovi največje verjetnosti in vnaprejšnje popravljanje napak, Viterbi algoritem). | | | | | | | |  | | Basic telecommunications model. Sampling. Baseband transmission (pulse transmission, power spectrum of coded signal, separation direction of transmission, synchronization, optimal receiving filter, inter-symbol interference). Adaptive systems (adaptive filters, adaptive algorithms, equalizer, inter-symbol interference canceller). Modulation (amplitude modulation, frequency modulation, phase modulation, quadrature modulation, digital modulation techniques, spectral efficiency, multiple carrier modulation). Transmission channel capacity. Multiple access (random multiple access, frequency division multiple access, time division multiple access, spread spectrum and code division multiple access, cellular networks). Coding (linear block codes, convolution codes, trellis codes, product codes). Decoding (soft and hard decision, detection and error correction, maximum likelihood and forward error correction, Viterbi algorithm). | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. Sašo Tomažič, Digitalne komunikacije, Založba FE-FRI, 2014  2. Simon Haykin, Michael, Communication Systems, 5th Edition, John Wiley & Sons, 2009 | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Spoznavanje osnovnih principov prenosa signalov pri digitalnih komunikacijah. Spoznavanje problemov, ki nastopajo pri prenosu podatkov po neidealnem kanalu, ki vnaša popačenje in šum ter postopkov za njihovo odpravljanje. Spoznavanje različnih načinov za souporabo skupnega prenosnega medija, predvsem pri brezžičnih komunikacijah, kjer je zmogljivost skupnega medija omejena, saj si vsi uporabniki delijo isti medij. | |  | | Learning about basic principles of signal transmission in digital communications. Learning about the problems that occur with data transmission via non-ideal channel, which introduces distortion and noise, and procedures to address them. Learning about different ways to share a common transmission medium primarily in wireless communications, where the capacity is a common medium is limited, because we all users share the same medium. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Poznavanje in razumevanje osnovnih načel digitalnega prenosa, motenj in napak, ki jih motnje povzročajo, ter postopkov za odpravljanje napak in učinkovito izkoriščanje frekvenčnega prostora. | | |  | Knowledge and understanding of the basic principles of digital transmission, errors caused by interference, and procedures for error correction and efficient use of the frequency space. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, na katerih se študent seznani s teoretičnimi osnovami, in laboratorijske vaje, kjer nekaj problemov spozna tudi praktično in jih skuša v duhu timskega dela reševati. | | |  | Lectures on which the student is acquainted with the theoretical basics and lab work, where he learns how to solve some practical problems in the spirit of teamwork. | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Način: laboratorijske vaje, projekt, 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 izpitu.  Prispevki k oceni:  laboratorijske vaje in projekt  ustni izpit | 25%  75% | | | | Type: laboratory exercises, project, oral exam.  Negative grades: from 1 to 5, positive grades: from 6 to 10.  Positive evaluation of laboratory exercises is a prerequisite for the exam.  Contributions to final grade:  laboratory exercises and project  oral examination |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. TOMAŽIČ, Sašo. Spectral efficiency. Encyclopedia of wireless and mobile communications. Boca Raton; New York: Taylor & Francis Group: Auerbach Publications, cop. 2008, vol. 2, str. 1095-1099.  2. TOMAŽIČ, Sašo. Comments on spectral efficiency of VMSK. IEEE transactions on broadcasting, 2002, vol. 48, no. 1, str. 61-62.  3. TOMAŽIČ, Sašo. Risidual noise reduction in sign algorithm. IEEE signal processing letters, 2000, vol. 7, no. 8, str. 233-234.  4. TOMAŽIČ, Sašo, ŠTULAR, Mitja. Razširjeni spekter v mobilnih komunikacijah: (1) Sistemi z raširjenim spektrom. Elektrotehniški vestnik, 1998, let. 65, št. 5, str. 303-310.  5. BERTOK, Jurij, TOMAŽIČ, Sašo. Sekvenčno dekodiranje konvolucijskih kod. Elektrotehniški vestnik, 1991, let. 58, št. 5, str. 291-301. | | | | | |