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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Signali | | | | | | | | | | | | | | |
| **Course title:** | | | Signals | | | | | | | | | | | | | | |
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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 | | | | | **Avtomatika** | | | | | | | | 3. | | zimski | | |
| 1st cycle academic study programme Electrical Engineering | | | | | **Control Systems** | | | | | | | | **3.** | | **winter** | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | Obvezni- strokovni/compulsory professional | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | 64125 | | | | | |
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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:** | | | | | France Mihelič | | | | | | | | | | | | |
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| **Jeziki /**  **Languages:** | | **Predavanja / Lectures:** | | | | slovenski | | | | | | | | | | | |
| **Vaje / Tutorial:** | | | | slovenski | | | | | | | | | | | |
| **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):** | | | | | | | |
| Uvod: definicija pojma signal, kratek zgodovinski oris razvoja teorije signalov, mesto teorije in obdelave signalov v elektrotehniki in splošno v znanosti.  Vrste signalov: energijski, močnostni signali; periodični, neperiodični signali; deterministični, naključni signali.  Ponazarjanje signalov: uporabnost ponazarjanja signalov z drugimi signali, načini ponazoritve in kriterij kakovosti ponazoritve, primeri temeljnih funkcij, ki jih uporabljamo za ponazarjanje.  Frekvenčna analiza determinističnih signalov: Fourierova vrsta in Fourierov integral.  Naključni signali: predstavitev osnovnih principov pri obdelavi naključnih signalov, korelacijska in kovariančna funkcija naključnih signalov, stacionarnost naključnih procesov in njihove deterministične karakteristike, vzorčno in časovno povprečje, ergodičnost.  Korelacija in konvolucija signalov: definicija korelacije in konvolucije na različnih tipih signalov in njihove lastnosti.  Uporaba korelacije in konvolucije: ocena podobnosti signalov, ocena spektra stacionarnih naključnih signalov, konvolucija in linearni stacionarni sistemi, določanje prenosne funkcije, detekcija periodične komponente.  Vzorčenje in kvantizacija signalov: namen vzorčenja in kvantizacije signalov, Shannon-ov stavek o vzorčenju, predstavitev vzorčenja in rekonstrukcije, vrste kvantizacije, signal kvantizacijske napake in njegove lastnosti, primeri kvantizacije.  Obdelava digitalnih signalov: diskretna Fourierjeva transformacija (DFT). | | | | | | | |  | | Introduction: Basic definitions, short history of the signal processing theory, position of the signal processing theory in electrotechnical and other sciences.  Signals classification: Signals with finite energy and finite average power, periodical a-periodical, deterministic and random signals.  Signals representations: Use of the signals representations, types of representations and representations quality measures, examples of basic functions sequences.  Frequency analysis: Fourier series and Fourier transform.  Random signals: Approaches to the random signal processing, stationary random process, correlation and covariance functions, sampling and time averages, ergodicity.  Signals correlation and convolution: Correlation and convolution definitions and properties for different types of signals.  Applications with correlation and convolution transformations: similarity measures, random signals spectrum evaluation, convolution and linear stationary systems, detection of periodic components in combination of signals.  Sampling and quantization: Purpose of the sampling and quantization, sampling theorem, representation of sampling and reconstruction, types of quantization, quantization error signal and his properties, examples for quantization.  Digital signal processing: Discrete Fourier Transform (DFT). | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. MIHELIČ, France, GYERGYÉK, Ludvik, EBENŠPANGER, Tomaž*. Signali : priročnik z zbirko rešenih nalog*. 4. popravljena in dopolnjena izd. Ljubljana: Založba FE in FRI, 2009. 132 str., ilustr. ISBN 978-961-243-116-7.  2. MIHELIČ, France*. Signali*. 1. izd. Ljubljana: Založba FE, 2014. ISBN 978-961-243-270-6. <http://luks.fe.uni-lj.si/nluks/wp-content/uploads/2014/11/Signali.pdf> | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Seznanjanje s posameznimi vrstami signalov, spoznavanje metod za njihov opis in obdelavo. | |  | | The aim of this course is to acquaint the student with the knowledge of different types and description of signals and processing methods. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Znanje o načinu matematičnih opisov in predstavitev signalov.  Razumevanje dualnosti časovne in frekvenčne predstavitve signalov in razlogov za različne načine opisovanja.  Znanje in razumevanje lastnosti različnih predstavitev in obdelav signalov. | | |  | Knowledge about mathematical signal modelling and representations  Comprehension of time and frequency duality of signal representation and motivations for different signal descriptions  Knowledge and comprehension of different signal representations and signal processing methods | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja  Sodelovalno učenje  Laboratorijske vaje | | |  | Lectures  Interactive teaching  Practical assignements | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Način: laboratorijske vaje, pisni izpit, ustni izpit.  Ocene od 1 do vključno 5 so negativne, ocene od vključno 6 do 10 so pozitivne.  Kandidat, ki na pisnem izpitu zbere vsaj 50 % možnih točk in v okviru laboratorijskih vaj zbere vsaj 30% točk, lahko pristopi k ustnemu izpitu.  Kriterij po kategorijah:  Ustni izpit  Pisni izpit (2xkolokvij)  Laboratorijske vaje | 50%  20%  30% | | | | Type: laboratory exercises, written exam, oral exam.  Negative grades: from 1 to 5, positive grades: from 6 to 10.  To qualify for the oral exam, each student has to score above 50% in the written eaxm and gather more than 30% of the available points during the practical assignements.  Contribution of each criterium to the final grade:  Oral exam  Written exam  Practical assignments |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. GAJŠEK, Rok, MIHELIČ, France, DOBRIŠEK, Simon. Speaker state recognition using an HMM-based feature extraction method. Computer speech & language, ISSN 0885-2308, Jan. 2013, vol. 27, no. 1, str. 135-150  2. DOBRIŠEK, Simon, GAJŠEK, Rok, MIHELIČ, France, PAVEŠIĆ, Nikola, ŠTRUC, Vitomir. Towards efficient multi-modal emotion recognition. International journal of advanced robotic systems, ISSN 1729-8814, 2013, vol. 10, no. 53, str. 1-10  3. DOBRIŠEK, Simon, ŽIBERT, Janez, PAVEŠIĆ, Nikola, MIHELIČ, France. An edit-distance model for the approximate matching of timed strings. IEEE transactions on pattern analysis and machine intelligence, ISSN 0162-8828. [Print ed.], Apr. 2009, vol. 31, no. 4, str. 736-741  4. MIHELIČ, France. Samodejna obdelava slovenskega govora. Inženir, ISSN 1855-0290, 2010, vol. 3, št. 2, str. 54-61  5. MIHELIČ, France (intervjuvanec), DOBRIŠEK, Simon (intervjuvanec), JUSTIN, Tadej (intervjuvanec). Vabljeni na pogovor s stroji! : Frekvenca X. Ljubljana: Val 202, 3. 10. 2013. http://www.val202.si/2013/10/frekvenca-x-umetna-sinteza-govora/ | | | | | |