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| **UČNI NAČRT PREDMETA / COURSE SYLLABUS** | | | | | | | | | | | | | | | | | | |
| **Predmet:** | | | Akustika in ultrazvok | | | | | | | | | | | | | | | |
| **Course title:** | | | Acoustics and Ultrasound | | | | | | | | | | | | | | | |
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| **Študijski program in stopnja**  **Study programme and level** | | | | | | | | **Študijska smer**  **Study field** | | | | | | **Letnik**  **Academic year** | | **Semester**  **Semester** | | |
| **Podiplomski študijski program 2. Stopnje Elektrotehnika** | | | | | | | | **Vse smeri** | | | | | |  | |  | | |
| **2nd cycle: postgraduate study programme Electrical Engineering** | | | | | | | | **All** | | | | | | **2** | | **3** | | |
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| **Vrsta predmeta / Course type** | | | | | | | | | | | | | izbirni / elective | | | | | |
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| **Univerzitetna koda predmeta / University course code:** | | | | | | | | | | | | | 64306 | | | | | |
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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:** | | | | | Samo Beguš | | | | | | | | | | | | | |
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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 predmeta | | | | | | | | | |  | Enrolment in the year of the course | | | | | | | |
| **Vsebina:** | | | | | | | | |  | | **Content (Syllabus outline):** | | | | | | | |
| Osnove fizikalne akustike, uho in zaznava zvoka. Človeški govor. Akustika prostorov, ozvočenje prostorov, gluha soba. Metode za zvočno izolacijo in dušenje. Zaščita pred hrupom. Mikrofon kot mehansko-električni akustični pretvornik. Govorna in glasbena snemanja. Zvočnik kot elektromehanski pretvornik. Modeliranje in simulacija akustičnih sistemov. Ultrazvočni pretvorniki. Digitalno procesiranje akustičnih signalov. Slepo ločevanje signalov, konvolucijsko mešanje, 'coctail-party' problem. Multimedijski sistemi, zvočni efekti, prostorski zvok, stiskanje avdio zapisov, protokol MIDI, algoritmi in standardi. AES3 standard. Merjenje lastnosti avdio sistemov. Naprave za reprodukcijo in snemanje zvoka, sistemi za redukcijo šuma in dinamika. Hrup in vibracije, fizikalne lastnosti hrupa in vibracij. Vpliv hrupa in vibracij na ljudi. Infrazvok. Meritve hrupa in vibracij. | | | | | | | | |  | | Principles of physical acoustics, human ear and perception of sound. Human speech. Room acoustics, sound reinforcement systems, anechoic chamber. Sound isolation and sound damping. Protection against noise. Microphone as acoustic-to-electric transducer. Speech and music recording. Speaker as electric-to-acoustic transducer. Modelling and simulation of acoustic systems. Ultrasonic transducers. Digital processing of acoustic signals. Blind source separation, convolution mixing, cocktail-party problem. Multimedia systems, sound effects, spatial sound, audio recording compression, MIDI protocol, algorithms and standards, AES3 standard. Evaluation of digital systems. Devices for sound recording and reproduction, noise and dynamic reduction systems. Noise and vibrations. Physical characteristics of noise and vibrations. Noise and vibrations influence on people's health. Infrasound. Noise and vibration measurement. | | | | | | | |

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| **Temeljni literatura in viri / Readings:** | | | | | |
| 1. Dale Ensminger, Leonard J. Bond, Ultrasonics: Fundamentals, Technologies, and Applications, CRC Press (Sept 2011). 2. David Howard and Jamie Angus, Acoustics and Psychoacoustics, Focal Press (Aug 2009). 3. Jens Blauert and Ning Xiang, Acoustics for Engineers: Troy Lectures, Springer (Jun 2009). 4. M. David Egan, Architectural Acoustics, J. Ross Publishing Classics (Jan 2007). 5. Thomas D. Rossing, Neville H. Fletcher: Principles of Vibration and Sound, Springer-Verlag (Jan 2004). 6. William M. Hartmann, Signals, Sound, and Sensation (Modern Acoustics and Signal Processing), American Institute of Physics (Sept 2004). | | | | | |
| **Cilji in kompetence:** | |  | | **Objectives and competences:** | |
| Razširiti znanja s področja akustike, elektroakustike in spoznati problematiko meritev zvoka, hrupa, ultrazvoka, vibracij ter procesiranja akustičnih signalov. | |  | | To expand the knowledge in the field of acoustics, electroacoustic and ultrasound. To obtain expertise in measuring sound, measuring vibrations and acoustic signal processing. | |
| **Predvideni študijski rezultati:** | | |  | **Intended learning outcomes:** | |
| Študent bo pridobil znanja o:  - osnovah akustike  - izvajanju in interpretaciji meritev akustičnih naprav in sistemov  - generiranju in merjenju ultrazvoka  - digitalni in analogni obdelavi akustičnih signalov  - tvorbi in redukciji zvočnega zapisa  - meritvah in vplivu hrupa na človeka.  Seminarji predstavljeni z nastopom pred avditorijem ali načrtovanje, izdelava, testiranje in predstavitev projekta s področja akustike in ultrazvoka. | | |  | The student will gain knowledge of:  - fundamentals of acoustics  - implementation and interpretation of measurements of acoustic devices and systems  - generation and measurement of ultrasound  - digital and analogue signal processing techniques  - production and compression of audio recording  - noise measurement and influence of noise on human beings.  Seminars presented to the audience in the auditorium or planning, preparation, testing and presentation of a project in the field of acoustic and ultrasound. | |
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| **Metode poučevanja in učenja:** | | |  | **Learning and teaching methods:** | |
| Predavanja, praktični prikazi, priprava in predstavitev individualnega seminarja ali projekta. | | |  | Lectures, demonstrations, preparation and presentation of individual seminar or project. | |
| **Načini ocenjevanja:** | Delež (v %) /  Weight (in %) | | | | **Assessment:** |
| Način: Ustni izpit, predstavitev seminarja ali projekta.  Ocene od 1 do vključno 5 so negativne, ocene od vključno 6 do 10 so pozitivne.  Opravljene laboratorijske vaje ter seminar ali projekt je pogoj za pristop k izpitu.  Prispevki k oceni:  Seminar ali projekt  ustni izpit | 50 %  50 % | | | | Type: laboratory exercises, homework, project, written exam, oral exam.  Negative grades: from 1 to 5, positive grades: from 6 to 10.  Finished laboratory exercises and seminar or project are prerequisites for the exam.  Contributions to final grade:  laboratory exercises or project  oral examination |
| **Reference nosilca / Lecturer's references:** | | | | | |
| 1. BEGUŠ, Samo. Moderni pristopi k poučevanje akustike in ultrazvoka. Elektrotehniški vestnik, ISSN 0013-5852. [Slovenska tiskana izd.], 2013, letn. 80, št. 1/2, str. 27-33. 2. MIHELJ, Matjaž, NOVAK, Domen, BEGUŠ, Samo. Virtual reality technology and applications, (Intelligent systems, control and automation, vol. 68). Dordrecht [etc.]: Springer, [2013], cop. 2014. 3. KIM, Kiwoong, BEGUŠ, Samo, XIA, Hui, LEE, Seung-Kyun, JAZBINŠEK, Vojko, TRONTELJ, Zvonko, ROMALIS, Michael V. Multi-channel atomic magnetometer for magnetoencephalography: a configuration study. NeuroImage, ISSN 1053-8119, 1 Apr. 2014, vol. 89, str. 143-151. 4. BEGUŠ, Samo. Avdiologija in elektroakustika : gradivo za laboratorijske vaje. Ljubljana: Fakulteta za elektrotehniko, Laboratorij za metrologijo in kakovost, 2014. 30 str. 5. BEGUŠ, Samo. Avdio inženiring : gradivo za laboratorijske vaje. Ljubljana: Fakulteta za elektrotehniko, Laboratorij za metrologijo in kakovost, 2013. 40 str. | | | | | |