



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Akustika
Course title:	Acoustics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Enovit magistrski študijski program druge stopnje Predmetni učitelj		4	8
Five-year master's degree program Subject Teacher			

Vrsta predmeta / Course type:

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
50			10		90	5

Nosilec predmeta / Lecturer:

Jeziki / Predavanja / Lectures:
Languages: Vaje / Tutorial:

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

Vsebina:	Content (Syllabus outline):
Nihala, sinusna in nesinusna nihanja, šumi, spektri in spektrogrami. Valovanje, zvočno valovanje. Razširjanje valovanja - zvoka v prostoru, Dopplerjev pojav. Odboj, lom, uklon in interferenca zvočnega valovanja. Vsiljeno nihanje in resonanca. Stoječe valovanje, nihanje strun. Odprte in zaprte piščali, akustična impedanca.	Vibrating bodies, simple and complex vibrations, noises, spectrums and spectrograms. Waves, sound waves. Progression of waves - sound in space, Doppler effect. Reflection, refraction, diffraction and interference of sound waves. Driven vibrations and resonance. Standing waves, vibration of strings. Open and closed pipes, acoustic impedance.



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<p>Sluh, glasnost, uho, naglušnost. Občutek višine in barve zvoka. Kombinacijski toni, konsonanca, disonanca. Glasbeni intervali in lestvice. Glasbeni instrumenti s strunami, trobila, pihala, tolkala. Akustični pojavi v neživi in živi naravi. Človeški glas; zgradba govoril, resonance govorne cevi, analiza in sinteza govora, značilnosti pevskega glasu. Hrup in okolje, merjenje, zaščita, hrup strojev iz našega okolja. Akustika prostorov. Električne in elektronske akustične naprave. Mikrofoni, ojačevalniki, zvočniki. Analogni in digitalni zvočni zapisi. Računalniška obdelava in analiza zvočnih zapisov.</p>	<p>Hearing, loudness, ear, hearing loss. Pitch and timbre. Combination tones, consonance, dissonance. Musical intervals and scales. String, brass, woodwind, and percussion musical instruments. Natural acoustic phenomena. The human voice; vocal organs, resonances of the vocal tract, analyses and synthesis of speech, the characteristics of singing voice. Noise and the environment, measurement, protection, noise from different devices. Acoustics of rooms. Electrical and electronic acoustical devices. Microphones, amplifiers, loudspeakers. Analog and digital sound records. Computer processing and analyses of sound records.</p>
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Temeljni literatura in viri / Readings:

Eberhard Hänslar, Gerhard Schmidt, Topics in Acoustic Echo and Noise Control, Springer-Verlag Berlin Heidelberg, 2006

Thomas D. Rossing, The science of sound (3rd edition), Addison-wesley Publishing. Company, 2001

Bruno Ravnikar, Osnove glasbene akustike in informatike, DZS, Ljubljana 2001

Ivo Verovnik, Uporaba računalnika pri obravnavi zvočnih pojavov, Zavod Republike Slovenije za šolstvo, Ljubljana, 2001.

Leopold Mathelitsch, Ivo Verovnik, Akustische Phaenomene, Aulis Verlag Deubner GMBH & CO, Koeln, 2004 ali Verlag Oebv & hpt, Wien 2004.

Znanstveni in strokovni prispevki v domači in tuji periodiki (npr. Obzornik DMFA, Presek, Fizika v šoli, Physick in unserer Zeit, AJP, EJP...) ter druga študijska gradiva na spletnih straneh FNM UM.

Cilji in kompetence:

Študenti usvojijo znanja z različnih področij akustičnih pojavov in orodji za obdelavo in analizo zvoka, ki jih omogoča sodobna računalniška tehnologija.

Objectives and competences:

Students obtain the knowledge about a wide variety of acoustic phenomena. Especially they get an insight of using contemporary computer technology for processing and analyses of sound records.

Predvideni študijski rezultati:

Intended learning outcomes:



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Znanje in razumevanje:

Po uspešno zaključeni učni enoti je študent zmožen:

- uporabiti teoretično znanje s področja nihanja in valovanja za razumevanje različnih pojavov v akustiki,
- kvalitativno in kvantitativno pojasniti zvočne pojave,
- uporabiti sodobne metode za analizo zvočnih pojavov,
- uporabiti sodobne metode in programska okolja za obdelavo in analizo zvoka ter zvočnih pojavov.
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Prenesljive/ključne spretnosti in drugi atributi:

Študent je sposoben:

- uporabiti sodobno računalniško tehnologijo za obravnavo zvočnih pojavov,
- načrtovati in izvesti osnovne meritve zvoka in zvočnih materialov z uporabo različnih merilnih tehnik in metod,
- natančno in adekvatno poročati in zagovarjati o svojih ugotovitvah.

Knowledge and understanding:

On completion of this course student will be able to:

- use theoretical knowledge from the field of oscillation and wave to understand different acoustic's phenomena,
- qualitatively and quantitatively explain sound phenomena,
- use different methods to analyze sound phenomena,
- use different software tools to process and analyze sound and sound phenomena.

Transferable/Key Skills and other attributes:

Student is able to:

- use computer technology to study sound phenomena,
- plan and execute basic measurements of sound and sound phenomena using different measuring techniques and methods,

accurate and adequate reporting on their findings.

Metode poučevanja in učenja:

Predavanja in eksperimentalna predavanja (razlaga, razgovor, demonstracija)
Laboratorijske vaje (delo s tekstom, metoda pisnih in grafičnih del, metoda praktičnih del, uporaba simulacij in simulacijskih okolij)

Poučevanje in učenje potekata z didaktično uporabo informacijsko-komunikacijske tehnologije.

Learning and teaching methods:

Lectures and experimental lectures (explanation, discussion, demonstration)
Laboratory exercises (work with text, work with graphic elements, practical work, use of simulations and simulation environments)

Teaching and learning are done through the didactic use of ICT.

Delež (v %) /

Načini ocenjevanja:

Weight (in %) **Assessment:**



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Opravljenе laboratorijske vaje in njihov zagovor.	20	All laboratory work done and the oral avocation of laboratory work.
Ustni izpit.	80	Oral exam.
Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.		Each of the mentioned commitments must be assessed with a passing grade.
Pozitivna ocena iz zagovora laboratorijskih vaj je pogoj za pristop k izpitu.		Positive grade of laboratory work and advocacy are a prerequisite for access to the exam.

Reference nosilca / Lecturer's references:

HAUKO, Robert, ANDREEVSKI, Damjan, PAUL, Domen, ŠTERK, Marko, REPNIK, Robert. Teaching of the harmonic oscillator damped by a constant force: The use of analogy and experiments. *American journal of physics : a publication of American association of physics teachers*, ISSN 0002-9505. [Print ed.], Sep. 2018, vol. 86, no. 9, str. 657-662, ilustr. <https://aapt.scitation.org/doi/pdf/10.1119/1.5044654>,

ÜLEN, Simon, GERLIČ, Ivan, SLAVINEC, Mitja, REPNIK, Robert. Evaluating the effectiveness of physlet-based materials in supporting conceptual learning about electricity. *Journal of science education and technology*, ISSN 1059-0145, 2017, vol. 26, iss. 2, str. 151-160, tabele, doi: [10.1007/s10956-016-9661-1](https://doi.org/10.1007/s10956-016-9661-1). [COBISS.SI-ID [22803208](https://www.cobiss.si/id/22803208)]

NEPOMUCENO, Erivelton Geraldo, LIMA, Arthur M., ARIAS-GARCÍA, Janier, PERC, Matjaž, REPNIK, Robert. Minimal digital chaotic system. *Chaos, solitons and fractals*. [Print ed.], 2019, vol. 120, str. 62-66, doi: [10.1016/j.chaos.2019.01.019](https://doi.org/10.1016/j.chaos.2019.01.019). [COBISS.SI-ID [24425992](https://www.cobiss.si/id/24425992)]