Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Fizika materialov
Course title:	Physics of materials

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika 2. st.		**1,2**	**1,2,3,4**
Physics 2nd degree		**1,2**	**1,2,3,4**

Vrsta predmeta / Course type izbirni/elective

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Seminarske vaje Tutorial	Terenske vaje Field work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	**5**	**20**	**5**		**110**	**5**

Nosilec predmeta / Lecturer: Mitja Slavinec

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Pogojev ni. Priporočljivo predznanje Mehanike, Elektromagnetizma, Matematične fizike, Moderne fizike in Trdne snovi.	None. Recommended preknowledge in Mechanics, Electromagnetism, Mathematical physics, Modern Physics and Solid State Physics.

Vsebina:	**Content (Syllabus outline):**
• Kristali in simetrije • Interakcije v trdni snovi • Blochovi elektroni, prevodnost, specifična toplota • Mrežna nihanja, specifična toplota (eno dimenzionalni (1D), 3D, 1D sistemi in nečistoče)	• Crystals and symmetries • Interactions in solid state systems • Bloch electrons, conductivity, specific heat • Lattice oscillations, specific heat (one dimensional (1D), 3D, 1D system and impurities) • Quantization of oscillations, phonons

• Kvantizacija mrežnih nihanj, fononi • Termično raztezanje • Elektronska in ionska polarizabilnost • Fazni in strukturni prehodi, spinski valovi, mehke in Goldstonove fluktuacije, teorija superprevodnosti, kritični pojavi, skaliranje • Mehanske lastnosti strukturnih materialov • Fazna separacija in večkomponentni materiali • Umetne mase • Tekstilni materiali • Jeklo in železove zlitine • Preizkusi mehanskih lastnosti jekel • Barvne kovine • Akustično aktivni materiali	• Thermal expansion • Electron and ion polarizability • Phase and structural transitions, spin waves, soft and Goldstone modes, theory of superconductivity, critical phenomena, scaling • Mechanical properties of structural materials • Phase separation and multi-component materials • Plastics • Textile materials • Steel and iron alloys • Tests of mechanical properties of steels • Color metals • Acoustically active materials

Temeljni literatura in viri / Readings:

1. N.W. Ashcroft, N.D. Mermin, Solid state physics, Rinehart and Winston, New York, 1976 in kasnejše izdaje.
2. C. Kittel, Introduction to Solid State Physics, John Wiley&Sons, New York, 1986 in kasnejše izdaje.
3. S. Blundell, Magnetism in Condensed Matter, Oxford University Press, New York, 2001.

Dodatna literatura / Additional Readings:

1. Aktualna gradiva bodo sproti objavljena tudi v spletni učilnici na Moodlu.

The relevant sources and teaching material will also be regularly posted in the online classroom on Moodle.

Cilji in kompetence:	**Objectives and competences:**
Študent osvoji napredno znanje na področju fizike trdne snovi in fizike materialov: kristali, keramika, umetne mase, jeklo in železove zlitine, tekstilni materiali.	Student acquires advanced knowledge on physics of solid state physics and physics of materials: crystals, ceramics, plastics, steel and iron alloys, textile materials.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Po uspešno zaključeni učni enot študent: • razume ključne koncepte in procese v fiziki trdnih snovi, • povezuje teoretično znanje iz fizike za študijo lastnosti materialov, • povezuje teoretično znanje fizike različnih materialov (kristali, keramika, umetne mase, jeklo in železove zlitine,	Knowledge and Understanding: On completion of this course student: • understands key concepts and processes in the physics of solids, • connects theoretical knowledge in physics to study the properties of materials, • connects the theoretical knowledge of the physics of various materials (crystals, ceramics, plastics, steel and iron alloys,

tekstilni materiali) in oblikuje celostno sliko, • se seznani z merilnimi tehnikami in metodami na področju fizike materialov, • spozna in uporablja matematične modele za obravnavo fizikalnih problemov v fiziki materialov, • vrednoti in interpretira rezultate. Prenesljive/ključne spretnosti in drugi atributi: Študent je zmožen uporabiti matematične modele za reševanje realnih fizikalnih problemov, uporabljati sodobno računalniško programsko opremo kot pomoč pri kvantitativni obravnavi zahtevnih fizikalnih problemov in uporabiti znanje za obravnavo dejanskih tehnoloških problemov v fiziki materialov.	textile materials) to form overall understanding, • gets acquainted with measurement techniques and methods in the field of physics of materials, • learns about the use of mathematical models for studying physical problems in the field of physics of materials, • evaluates in interprets results. Transferable/Key Skills and other attributes: Student is able to use mathematical methods to solve real problems in physics, use modern computer software tools for quantitative study of advanced physical problems, use the knowledge to tackle actual technological problems in physics of materials.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in eksperimentalna predavanja (razlaga, razgovor, demonstracija) Seminarske vaje (delo s tekstom, metoda pisnih in grafičnih del, metoda praktičnih del, uporaba simulacij in simulacijskih okolij) Terensko delo (ekskurzije, študija primera) Seminar (razlaga in razgovor) Poučevanje in učenje potekata z didaktično uporabo informacijsko-komunikacijske tehnologije.	Lectures and experimental lectures (explanation, discussion, demonstration) Seminar exercises (work with text, work with graphic elements, practical work, use of simulations and simulation environments) Field work (excursion, case study) Seminar (explanation and discussion) Teaching and learning are done through the didactic use of ICT.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminarska naloga ustni izpit Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno. Pozitivna ocena iz seminarske naloge je pogoj za pristop k izpitu.	**50** **50**	Seminar paper oral exam Each of the mentioned commitments must be assessed with a passing grade. A positive grade of the seminar is a prerequisite for access to the exam.

Reference nosilca / Lecturer's references:

1. WEI, Zhouchao, ZHU, Bin, YANG, Jing, PERC, Matjaž, SLAVINEC, Mitja. Bifurcation analysis of two disc dynamos with viscous friction and multiple time delays. Applied mathematics and computation. [Print ed.]. 2019, vol. 347, str. 265-281. ISSN 0096-3003. DOI: 10.1016/j.amc.2018.10.090. [COBISS.SI-ID 24361480]
2. FISTER, Iztok, IGLESIAS, Andres, GÁLVEZ, Akemi, DEL SER, Javier, OSABA, Eneko, FISTER, Iztok, PERC, Matjaž, SLAVINEC, Mitja. Novelty search for global optimization. Applied mathematics and computation. [Print ed.]. 2019, vol. 347, str. 865-881. ISSN 0096-3003. DOI: 10.1016/j.amc.2018.11.052. [COBISS.SI-ID 24211976]
3. WANG, Zhen, ROSTAMI, Zahra, JAFARI, Sajad, ALSAADI, Fawaz E., SLAVINEC, Mitja, PERC, Matjaž. Suppression of spiral wave turbulence by means of periodic plane waves in two-layer excitable media. Chaos, solitons and fractals. [Print ed.]. 2019, vol. 128, str. 229-233. DOI: 10.1016/j.chaos.2019.07.045. [COBISS.SI-ID 24725000]