



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.		2	3
Physics 2 nd degree		2	3

Vrsta predmeta / Course type

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:

Jeziki / Languages:

Predavanja / Lectures:	slovenski/Slovene
Vaje / Tutorial:	slovenski/Slovene

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

Predznanje Mehanike, Elektromagnetizma, Matematične fizike, Moderne fizike in Trdne snovi.

Prerequisites:

Preknowledge in Mechanics, Electromagnetism, Mathematical physics, Modern Physics and Solid State Physics.

Vsebina:

- Kristali in simetrije
- Interakcije v trdni snovi
- Blochovi elektroni, prevodnost, specifična toplota
- Mrežna nihanja, specifična toplota (eno dimenzionalni (1D), 3D, 1D sistemi in nečistoče)
- Kvantizacija mrežnih nihanj, fononi
- Termično raztezanje

Content (Syllabus outline):

- 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
- Thermal expansion
- Electron and ion polarizability

<ul style="list-style-type: none"> • 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
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<ul style="list-style-type: none"> • 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
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Temeljni literatura in viri / Readings:

<ol style="list-style-type: none"> 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. 4. http://solidstate.physics.sunysb.edu/teach/intlearn/ 5. http://www-thphys.physics.ox.ac.uk/people/SteveSimon/

Cilji in kompetence:

Študenti poglobijo znanje na področju fizike trdne snovi.

Objectives and competences:

Students acquire advanced knowledge on physics of solid state physics.
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Predvideni študijski rezultati:

<p>Znanje in razumevanje: Razumevanje procesov v trdni snovi.</p> <p>Prenosljive/ključne spretnosti in drugi atributi: Predmet da temeljna znanja za razumevanje specifičnih področij v biofiziki, fiziki mehke snovi, okoljski fiziki in aplikativni fiziki.</p>

Intended learning outcomes:

<p>Knowledge and Understanding: Understanding of processes in solid states.</p> <p>Transferable/Key Skills and other attributes: The subject gives basic knowledge necessary to study specific fields in biophysics, soft matter physics, environmental physics and physics application.</p>
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Metode poučevanja in učenja:

Metodika obsega: teoretičen uvod v problematiko in numerično reševanje posameznih problemov

Learning and teaching methods:

They are based on: theoretical introduction and numerical solving of specific problems.

Načini ocenjevanja:Delež (v %) /
Weight (in %)**Assessment:**

dve seminarski nalogi	50	two seminar works
ustni izpit	50	oral exam

Reference nosilca / Lecturer's references:

Izvirni znanstveni članki / Original scientific articles

1. ÜLEN, Simon, ČAGRAN, Branka, SLAVINEC, Mitja, GERLIČ, Ivan. Designing and evaluating the effectiveness of Physlet-based learning materials in supporting conceptual learning in secondary school physics. *Journal of science education and technology*, ISSN 1059-0145, 2014, vol. 23, iss. 5, str. 658-667, tabele, doi: 10.1007/s10956-014-9492-x. [COBISS.SI-ID 20475656]
2. SVETEC, Milan, SLAVINEC, Mitja. Nematic liquid crystal locking menisci. *Advances in condensed matter physics*, ISSN 1687-8108, 2013, vol. 2013, art. ID 756902, str. 1-6. <http://dx.doi.org/10.1155/2013/756902>. [COBISS.SI-ID 19802888]
3. RANJKESH SIAHKAL, Amid, AMBROŽIČ, Milan, SLAVINEC, Mitja. Study of phase transitions and structural order in perturbed nematic liquid crystals = Študij faznega prehoda in strukturnega reda v perturbiranemu nematičnemu tekočemu kristalu. *Anali PAZU*, ISSN 2232-416X, 2013, letn. 3, št. 2, str. 57-67, graf. prikazi. http://www.anali-pazu.si/sites/default/files/Separat_Ranjkesht_et.al_.pdf. [COBISS.SI-ID 20496136]
4. SLAVINEC, Mitja, ZAVEC PAVLINIČ, Daniela, REPNIK, Robert, DUH, Nejc, MEKJAVIĆ, Igor B. Istraživanje udobnosti odjeće fizikalnom analizom i pomoću "termo odijela". *Tekstil*, ISSN 0492-5882, 2013, vol. 62, no. 9/10, str.361-369, ilustr. [COBISS.SI-ID 27428135]
5. SLAVINEC, Mitja, FRAS, Maja, ZAVEC PAVLINIČ, Daniela, MEKJAVIĆ, Igor B. Toplotno prevajanje skozi vlažne plasti = Heatconducting through the damplayer. *Anali PAZU*, ISSN 2232-416X, 2012, letn. 2, št. 2, str. 62-69, ilustr. [COBISS.SI-ID 19802632]
6. SVETEC, Milan, SLAVINEC, Mitja. Structural transition of nematic liquid crystal in cylindrical capillary as a result of the annihilation of two point defects. *The Journal of chemical physics*, ISSN 0021-9606, 2008, vol. 128, no. 8, str. 084704-1-084704-6, ilustr. <http://link.aip.org/link/?JCPA6/128/084704/1>, <http://dx.doi.org/10.1063/1.2839301>. [COBISS.SI-ID 15899400]
7. SLAVINEC, Mitja, KRALJ, Samo, ŽUMER, Slobodan, SLUCKIN, T. J. Surface depinning of smectic-A edge dislocations. *Physical review. E*, ISSN 1063-651X, 2001, 63, str. 031705-1-031705-6. [COBISS.SI-ID 1277796]
8. SLAVINEC, Mitja, KRALJ, Samo, ŽUMER, Slobodan. Formation of edge dislocations in the surface constrained smectic a film. *Molecular crystals and liquid crystals science and technology. Section A, Molecular crystals and liquid crystals*, ISSN 1058-725X, 2000, vol. 351, str. 153-160, ilustr. [COBISS.SI-ID 10579464]
9. SLAVINEC, Mitja, CRAWFORD, G. D., KRALJ, Samo, ŽUMER, Slobodan. Determination of the nematic alignment and anchoring strength at the curved nematic-air interface. *Journal of applied physics*, ISSN 0021-8979, 1997, vol. 81, str. 2153-2156. [COBISS.SI-ID 5769736]
10. SLAVINEC, Mitja, KRALJ, Samo. Annihilation of nematic point defects within a cylindrical tube = Anihilacija nematičnih točkovnih defektov v cilindrični kapilari. *Znanstvena revija*, ISSN 1318-7945, 1997, letn. 9, št. 1, str. 19-25, ilustr. [COBISS.SI-ID 77702144]

