



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Trdna snov
Course title:	Solid state

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Dvopredmetna izobraževalna fizika	/	2	3
Double major Educational Physics	/		

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
45			30		75	5

Nosilec predmeta / Lecturer:

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

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

Prerequisites:

Vsebina:

Content (Syllabus outline):

- Osnove kristalografije, Bravaisova in recipročna mreža.
- Mrežna nihanja: harmonski približek, specifična toplota trdnih teles, anharmonični pojavi (termično raztezanje, toplotna prevodnost).
- Kolektivni pojavi: dielektrične lastnosti dielektrikov, paraelektriki, feroelektriki, antiferoelektriki, paramagnetizem, feromagnetizem.
- Landauova teorija faznih prehodov, metoda molekularnega polja.

- Basics of crystallography, Bravais lattices.
- Lattice oscillations: harmonic approximation, specific heat of solids, anharmonic effects (thermal expansion, heat conductivity)
- Collective phenomena: dielectric, paraelectric, ferroelectric, diamagnetic, paramagnetic, ferromagnetic behaviour.
- Landau theory of phase transitions, mean field approximation.

Temeljni literatura in viri / Readings:

- D. Halliday, R. Resnick, J. Walker, Fundamentals of Physics, 5. izdaja, (John Wiley & Sons, Inc., New York, 1997).
- Članki v Science, Nature, Scientific American.
- N.W. Ashcroft, N.D. Mermin, Solid state physics, (Rinehart and Winston, New York, 1976 in kasnejše izdaje).
- <http://solidstate.physics.sunysb.edu/teach/intlearn/>
- <http://www.ruph.cornell.edu/sss/sss.html>

Cilji in kompetence:

- Študenti osvojijo osnovno znanje s področja fizike trdne snovi.
- Demonstriran je prenos znanja med različnimi vejami fizike.
- Prikazana je uporaba računalnika v demonstracijske namene.

Objectives and competences:

- Students acquire basic knowledge on solid state physics.
- Transfer of knowledge among different areas of physics is demonstrated.
- Use of computer simulations to analyse physical phenomena is demonstrated.

Predvideni študijski rezultati:

Znanje in razumevanje:
Razumevanje osnovnih procesov v trdni snovi.

Intended learning outcomes:

Knowledge and Understanding:
Understanding of basic processes in solid materials.

Prenesljive/ključne spretnosti in drugi atributi:
Rešitev problemov z matematičnimi orodji
in celosten pristop k reševanju problemov.

Transferable/Key Skills and other attributes:
Solving of problems with mathematical tools
and gained global approach on solving a
problem.

Metode poučevanja in učenja:

Learning and teaching methods:

- Predavanja
- Teoretične vaje

- Lectures
- Theoretical exercises

Delež (v %) / oral exam, seminar

Načini ocenjevanja:

Weight (in %)

- ustni izpit	70	- oral exam
- seminarska naloga	30	- seminar

Reference nosilca / Lecturer's references:

- 1 G. Cordoyiannis, S. Kralj, Z. Kutnjak, D. Jesenek, I. Musevic, A. Zidansek, Different modulated structures of topological defects stabilized by adaptive targeting nanoparticles, *Soft matter* **9**, 3956-3964 (2013).
- 2 A. Ranjkesh, M. Ambrozic, G. Cordoyiannis, Z. Kutnjak, S. Kralj, History dependent patterns in randomly perturbed nematic liquid crystals, *Advances in Condensed Matter Physics* **2013**, 505219-1-505219-10 (2013).
- 3 R. Repnik, A. Ranjkes, V. Simonka, M. Ambrozic, Z. Bradac, S. Kralj, Symmetry breaking in nematic liquid crystals: analogy with cosmology and magnetism, *J. Phys.: Condens. Matter, Special Issue on Condensed matter analogues of cosmology* **25**, 404201-1-404201-10, (2013).
- 4 M. Lavrič, V. Tzitzios, S. Kralj, G. Cordoyiannis, I. Lelidis, G. Nounesis, V. Georgakilas, H. Amenitsch, A. Zidansek, Z. Kutnjak, The effect of graphene on liquid-crystalline blue phases, *Appl. Phys. Lett.* **103**, 143116 (2013).
- 5 D. Jesenek, S. Perutkova, W. Gozdz, V. Kralj-Iglic, A. Iglic, S. Kralj, Vesiculation of biological membrane driven by curvature induced frustrations in membrane orientational ordering, *International journal of nanomedicine* **8**, 677-687 (2013).