Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Mehka snov
Course title:	Soft Matter

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

Vrsta predmeta / Course type	izbirni/ optional
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
15		30			105	5

Nosilec predmeta / Lecturer:	Samo Kralj

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski/Slovenian in/and angleški/English
	Vaje / Tutorial:	slovenski/Slovenian in/and angleški/English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Pogojev ni. Priporočljiva znanja so: predznanje iz Mehanike, Elektromagnetizma, Matematične fizike in Moderne fizike.	None. Recommended is: preknowledge of Mechanics, Electromagnetism, Mathematical physics and Modern Physics.

Vsebina:	**Content (Syllabus outline):**

• Mehka snov, splošne značilnosti • Značilne sklopitve med sestavnimi enotami, atomske in molekularne structure • Kontinuumski opis in ureditveni parameter • Fazni in strukturni prehodi • Fizika defektov, univerzalnosti, povezava z drugimi fizikalnimi sistemi (fizika delcev, kozmologija) • Površinski pojavi, fizika tankih slojev, sidranja in močenja • Stabilnost koloidnih sistemov, nastanek mrež, gelov • Polimeri • Fazna separacija • Aplikacije	• Soft matter, general characteristics • Interactions, atomic and molecular structures • Continuum description and order parameter • Phase and structural transitions • Physics of defects, universalities, analogous systems (in solid state, particle physics and cosmology) • Surface phenomena, thin films, wetting, anchoring • Stability of colloidal patterns, gels • Polymers • Phase separation • Applications

Temeljni literatura in viri / Readings:

1. M. Kleman, O.D. Lavrentovich, Soft Matter Physics, Springer-Verlag, New York, 2003,
2. V. Popa-Nita, Phase transitions, applications to liquid crystals, organic electronic and optoelectronic fields, Research Signpost, Kerala, 2006
3. F. Reif, Fundamentals of statistical and thermal physics, McGraw Hill Book Company, New York, 1965
4. http://plc.cwru.edu/tutorial/enhanced/files/hindex.html

Članki v Science, Nature, Scientific American

Cilji in kompetence:	**Objectives and competences:**
Študenti usvojijo znanje s področja univerzalnosti mehkih sistemov. Predstavljeni so minimalni modeli, ki opisujejo njihovo fazno in strukturno obnašanje.	Students acquire knowledge on universal properties of soft systems. Minimal models to model phase and structural behavior of soft materials are presented.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje in modeliranje fundamentalnih mehanizmov, ki narekujejo značilno obnašanje mehkih sistemov Prenesljive/ključne spretnosti in drugi atributi: Rešitev problemov z matematičnimi orodji in celosten pristop k reševanju problemov.	Knowledge and Understanding: Understanding and modelling of fundamental mechanism which dominate behavior of soft systems. 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:
Metodika obsega: teoretičen uvod v problematiko in numerično reševanje posameznih problemov.	They are based on: theoretical introduction and numerical solving of specific problems.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Ustni izpit.	100%	Oral exam.

Reference nosilca / Lecturer's references:

1) AMBROŽIČ, Milan, KRALJ, Samo. Field percolation-switching in soft ternary anisotropic system. Physica. A, Statistical mechanics and its applications, 2019, vol. 520, str. 11-25, doi: 10.1016/j.physa.2018.12.044 [COBISS.SI-ID 24324104].
2) KLEMENČIČ, Eva, TRČEK, Maja, KUTNJAK, Zdravko, KRALJ, Samo. Giant electrocaloric response in smectic liquid crystals with direct smectic-isotropic transition. Scientific reports, 2019, vol. 9, art. no. 1721, str. 1721-1-1721-10, doi: 10.1038/s41598-019-38604-9 [COBISS.SI-ID 32102951].
3) KURIOZ, Pavlo, KRALJ, Marko, MURRAY, Bryce S., ROSENBLATT, Charles, KRALJ, Samo. Nematic topological defects positionally controlled by geometry and external fields. Beilstein journal of nanotechnology, 2018, vol. 9, str. 109-118, https://www.beilstein-journals.org/bjnano/content/pdf/2190-4286-9-13.pdf, doi: 10.3762/bjnano.9.13 [COBISS.SI-ID 23661832].
4) KRAŠNA, Marjan, KLEMENČIČ, Eva, KUTNJAK, Zdravko, KRALJ, Samo. Phase-changing materials for thermal stabilization and thermal transport. Energy, 2018, vol. 162, str. 554-563 [COBISS.SI-ID 24002824].
5) DUBTSOV, Alexander, PASECHNIK, Sergey V., SHMELIOVA, Dina V., SAIDGAZIEV, Ayvr Sh., GONGADZE, Ekaterina, IGLIČ, Aleš, KRALJ, Samo. Liquid crystalline droplets in aqueous environments: electrostatic effects. Soft matter, 2018, vol. 14, iss. 47, str. 9619-9630, doi: 10.1039/C8SM01529E [COBISS.SI-ID 24177416].
6) MESAREC, Luka, KURIOZ, Pavlo, IGLIČ, Aleš, GÓŹDŹ, Wojciech, KRALJ, Samo. Curvature-controlled topological defects. Crystals, 2017, vol. 7, no. 6, str. 1-11, http://www.mdpi.com/2073-4352/7/6/153, doi: 10.3390/cryst7060153 [COBISS.SI-ID 11753556].