



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	1,2,3,4
Physics 2 nd degree		1,2	1,2,3,4

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:

Pogojev ni.

Priporočljiva znanja so:
predznanje iz Mehanike, Elektromagnetizma,
Matematične fizike in Moderne fizike.

Prerequisites:

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
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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.

Dodatna literatura / Additional Readings:

1. F. Reif, Fundamentals of statistical and thermal physics, McGraw Hill Book Company, New York, 1965.
2. <http://plc.cwru.edu/tutorial/enhanced/files/hindex.html>
3. Članki v Science, Nature, Scientific American

Cilji in kompetence:

Študenti usvojijo znanje s področja univerzalnosti mehkih sistemov. Predstavljeni so minimalni modeli, ki opisujejo njihovo fazno in strukturno obnašanje.

Objectives and competences:

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:

Znanje in razumevanje:
Razumevanje in modeliranje fundamentalnih mehanizmov, ki narekujejo značilno obnašanje mehkih sistemov

Intended learning outcomes:

Knowledge and Understanding:
Understanding and modelling of fundamental mechanism which dominate behavior of soft systems.

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.
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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.

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

Reference nosilca / Lecturer's references:

1. MESAREC, Luka, IGLIČ, Aleš, KRALJ, Samo. Spatial manipulation of topological defects in nematic shells. The European physical journal. E, Soft matter. Jul. 2022, iss. 7, art. no. 62, 1-7 str., ilustr. ISSN 1292-8941. <https://link.springer.com/article/10.1140/epje/s10189-022-00216-z>, DOI: 10.1140/epje/s10189-022-00216-z. [COBISS.SI-ID 117006851]

2. POLANŠEK, Juš, HÖLBL, Arbresha, STARZONEK, Szymon, DROZD-RZOSKA, Aleksandra, RZOSKA, Sylwester, KRALJ, Samo. History-dependent phase transition character. The European physical journal. E, Soft matter. Sep. 2022, vol. 45, iss. 9, 1-14 str. ISSN 1292-8941. DOI: 10.1140/epje/s10189-022-00221-2. [COBISS.SI-ID 120603395]

financer: ARRS, Programi, P1-0099, SI, Fizika mehkih snovi, površin in nanostruktur; ARRS, Projekti, J1-2457, SI, Fazni prehodi proti koordinaciji v večplastnih omrežjih

3. HARKAI, Saša, KRALJ, Samo. Structural transformations of nematic disclinations. The European physical journal. E, Soft matter. Sep. 2022, vol. 45, iss. 9, 8 str. ISSN 1292-8941. DOI: 10.1140/epje/s10189-022-00226-x. [COBISS.SI-ID 136110339]

financer: ARRS, Programi, P1-0099, SI, Fizika mehkih snovi, površin in nanostruktur