



Univerza v Mariboru



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Fakulteta za naravoslovje in
matematiko

UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION

Predmet:	Mehka snov
Subject 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 2 nd degree		1	2

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Labor work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
15	0	30	0	0	105	5

Nosilec predmeta / Lecturer:

Jeziki / Languages: **Predavanja / Lecture:**
Vaje / Tutorial:

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

Predznanje iz Mehanike, Eletromagnetizma, Matematične fizike in Moderne fizike.

Prerequisites:

Preknowledge of Mechanics, Electromagnetism, Mathematical physics and Modern Physics.

Vsebina:

- 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

Content (Syllabus outline):

- 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 / Textbooks:

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>
5. Članki v *Science*, *Nature*, *Scientific American*.

Cilji:

Študenti usvojijo znanje s področja univerzalnosti mehkih sistemov.

Objectives:

Students acquire knowledge on universal properties of soft systems.

Predvideni študijski rezultati:

Znanje in razumevanje:
Razumevanje procesov v mehkih sistemih.

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

Intended learning outcomes:

Knowledge and Understanding:
Understanding of processes in 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:

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:

Pisni izpit

50%

Written exam

Ustni izpit

50%

Oral exam

Reference nosilca / Lecturer's references:

KRALJ, Samo, ROSSO, Riccardo, VIRGA, Epifanio G. Curvature control of valence on nematic shells. *Soft matter*, 2011, vol. 7, issue 2, str. 670-683, ilustr., doi: [10.1039/C0SM00378F](https://doi.org/10.1039/C0SM00378F). [COBISS.SI-ID [17960200](https://www.cobiss.si/id/17960200)]

BRADAČ, Zlatko, KRALJ, Samo, ŽUMER, Slobodan. Early stage domain coarsening of the isotropic-nematic phase transition. *J. chem. phys.*, 2011, vol. 135, no. 2, str. 024506-1-024506-9, ilustr., doi:[10.1063/1.3609102](https://doi.org/10.1063/1.3609102). [COBISS.SI-ID [18553864](https://www.cobiss.si/id/18553864)]

SCHOOT, Paul van der, POPA-NITA, Vlad Dumitru, KRALJ, Samo. Alignment of carbon nanotubes in nematic liquid crystals. *J. phys. chem., B Condens. mater. surf. interfaces biophys.*, 2008, 112, iss. 15, str. 4512-4518. <http://dx.doi.org/10.1021/jp712173n>, doi: [10.1021/jp712173n](https://doi.org/10.1021/jp712173n). [COBISS.SI-ID [15940616](https://www.cobiss.si/id/15940616)]

KRALJ, Samo, ROSSO, Riccardo, VIRGA, Epifanio G. Fingered core structure of nematic boojums. *Phys. rev., E Stat. nonlinear soft matter phys. (Print)*, 2008, vol. 78, no. 3, str. 031701-1-031701-4, ilustr.<http://dx.doi.org/10.1103/PhysRevE.78.031701>, doi: [10.1103/PhysRevE.78.031701](https://doi.org/10.1103/PhysRevE.78.031701). [COBISS.SI-ID [16177416](https://www.cobiss.si/id/16177416)]

KRALJ, Samo, CORDOYIANNIS, George, JESENEK, Dalija, ZIDANŠEK, Aleksander, LAHAJNAR, Gojmir, NOVAK, Nikola, AMENITSCH, Heinz, KUTNJAK, Zdravko. Dimensional crossover and scaling behavior of a smectic liquid crystal confined to controlled-pore glass matrices. *Soft matter*, 2012, vol. 8, issue 8, str. 2460-2470, doi: [10.1039/C1SM06884A](https://doi.org/10.1039/C1SM06884A). [COBISS.SI-ID [25534759](https://www.cobiss.si/id/25534759)]

