

**UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION**

<b>Predmet:</b>	Mehka snov
<b>Subject Title:</b>	Soft Matter

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika 2. st.		1,2	2,3
Physics 2 <sup>nd</sup> degree		1,2	2,3

**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
45	0	30	0	0	75	5

**Nosilec predmeta / Lecturer:**

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

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

Predznanje iz Mehanike, Elektromagnetizma, 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:**

**Objectives:**

Študenti usvojijo znanje s področja univerzalnosti mehkih sistemov.

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:**

2 pisna kolokvija ali pisni izpit	50%	2 written tests or written or 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)]