Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Modeliranje v fiziki mehke snovi**
Course title:	**Modelling in soft matter physics**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
FIZIKA		**1**. ali 2.	**1., 2. ali 3.**
PHYSICS		1. or 2.	**1., 2. or 3.**

Vrsta predmeta / Course type

Izbirni za modula Biofizika 3 in Fizika 1, 2, 3

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Mentorstvo Mentorship	Samost. delo Individ. work	ECTS
15					**435**	**15**

Nosilec predmeta / Lecturer: **Samo Kralj**

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski/Slovenian
	Vaje / Tutorial:	

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

Predznanje iz klasične in moderne fizike, trdne snovi in iz matematične fizike

Prerequisits:

Preknowledge of classical and modern physics, solid state physics and mathematical methods in physics.

Vsebina:

1) Modeliranje: makroskopski, mezoskopski in semi-mikroskopski modeli

Content (Syllabus outline):

1) Modelling: macroscopic, mesoscopic, semi-microscopic models

2) Tipične eksperimentalne meritve 3) Numerično modeliranje 4) Fizikalni pojavi: fazno obnašanje in kritični pojavi v sistemih z orientacijsko in translacijsko urejenostjo, neravnovesni pojavi, topološki defekti v mehki snovi,vpliv nereda na fazno in strukturno obnašanje 5) Aplikacije	2) Typical experimental measurements 3) Numerical modelling 4) Physical phenomena: phase behaviour and critical phenomena in systems exhibiting orientational and translational ordering, non-equilibrium behaviour, topological defects in soft materials, impact of disorder on phase and structural ordering 5) Applications

Temeljni literatura in viri / Readings:

1) M. Kleman, O.D. Lavrentovich, Soft Matter Physics, Springer-Verlag, New York, 2003.

2) P. M. Chaikin, T. C. Lubensky, Principles of Condensed Matter Physics, Cambridge University Press, Cambridge, England, 1995.

3) P.G. de Gennes, J. Prost, The Physics of Liquid Crystals, Oxford University Press,Oxford,1993.

4) A. Leach, Molecular modelling: Principles and applications, Pearson, 2001.

5) D. Chandler, Introduction to modern statistical mechanics, Oxford University Press, Oxford, 1987.

Cilji in kompetence:	**Objectives and competences:**
Študenti poglobijo znanje s področja modeliranja v fiziki mehkih sistemov in povezavo z drugimi področji v fiziki.	Students acquire advanced knowledge on modeling in physics of soft systems and universalities.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje procesov v mehki snovi. Prenesljive/ključne spretnosti in drugi atributi: Rešitev problemov z matematičnimi orodji, numeričnimi metodami, univerzalnosti v fiziki in celosten pristop k reševanju problemov.	Knowledge and understanding: Understanding of processes in soft systems. Transferable/Key Skills and other attributes: Solving of problems with mathematical tools, numerical methods, universalities in physics and gained global approach on solving a problem.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminar, reševanje odprtih problemov.	Lectures, seminar, solving open problems.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
Seminarji Ustni izpit	**50%** **50%**	3 Seminars Oral exam

Reference nosilca / Lecturer's references:

1. RANJKESH SIAHKAL, Amid, AMBROŽIČ, Milan, KRALJ, Samo, SLUCKIN, T. J. Computational studies of history dependence in nematic liquid crystals in random environments. *Physical review. E, Statistical, nonlinear, and soft matter physics*, ISSN 1539-3755, 2014, vol. 89, iss. 2, str. 022504-1-022504-14, doi: 10.1103/PhysRevE.89.022504. [COBISS.SI-ID 20347912]

2. TRČEK, Maja, CORDOYIANNIS, George, TZITZIOS, Vassilios, KRALJ, Samo, NOUNESIS, George, LELIDIS, Ioannis, KUTNJAK, Zdravko. Nanoparticle-induced twist grain boundary phases. *Physical review. E, Statistical, nonlinear, and soft matter physics*, ISSN 1539-3755, 2014, vol. 90, issue 3, str. 1-8, doi: 10.1103/PhysRevE.90.032501. [COBISS.SI-ID 27908903]

3. KRALJ, Samo, MAJUMDAR, Apala. Order reconstruction patterns in nematic liquid crystal wells. *Proceedings. Series A, Mathematical, Physical and Engineering Sciences*, ISSN 1364-5021. [Print ed.], 2014, vol. 470, no. 2169, str. 1-18. http://rspa.royalsocietypublishing.org/content/470/2169/20140276.abstract, doi: 10.1098/rspa.2014.0276. [COBISS.SI-ID 20812040]

4. RANJKESH SIAHKAL, Amid, AMBROŽIČ, Milan, CORDOYIANNIS, George, KUTNJAK, Zdravko, KRALJ, Samo. History-dependent patterns in randomly perturbed nematic liquid crystals. *Advances in condensed matter physics*, ISSN 1687-8108, 2013, vol. 2013, str. 505219-1-505219-10, doi: 10.1155/2013/505219. [COBISS.SI-ID 26806567]

5. S. Kralj, R. Rosso, E.G. Virga, Curvature control of valence on nematic shells. Soft matter 7, 670 (2011).