Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Kompleksni sistemi**
Course title:	**Complex Systems**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Enovit magistrski študijski program druge stopnje Predmetni učitelj	/	3	5
Five-year master's degree program Subject Teacher	/		

Vrsta predmeta / Course type	Obnezni/Obligatory
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
30		15			75	4

Nosilec predmeta / Lecturer:	Samo Kralj

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Predznanje klasične in moderne fizike	Preknowledge of classical and modern physics

Vsebina:	**Content (Syllabus outline):**
Definicija kompleksnosti kot vmesno stanje med redom in neredom. Enostavnost na subatomskem nivoju in kompleksnost na makroskopski skali.Naključje na mikroskopski skali in determinizem na makroskopski skali. Vzroki skalnega obnašanja.DNK in ompleksnost živih bitij, nastanek vzorcev.Granularni sistemi kot modelni sistemi tekočih, trdnih in celo kristalnih stanj. Kinetika bioloških sistemov:	Definition of complexity as a state between order and disorder.Simplicity on the subatomic scale and complexity on the macroscopic scale. Reasons behind scaling behaviour.DNA and complexity, onset of patterns in leaving creatures.Granular systems as model systems of fluids, solids and even crystal states. The kinetics of biological systems: - systems of metabolism and transport

– sistemi metabolizma in transporta (shrambni modeli, modeli biokemijskih reakcij, farmakokinetski modeli) – modelni pristop h kompleksnim biološkim procesom (modeli razmnoževanja in interakcij, modeli rasti in delitve, evolucijski modeli, modeli neuronskih procesov) – difuzijski sistemi in oblikovanje vzorcev	(compartmental analysis, models of biochemical reactions, pharmacokinetic models) - model approaches to some complex biological processes (models of propagation and ecological interactions, models of growth and differentiation, models of evolution, models of neuronal processes) - diffusion system and pattern growth

Temeljni literatura in viri / Readings:

1. R. Glaser, Biophysics, (4. izdaja), Springer Verlag, Berlin, 1996.
2. H. Haken, Synergetics. An Introduction (2. izdaja), Springer Verlag, New York, 1978.
3. P.G. de Gennes, Scaling Concepts in Polymer Physics, Cornell University Press, Itaca 1979
4. A.J. Lichtenberg, Regular and Stohastic Motion, Springer Verlag, Heidelberg, 1983
5. Članki v Science, Nature, Scientific American.

Cilji in kompetence:	**Objectives and competences:**
Študenti usvojijo osnovno znanje s področja kompleksnih pojavov.	Students acquire elemental knowledge on complexity.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje osnovnih procesov v naravi, ki vodijo do kompleksnih obnašanj. **Prenesljive/ključne spretnosti in drugi atributi:** Razumevanje osnovnih procesov v naravi, ki vodijo do kompleksnih obnašanj in celosten pristop k reševanju problemov.	**Knowledge and understanding:** Understanding of basic processes in the nature giving rise to complexity. **Transferable/Key Skills and other attributes:** Understanding of basic processes in the nature giving rise to complexity and gained global approach to solving problems.

Metode poučevanja in učenja:	**Learning and teaching methods:**

Metodika obsega: teoretičen uvod v problematiko in numerično reševanje posameznih problemov, demonstracijski poskusi pri predavanjih	They are based on: theoretical introduction and numerical solving of specific problems, demonstration experiments during lectures

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

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. [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. [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. [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. [COBISS.SI-ID16177416]

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. [COBISS.SI-ID 25534759]