Univerza v Mariboru
University of Maribor

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION	
Predmet:	**Kompleksni sistemi**
Subject Title:	Complex Systems

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Fizika Physics		3	5

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
30		15			75	4

Nosilec predmeta / Lecturer: Samo Kralj

Jeziki / Languages:
Predavanja / Lecture: slovenski/Slovene
Vaje / Tutorial: slovenski/Slovene

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

Predznanje klasične in moderne fizike

Prerequisits:

Preknowledge of classical and modern physics

Vsebina:

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 kompleksnost živih bitij, nastanek vzorcev.
Granularni sistemi kot modelni sistemi tekočih, trdnih in celo kristalnih stanj.

Kinetika bioloških sistemov:
- 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

Content (Syllabus outline):

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 (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 / Textbooks:

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:	**Objectives:**
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:**
Pisni izpit	**50 %**	Pisni izpit
Ustni izpit	**50 %**	Ustni izpit