



Univerza v Mariboru
University of Maribor

Fakulteta za naravoslovje in
matematiko
Faculty of natural sciences and
mathematics



UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION

Predmet: Subject Title:	Fizika kompleksnih sistemov Physics of complex systems
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Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Izobraževalna fizika Educational 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			105	5

Nosilec predmeta / Lecturer:

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

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

Opravljen izpiti iz Fizike 1 (mehanika), Fizike 2 (toplota, elektrika) in Fizike 3 (nihanje/valovanje, optika) oziroma temu ekvivalenten kurs fizike na drugi fakulteti in/ali univerzi.

Prerequisites:

Done exam of Physics 1 (mechanics), Physics 2 (heat, electricity), and Physics 3 (waves and optics) or alternatively, a certificate confirming the existence of equivalent knowledge obtained from a physics course attended at a different faculty and/or university.

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. Kompleksne mreže. DNK in kompleksnost živih bitij. Granularni sistemi kot modelni sistemi tekočih, trdnih in celo kristalnih stanj. Kinetika bioloških sistemov:

- sistemi metabolizma in transporta (shrambni modeli, modeli biokemijskih reakcij, farmakokinetični modeli)
- modelni pristop h kompleksnim biološkim procesom (modeli razmnoževanja in interakcij, modeli rasti in delitve, evoliucijski modeli, modeli nevronskega procesa)
- difuzijski sistemi in oblikovanje vzorcev

Definition of complexity as a state between order and disorder. Simplicity on the subatomic scale and complexity on the macroscopic scale. Reasons behind scaling behavior. Complex networks. DNA and complexity. 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

Temeljna literatura in viri / Textbooks:

D. Halliday, R. Resnick, J. Walker, *Fundamentals of Physics*, 5. izdaja, (John Wiley & Sons, Inc., New York, 1997).

Članki v Science, Nature, Scientific American.

Cilji:

Študenti osvojijo osnovna znanja s področja kompleksnih sistemov.

Objectives:

Students acquire basic knowledge from the field of complex systems.

Predvideni študijski rezultati:

Znanje in razumevanje:

Razumevanje osnovnih procesov v naravi, ki vodijo do kompleksnih obnašanj.

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 basic processes in nature and the ability to demonstrate them in an appropriately equipped laboratory.

Transferable/Key Skills and other attributes:

A didactic approach to real-life phenomena and the ability to transfer this knowledge to a non-specialist; or to provide a detailed and accurate description of a particular problem and propose mathematically and

physically motivated solutions, thus facilitating development in a research oriented environment.

Metode poučevanja in učenja:

Teoretičen uvod v problematiko in numerično reševanje posameznih problemov, demonstracijski poskusi pri predavanjih.

Learning and teaching methods:

Theoretical introduction and numerical solving of specific problems, demonstration experiments during lectures

Načini ocenjevanja:

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

Ustni izpit
Seminarska naloga

Delež (v %) /
Weight (in %)

70%
30%

Assessment:

Type (examination, oral, coursework, project):

Oral exam
Written seminar work

Materialni pogoji za izvedbo predmeta :

Učilnica z računalnikom in LCD projektorjem (slednji bo v uporabi le občasno).

Material conditions for subject realization

Classroom with a personal computer and an LCD projector (the latter will be in use only occasionally).

Obveznosti študentov:

(pisni, ustni izpit, naloge)

Seminarska naloga ter ustni izpit.

Student's commitments:

(written, oral examination, courseworks):

Written seminar work as well as an oral exam.