Univerza v Mariboru
University of Maribor

Fakulteta za naravoslovje in matematiko

OPIS PREDMETA / SUBJECT SPECIFICATION	
Predmet:	**Sistemsko mišljenje**
Subject Title:	System Thinking

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Fizika Physics		1	**1**

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Lab. work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
45			30		105	**6**

Nosilec predmeta / Lecturer: Marko MARHL

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Jih ni	none

Vsebina:	**Contents (Syllabus outline):**
1. Struktura, dinamika in evolucija kompleksnih sistemov v naravi, tehniki in družbi. 2. Sistemsko mišljenje in modeliranje sistemske dinamike. 3. Analiza kompleksnega sistema: določitev sistema in njegove okolice, ki ima vpliv na dinamiko sistema (primeri iz fizike; npr. mehanike – izbor sistema in določitev njegove okolice). Razgradnja kompleksnega sistema; prepoznavanje komponent sistema, določitev povezav med deli sistema, medsebojnih vplivov in zunanjih vplivov na sistem. 4. Kvalitativni opis sistemske dinamike: kavzalni diagrami in diagrami stanj in tokov. 5. Aplikacije v fiziki in na drugih področjih: populacijska dinamika, okoljevarstvo, dinamika bioloških sistemov, ….	1. Structure, dynamics and evolution of natural, technical and social complex system. 2. System Thinking and System Dynamics Modelling. 3. Analysis of complex system: system determination and taking into account the surrounding that influences the system (examples in Physics, e.g., mechanics – system determination and its surrounding). Decomposition of complex system into components, determining the interrelations between the components, influences between the components and external influences on the system. 4. Qualitative approaches in system dynamics: causal loop diagrams, stock-flow diagrams. 5. Applications in Physics and in other fields: population dynamics, environmental systems, biological systems, …

Temeljni študijski viri / Textbooks:

- J. W. Forrester, World Dynamics, Wright-Allen Press, Cambridge 1971.
- G. Ossimitz, Entwicklung systemischen Denkens, Theoretische Konzepte und empirische Untersuchungen, Profil Verlag, München 2000.
- P.M. Senge, The Fifth Discipline: The Art and Practice of the Learning Organisation. Doubleday, New York 1990.
- P.M. Senge, N. Cambron-McCabe, T. Lucas, B. Smith, J. Dutton, A. Kleiner, Schools that Leatn: A Fifth Discipline Fieldbook for Educators, Parents, and Everyone Who Cares About Education.

Doubleday, New York 2000.
- Strokovni in znanstveni članki v revijah / Articles published in professional and scientific journals.

Cilji:

- Ponazoriti zvezo med strukturo, dinamiko in evolucijo kompleksnih sistemov.
- Predstaviti odnos med sistemskim mišljenjem in modeliranjem sistemske dinamike.
- Obdelati celotno kvalitativno analizo dinamike kompleksnih sistemov na enostavnih fizikalnih primerih.
- Prenos uporabe univerzalnih metod analize s fizikalnih primerov na področja populacijske dinamike, okoljevarstva, bioloških sistemov, …

Objectives:

- Presenting the relationship between the structure, dynamics, and evolution of complex systems.
- Establishing the relationship between the system thinking and system dynamics modelling.
- Working on a complete qualitative analysis of system dynamics for simple physical systems.
- Transfer of using general methods for the analysis of physical systems to other fields, e.g., population dynamics, environment, biological systems, …

Predvideni študijski rezultati:

Znanje in razumevanje:

- Poznati zvezo med strukturo, dinamiko in evolucijo kompleksnih sistemov.
- Poznati odnos med sistemskim mišljenjem in modeliranjem sistemske dinamike.
- Obvladati kvalitativno analizo dinamike kompleksnih sistemov na enostavnih fizikalnih primerih.

Prenesljive/ključne spretnosti in drugi atributi:

- Metode kvalitativne analize dinamike sistemov so univerzalne in jih je mogoče uporabiti na najrazličnejših področjih.
- Poudarek je na prenosu znanja s primerov iz fizike na področja populacijske dinamike, okoljskih problemov, bioloških sistemov, …

Intended learning outcomes:

Knowledge and Understanding:

- Know the relationship between the structure, dynamics, and evolution of complex systems.
- Know the relationship between the system thinking and system dynamics modelling.
- Be able to carry out a complete qualitative analysis of system dynamics for simple physical systems.

Transferable/Key Skills and other attributes:

- Methods for qualitative analysis of system dynamics are universal and can be implemented in different fields of research.
- In particular, a knowledge transfer from examples in Physics to examples in population dynamics, environment and biological systems will be emphasised.

Metode poučevanja in učenja:

- Predavanja
- Teoretične vaje
- Vaje na računalniku
- Eksperimentalne vaje

Learning and teaching methods:

- Lectures
- Theoretical exercises
- Computer exercises
- Experiments

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
• ustni izpit	**40**	• oral
• pisni izpit	**40**	• written
• seminarska naloga	**20**	• seminar work