



OPIS PREDMETA / SUBJECT SPECIFICATION

Predmet:

Modeliranje sistemov v okolju

Subject Title:

Modelling of Environmental Systems

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Biologija in ekologija z naravovarstvom / Biology and ecology with nature conservation	Biologija; Ekologija z naravovarstvom / Biology; Ecology with nature conservation	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
30	15		30		135	7

Nosilec predmeta / Lecturer:

Marko MARHL

Jeziki /

Predavanja / Lecture: slovenski / Slovenian

Languages:

Vaje / Tutorial: slovenski / Slovenian

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

Prerequisites:

Vsebina:

Contents (Syllabus outline):

- Okoljski sistemi: struktura, dinamika in razvoj sistemov
- Analiza sistemov
- Kvalitativna analiza sistemov
 - Določitev sistema in njegove okolice, ki pomembno vpliva na dinamiko sistema. Razgradnja sistema; prepoznavanje komponent sistema, določitev povezav med deli sistema, medsebojnih vplivov in zunanjih vplivov na sistem.
 - Kvantitativna analiza dinamike sistemov Določanje spremenljivk v sistemu, ki opisujejo stanja in tokove. Medsebojni vplivi in zunanji vplivi na posamezne spremenljivke.
- Opis dinamike sistemov
 - Kvalitativni opis dinamike sistemov: diagrami stanj in tokov, kavzalni diagrami.
 - Kvantitativni opis systemske dinamike: prehod s kavzalnih diagramov in diagramov stanj in tokov na matematičen opis vpliva tokov količin na njihovo dinamiko; diferencialne enačbe; matematični model.
- Modeliranje, simulacija, napovedi modelov

- Environmental systems: structure, dynamics and system's development
- Systems analysis
- Qualitative system analysis:
 - Determination of a system and its surrounding that considerably influences the systems dynamics. Decomposition of a system into components, determining the interrelations between the components, influences between the components and external influences on the system.
 - Quantitative analysis of system dynamics: Determination of system variables – the so-called stock and flow variables. Interrelated influences and external influences on the variables.
- Description of system dynamics
 - Qualitative approaches in system dynamics: causal-loop diagrams, stock-flow diagrams.
 - Quantitative approaches in system dynamics: quantification of causal-loop diagrams and stock-flow diagrams; mathematical description of influences of fluxes on system variables; mathematical model.
- Modelling, simulation, model prediction

- Konstruiranje preprostih modelov: populacijski modeli, modeli ekosistemov, kroženje snovi v naravi, modeli na celični ravni, ... Reševanje diferencialnih enačb v urejevalnikih tabel (Excel) – simulacija s poudarkom na napovedni moči modelov.
- Uporaba računalniških programov
- Grafično orientirani računalniški programi za modeliranje sistemske dinamike: DynaSys, Stella, Vensim, Powersim, Madonna,

- Construction of simple models: models of population dynamics, ecosystems, models on cellular level, Solving of equations in spreadsheet programmes (Excel) – simulations with emphasis on predictive power of models.
- 5. Using computer programs
- Graphic-oriented computer programmes for modelling of system dynamics: DynaSys, Stella, Vensim, Powersim, Madonna,

Temeljni študijski viri / Textbooks:

- Ford, A., 1999: Modeling the Environment; An Introduction to System Dynamics Modeling of Environmental Systems, Island Press.
- Hritonenko, N., Y. Yatsenko, 1999: Mathematical Modeling in Economics, Ecology and the Environment, Springer, New York.
- Jørgensen, S. E., B. Halling-Sørensen, S.N. Nielsen, 1996: Handbook of Environmental and Ecological Modeling, CRC Press LLC.
- Ossimitz, G., 2000: Entwicklung systemischen Denkens, Theoretische Konzepte und empirische Untersuchungen, Profil Verlag, München.
- Strokovni in znanstveni članki v revijah / Articles published in professional and scientific journals.

Cilji:

- Ponazoriti zvezo med strukturo, dinamiko in razvojem okoljskih sistemov
- Predstaviti odnos med sistemskim mišljenjem in modeliranjem sistemske dinamike
- Obdelati celovito kvalitativno in kvantitativno analizo dinamike okoljskih sistemov
- Prenos uporabe univerzalnih metod analize na druga področja

Objectives:

- Presenting the relationship between the structure, dynamics, and development of environmental systems
- Establishing the relationship between the system thinking and system dynamics modelling
- Working on a complete qualitative and quantitative analysis of system dynamics
- Transfer of using general methods of the analysis to other fields

Predvideni študijski rezultati:

Znanje in razumevanje:

- Poznati zvezo med strukturo, dinamiko in razvojem okoljskih sistemov
- Poznati odnos med sistemskim mišljenjem in modeliranjem sistemske dinamike
- Obvladati kvalitativno in kvantitativno analizo dinamike okoljskih sistemov na enostavnih primerih
- Znati uporabljati grafično orientirane računalniške programe za modeliranje in simulacijo dinamike sistemov

Prenesljive/ključne spretnosti in drugi atributi:

- Metode kvalitativne in kvantitativne analize dinamike sistemov so univerzalne in jih je mogoče uporabiti na najrazličnejših področjih
- Poudarek je na prenosu znanja na druge sisteme ter povezavi predvsem okoljskih in bioloških sistemov

Intended learning outcomes:

Knowledge and Understanding:

- Know the relationship between the structure, dynamics, and development of environmental systems
- Know the relationship between the system thinking and system dynamics modelling
- Be able to carry out a complete qualitative and quantitative analysis of system dynamics for simple systems
- Be able to use graphic-oriented computer programmes for modelling and simulation of dynamical systems

Transferable/Key Skills and other attributes:

- Methods for qualitative and quantitative analysis of system dynamics are universal and can be implemented in different fields of research
- In particular, a knowledge transfer is emphasised to other fields and finding interconnections between environmental and biological systems

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:**

- Seminarska naloga
- Pisni kolkvij
- Ustni izpit

30
30
40

- Seminar essay
- Written partial exam
- Oral exam

Materialni pogoji za izvedbo predmeta :

- *Multimedijska predavalnica*
- *Učilnica z računalniki za študente*

Material conditions for subject realization

- *Lecture hall for multimedia presentations*
- *Laboratory with computers for students*

Obveznosti študentov:*(pisni, ustni izpit, naloge, projekti)*

- Seminarska naloga
- Pisni kolkvij
- Ustni izpit

Students' commitments:*(written, oral examination, coursework, projects):*

- Seminar essay
- Written partial exam
- Oral exam