Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Fizika družbe**
Course title:	**Social physics**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
FIZIKA, 1. stopnja		3.	**6.**
PHYSICS, 1st cycle		3.	**6.**

Vrsta predmeta / Course type	Izbirni / elective
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
30					**150**	**6**

Nosilec predmeta / Lecturer:	**Matjaž Perc**
Jeziki / Languages: **Predavanja / Lectures:**	Slovenski / Slovenian
Vaje / Tutorial:	Slovenski / Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Ni pogojev za vključitev v delo. Vsaka izmed naštetih obveznosti v načinih ocenjevanja mora biti opravljena s pozitivno oceno. Opravljen projekt je pogoj za pristop k ustnemu izpitu.	There are no prerequisites. Each of the listed obligations in the assessment methods must be completed with a positive grade. Completed project is a prerequisite for taking the oral exam.

Vsebina:	**Content (Syllabus outline):**

Teorija iger, fizikalna interpretacija Darwinovega zakona evolucije, uspešnost različnih vedenjskih vzorcev v luči fizike, vpliv vedenjskih vzorcev na uspešnost družbe kot celote, nastanek kompleksnih mrež in pojav malega sveta.	Game theory, physical interpretation of the Darwinian law of evolution, successfulness of different behavioural patterns in terms of physics, impacts of different behavioural patterns on the prosperity of society as a whole, emergence of complex networks and the small-world phenomenon.

Temeljni literatura in viri / Readings:

1) R. Axelrod, *The evolution of cooperation* (Basic Books, New York, 1984).
2) A. Szolnoki, et al., Cyclic dominance in evolutionary games: A review, J. R. Soc. Interface 11, 20140735 (2014)
3) M. Perc and P. Grigolini, Collective behavior and evolutionary games - An introduction, Chaos, Solitons & Fractals 56, 1-5 (2013)
4) M. Perc and A. Szolnoki, Coevolutionary games - A mini review, BioSystems 99, 109-125 (2010)

Dodatna literatura /Additional Readings:

5) K. Sigmund, *Games of life* (Oxford University Press, Oxford, 1993).
6) J. Hofbauer and K. Sigmund, *Evolutionary games and population dynamics* (Cambridge University Press, Cambridge, 1998).

Cilji in kompetence:	**Objectives and competences:**
Študenti usvojijo temeljna teoretična znanja s področja o vedenjskih strategijah v družbi in razumeti njihov uspeh (ali neuspeh) na podlagi fizike, in jih znajo uporabiti pri reševanju ustreznih problemov z rabo matematičnih orodij.	Students acquire basic theoretical knowledge about behavioural patterns in society and understand their success (or failure), in view of the underlying mechanisms of physics and are able to use the knowledge to solve problems with the use of mathematical tools.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Po uspešno zaključeni učni enoti bodo študenti zmožni: - Opisati učinke in potenciale različnih vedenjskih vzorcev v družbi. - Uporabiti programiranje za analizo in študij modelov, ki opisujejo socialno dinamiko. - Razlikovati med skupinsko in kolektivno dinamiko v socialnih modelih.	**Knowledge and understanding:** On completion of this course students will be able to: - Describe different behavioural patterns and strategies, and foretell their impact on the affected society. - Use programming to analyse and study models that describe social dynamics. - Differentiate between group and collective dynamics in social models.

Prenesljive/ključne spretnosti in drugi atributi:	**Transferable/Key Skills and other attributes:**
Po uspešno zaključeni učni enoti bodo študenti zmožni: - Prepoznati različne vedenjske vzorce in strategije ter predvideti njihov vpliv na družbo (ali skupino ljudi), ki jim je podvržena. - Pripravljati socialne modele za različne realne sisteme v družbi.	On completion of this course students will be able to: - Recognize different behavioural patterns and strategies, and foretell their impact on the affected society (or group of people). - Prepare social models for different real systems in our societies.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja in projektno delo.	Lectures and project work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ustni izpit projekt	**50%** **50%**	Oral exam project

Reference nosilca / Lecturer's references:

1. IZGI, Burhaneddin, ÖZKAYA, Murat, ÜRE, Nazim Kemal, PERC, Matjaž. A holistic matrix norm-based alternative solution method for Markov reward games. *Applied mathematics and computation*. [Print ed.]. Mar. 2025, vol. 488, [article no.] 129124, 13 str. ISSN 0096-3003. DOI: 10.1016/j.amc.2024.129124. [COBISS.SI-ID 213539331]

2. ZHANG, Yichao, WANG, Jiasheng, WEN, Guanghui, GUAN, Jihong, ZHOU, Shuigeng, CHEN, Guanrong, CHATTERJEE, Krishnendu, PERC, Matjaž. Limitation of time promotes cooperation in structured collaboration systems. *IEEE transactions on network science and engineering*. 2025, vol. 12, no. 1, str. 4-12. ISSN 2327-4697. DOI: 10.1109/TNSE.2024.3481434. [COBISS.SI-ID 221187331]

3. ROY, Sourav, MAJHI, Soumen, PERC, Matjaž, GHOSH, Dibakar. Transitive to cyclic dominance in eco-evolutionary dynamics of strategic species. *Proceedings of the royal society A. Mathematical, Physical and Engineering Sciences*. [Online ed.]. Feb. 2025, vol. 481, iss. 2307, [article no.] 20240734, 24 str. ISSN 1471-2946. DOI: 10.1098/rspa.2024.0734. [COBISS.SI-ID 227067651]

4. LI, Yusheng, YAO, Yichao, FENG, Minyu, PERC BENKO, Tina, PERC, Matjaž, ZAVRŠNIK, Jernej. Epidemic dynamics in homes and destinations under recurrent mobility patterns. *Chaos, solitons and fractals*. [Print ed.]. 2025, vol. 195, [article no.] 116273, 8 str. DOI: 10.1016/j.chaos.2025.116273. [COBISS.SI-ID 229795587]

5. LOUREIRO, Nathalia A., NETO, Camilo R., SUTTON, Jack, PERC, Matjaž, RIBEIRO, Haroldo V. Impact of inter-city interactions on disease scaling. *Scientific reports*. 2025, vol. 15, [article no.]

498, [12] str. ISSN 2045-2322. DOI: 10.1038/s41598-024-84252-z, DOI: 20.500.12556/DKUM-91505. [COBISS.SI-ID 221506563]