



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		3.	5.
PHYSICS		3.	5.

Vrsta predmeta / Course type

Izbirni za vse module

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:**

Ni pogojev.

Prerequisites:

None.

Vsebina:

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.

Content (Syllabus outline):

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) K. Sigmund, *Games of life* (Oxford University Press, Oxford, 1993).
- 2) R. Axelrod, *The evolution of cooperation* (Basic Books, New York, 1984).
- 3) J. Hofbauer and K. Sigmund, *Evolutionary games and population dynamics* (Cambridge University Press, Cambridge, 1998).
- 4) A. Szolnoki, et al., Cyclic dominance in evolutionary games: A review, *J. R. Soc. Interface* 11, 20140735 (2014)
- 5) M. Perc and P. Grigolini, Collective behavior and evolutionary games - An introduction, *Chaos, Solitons & Fractals* 56, 1-5 (2013)
- 6) M. Perc and A. Szolnoki, Coevolutionary games - A mini review, *BioSystems* 99, 109-125 (2010)

Cilji in kompetence:

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.

Objectives and competences:

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:

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.

Prenesljive/ključne spretnosti in drugi atributi:

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.

Intended learning outcomes:

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.

Transferable/Key Skills and other attributes:

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:

Predavanja in projektno delo.

Learning and teaching methods:

Lectures and project work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
Ustni izpit	50%	Oral exam
Opravljeno projektno delo	50%	Done project work
Za uspešno zaključeno učno enoto mora biti vsak del posebej pozitiven. Opravljeno projektno delo je pogoj za pristop k izpitu.		For a successfully finished course, both parts have to be positive. Done project work is a prerequisite to access the oral exam.

Reference nosilca / Lecturer's references:

SZOLNOKI, Attila, PERC, Matjaž. Competition of tolerant strategies in the spatial public goods game. *New journal of physics*, ISSN 1367-2630. [Online ed.], Aug. 2016, vol. 18, str. 083021-1-083021-11, doi: [10.1088/1367-2630/18/8/083021](https://doi.org/10.1088/1367-2630/18/8/083021). [COBISS.SI-ID [22452232](#)]

HELBING, Dirk, BROCKMANN, Dirk, CHADEFaux, Thomas, DONNAY, Karsten, BLANKE, Ulf, WOOLLEY-MEZA, Olivia, MOUSSAID, Mehdi, JOHANSSON, Anders, KRAUSE, Jens, SCHUTTE, Sebastian, PERC, Matjaž. Saving human lives : what complexity science and information systems can contribute. *Journal of statistical physics*, ISSN 0022-4715, 2015, vol. 158, iss. 3, str. 735-781, doi: [10.1007/s10955-014-1024-9](https://doi.org/10.1007/s10955-014-1024-9). [COBISS.SI-ID [21182728](#)], [JCR, SNIP, WoS do 12. 5. 2019: št. citatov (TC): 104, čistih citatov (CI): 100, Scopus do 28. 5. 2019: št. citatov (TC): 128, čistih citatov (CI): 124]

WANG, Zhen, BAUCH, Chris T., BHATTACHARYYA, Samit, D'ONOFRIO, Alberto, MANFREDI, Piero, PERC, Matjaž, PERRA, Nicola, SALATHÉ, Marcel, ZHAO, Dawei. Statistical physics of vaccination. *Physics reports*, ISSN 0370-1573. [Print ed.], Dec. 2016, vol. 664, str. 1-113, ilustr., doi: [10.1016/j.physrep.2016.10.006](https://doi.org/10.1016/j.physrep.2016.10.006). [COBISS.SI-ID [22848520](#)], [JCR, SNIP, WoS do 12. 5. 2019: št. citatov (TC): 267, čistih citatov (CI): 253, Scopus do 29. 5. 2019: št. citatov (TC): 292, čistih citatov (CI): 276]

PERC, Matjaž, JORDAN, Jillian J., RAND, David G., WANG, Zhen, BOCCALETTI, Stefano, SZOLNOKI, Attila. Statistical physics of human cooperation. *Physics reports*, ISSN 0370-1573. [Print ed.], 2017, vol. 687, str. 1-51, ilustr., doi: [10.1016/j.physrep.2017.05.004](https://doi.org/10.1016/j.physrep.2017.05.004). [COBISS.SI-ID [23279112](#)], [JCR, SNIP, WoS do 12. 5. 2019: št. citatov (TC): 246, čistih citatov (CI): 227, Scopus do 7. 6. 2019: št. citatov (TC): 264, čistih citatov (CI): 242]

PERC, Matjaž. Phase transitions in models of human cooperation. *Physics letters. Section A*, ISSN 0375-9601. [Print ed.], 2016, vol. 380, iss. 36, str. 2803-2808, doi: [10.1016/j.physleta.2016.06.017](https://doi.org/10.1016/j.physleta.2016.06.017). [COBISS.SI-ID [22452744](#)]

