Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Naključni procesi**
Course title:	**Random processes**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
FIZIKA, 3. stopnja		**1. ali 2.**	**1., 2. ali 4.**
PHYSICS, 3rd cycle		**1. or 2.**	**1., 2. or 4.**

Vrsta predmeta / Course type	Izbirni za vse module
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
10	5				165	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:	**Prerequisits:**
Ni pogojev.	None.

Vsebina:	**Content (Syllabus outline):**
Dinamika linearnih naključnih procesov, dinamika nelinearnih naključnih procesov, aditivne vs. multiplikativne naključnih motnje, stohastična in koherenčna resonanca, notranja stohastika, časovna vs. prostorska in časovno-prostorska dinamika, prostorska koherenčna resonanca, karakterizacija dinamičnih invariant v prisotnosti šuma (napredne metode nelinearne analize časovnih vrst).	Dynamics of linear random processes, dynamics of nonlinear random processes, additive vs. Multiplicative random disturbances, stochastic and coherence resonance, Internal stochasticity, temporal vs. spatial and spatio-temporal stochastic dynamics, spatial coherence resonance, characterization of dynamical invariants in the presence of noise

	(advanced methods of nonlinear time series analysis).

Temeljni literatura in viri / Readings:

1) C. W. Gardiner, *Handbook of stochastic methods* (Springer, New York, 1995).
2) N. G. Van Kampen, *Stochastic processes in physics and chemistry* (Elsevier, Amsterdam, 1992).
3) H. Kantz in T. Schreiber, *Nonlinear time series analysis* (Cambridge University Press, Cambridge, 2002).
4) H. D. I. Abarbanel, *Analysis of observed chaotic data* (Springer, New York, 1996).
5) M. Perc and M. Marhl, Minimal model for spatial coherence resonance, Phys. Rev. E 73, 066205 (2006)
6) M. Perc, Spatial coherence resonance in excitable media, Phys. Rev. E 72, 016207 (2005)

Cilji in kompetence:	**Objectives and competences:**
Osvojiti znanje o stohastičnih procesih in njihovem vplivu na dinamiko linearnih in nelinearnih dinamičnih sistemov.	Acquire knowledge about stochastic processes, specifically their impact on the dynamics of linear and nonlinear dynamical systems.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Obvladovanje naprednih konceptov in metod, ki služijo za analizo naključnih procesov v realnem svetu. Prenesljive/ključne spretnosti in drugi atributi: Sposobnost prepoznati in analizirati naključne procese kjerkoli se pojavijo, in imeti možnost prosperirati v različnih znanstvenih disciplinah kot so ekonomija, kemija, fizika, medicina, biologija in sociologija.	Knowledge and understanding: Mastering advanced concepts and methods, which can be used to analyse random processes in the real world. Transferable/Key Skills and other attributes: The ability to recognize and analyse Random processes wherever they may occur, and thus have the potential to prosper in diverse scientific disciplines such as: economy, chemistry, physics, medicine, biology, and sociologzy..

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, projektno delo	Lectures, 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

Reference nosilca / Lecturer's references:

1. AMARAL, Marco A., WARDIL, Lucas, PERC, Matjaž, SILVA, Jafferson K. L. da. Stochastic win-stay-lose-shift strategy with dynamic aspirations in evolutionary social dilemmas. *Physical review. E*, ISSN 2470-0045, 2016, vol. 94, iss. 3, str. 032317-1-032317-9, doi: 10.1103/PhysRevE.94.032317. [COBISS.SI-ID 22667528]

2. YILMAZ, Ergin, BAYSAL, Veli, PERC, Matjaž, OZER, Mahmut. Enhancement of pacemaker induced stochastic resonance by an autapse in a scale-free neuronal network. *Science China, Technological sciences*, ISSN 1869-1900, 2016, vol. 59, no. 3, str. 364-370, doi: 10.1007/s11431-015-5984-z. [COBISS.SI-ID 22030344]

3. YILMAZ, Ergin, OZER, Mahmut, BAYSAL, Veli, PERC, Matjaž. Autapse-induced multiple coherence resonance in single neurons and neuronal networks. *Scientific reports*, ISSN 2045-2322, 2016, vol. 6, art. no. 30914, str. 1-14, doi: 10.1038/srep30914. [COBISS.SI-ID 22456072]

4. BAČIĆ, Iva, KLINSHOV, Vladimir, NEKORKIN, Vladimir, PERC, Matjaž, FRANOVIĆ, Igor. Inverse stochastic resonance in a system of excitable active rotators with adaptive coupling. Europhysics letters : EPL, ISSN 0295-5075, Nov. 2018, vol. 124, no. 4, str. 40004-p1-40004-p7, doi: 10.1209/0295-5075/124/40004. [COBISS.SI-ID 24370696], [JCR, SNIP, WoS do 22. 3. 2019: št. citatov (TC): 0, čistih citatov (CI): 0]

5. GUO, Daqing, PERC, Matjaž, ZHANG, Yangsong, XU, Peng, YAO, Dezhong. Frequency-difference-dependent stochastic resonance in neural systems. Physical review. E, ISSN 2470-0045, 2017, vol. 96, iss. 2, str. 022415-1-022415-6, doi: 10.1103/PhysRevE.96.022415. [COBISS.SI-ID 23319816], [JCR, SNIP, WoS do 14. 4. 2019: št. citatov (TC): 19, čistih citatov (CI): 17, Scopus do 29. 4. 2019: št. citatov (TC): 20, čistih citatov (CI): 18]