UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	**Dinamika stohastičnih procesov**
Course title:	**Dynamics of stochastic processes**

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

Osnove teorije verjetnosti, teorije dinamičnih sistemov, programiranja v poljubnem jeziku in teorije stohastičnih procesov.

Prerequisits:

Basic knowledge of probability theory, dynamical system's theory, programming skills in an arbitrary language, and theory of stochastic processes.

Vsebina:

Dinamika linearnih stohastičnih procesov, dinamika nelinearnih stohastičnih procesov, aditivne vs. multiplikativne stohastične motnje, stohastična in koherenčna resonanca, notranja stohastika, časovna vs. prostorska in časovno-prostorska dinamika, prostorska koherenčna resonanca, karakterizacija dinamičnih invariant

Content (Syllabus outline):

Dynamics of linear stochastic processes, dynamics of nonlinear stochastic processes, additive vs. Multiplicative stochastic disturbances, stochastic and coherence resonance, Internal stochasticity, temporal vs. spatial and spatio-temporal stochastic dynamics, spatial coherence resonance,

v prisotnosti šuma (napredne metode nelinearne analize časovnih vrst).	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:**
Poglobiti znanje o stohastičnih procesih in njihovem vplivu na dinamiko linearnih in nelinearnih dinamičnih sistemov.	Deepen the 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 stohastičnih procesov v realnem svetu. Prenesljive/ključne spretnosti in drugi atributi: Sposobnost prepoznati in analizirati stohastične procese kjerkoli se pojavijo, in imeti možnost prosperirati v različnih znanstvenih disciplinah kot so ekonomija, kemija, fizika, medicina, biologija itd..	Knowledge and understanding: Mastering advanced concepts and methods, which can be used to analyse stochastic processes in the real world. Transferable/Key Skills and other attributes: The ability to recognize and analyse stochastic processes wherever they may occur, and thus have the potential to prosper in diverse scientific disciplines such as: economy, chemistry, physics, medicine, biology etc..

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminar, izdelava seminarske naloga.	Lectures, seminar work.

Načini ocenjevanja:	**Delež (v %) / Weight (in %)**	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
Ustni izpit	**60%**	Oral exam
Seminarska naloga	**40%**	Written seminar 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. KOSTIĆ, Srđan, VASOVIĆ, Nebojša, PERC, Matjaž, TOLJIĆ, Marinko, NIKOLIĆ, Dobrica. Stochastic nature of earthquake ground motion. *Physica. A, Statistical mechanics and its applications*, ISSN 0378-4371. [Print ed.], 2013, vol. 392, iss. 18, str. 4134-4145, doi:10.1016/j.physa.2013.04.045. [COBISS.SI-ID 19971336]

5. YILMAZ, Ergin, UZUNTARLA, Muhammet, OZER, Mahmut, PERC, Matjaž. Stochastic resonance in hybrid scale-free neuronal networks. *Physica. A, Statistical mechanics and its applications*, ISSN 0378-4371. [Print ed.], 2013, vol. 392, iss. 22, str. 5735-5741, doi: 10.1016/j.physa.2013.07.011. [COBISS.SI-ID 20053512]