Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Metode biofizikalnega modeliranja**
Course title:	**Methods of biophysical modelling**

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	Mentorstvo Mentorship	Samost. delo Individ. work	ECTS
10	**5**				**165**	**6**

Nosilec predmeta / Lecturer: **Aleš Fajmut**

Jeziki / Languages: **Predavanja / Lectures:**	slovenski/Slovenian in/and angleški s slovenskim prevodom/English with translation in Slovenian
Vaje / Tutorial:	slovenski/Slovenian in/and angleški s slovenskim prevodom/English with translation in Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Ni posebnih zahtev.	No special prerequisites.

Vsebina:	**Content (Syllabus outline):**
- modeliranje encimske kinetike in mrež biokemijskih reakcij - kontrolna analiza - modeliranje prenosa signalov v celici - optimizacijske metode in določanje parametrov	- modelling of enzyme kinetics and networks of biochemical reactions - control analysis - modelling of signal transduction in the cell - optimization methods and parameter estimation

- modeliranje fizioloških sistemov (srce, krvni obtok, izmenjava plinov, krčenje mišic, regulacija volumna celice…) - farmakokinetični modeli	- modelling of physiological systems (heart, blood flow, gas exchange, muscle contraction, cell volume regulation…) - pharmacokinetic models

Temeljni literatura in viri / Readings:

1) R. Heinrich, S. Schuster: The Regulation of Cellular Systems, Chapman and Hall, New York 1996
2) E. Klipp, R. Herwig, A. Kowald, C. Wierling, H. Lehrach, Systems biology in practice, Wiley-vch, 2005, Weinheim
3) F.C. Hoppensteadt, C.S. Peskin, Modelling and simulation in medicine and the life science, Springer, 2002, New York
4) J. Keener, J. Sneyd, Mathematical Physiology, Springer, 1998, New York

Cilji in kompetence:	**Objectives and competences:**
Študenti poglobijo znanje s področja metod biofizikalnega modeliranja, optimiranja, neravnovesne termodinamike, reakcij in difuzije. Razumejo povezanost matematično-fizikalnih znanj ter znanj o raziskovanih bioloških sistemih. Spoznajo najnovejše raziskave in delo raziskovalnih skupin na tem področju v regiji.	Students acquire advanced knowledge on methods of biophysical modelling, optimization, nonequilibrium thermodynamics, reactions and diffusion. Students understand the connection between mathematical-physical skills and knowledge about biological systems. Students get familiar with up-to-date research work and research teams working in that field in the region.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Poglabljanje in nadgradnja interdisciplinarnih znanj s področij biofizikalnega modeliranja in metod statistične termodinamike ter aplikacij pri raziskovanju kompleksnih bioloških sistemov. Prenesljive/ključne spretnosti in drugi atributi: Reševanje interdisciplinarnih problemov v bioloških vedah z matematično-fizikalnimi orodji, numeričnimi metodami, univerzalnosti v fiziki in celosten pristop k reševanju biofizikalnih problemov.	Knowledge and understanding: Gaining additional knowledge and upgrading interdisciplinary approach in the fields of biophysical modeling and statistical thermodynamics in exploration of complex biological systems. Transferable/Key Skills and other attributes: Solving interdisciplinary problems in biology sciences with mathematical-physical tools, numerical methods, universalities in physics and gained global approach on solving a biophysical problem.

Metode poučevanja in učenja:	**Learning and teaching methods:**

Predavanja in študij metod za analizo bio-relevantnih primerov	Lectures and study of methods for analysis of bio-relevant examples

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
Ustni zagovor	**50%**	Oral exam
Projektna naloga	**50%**	Project assignment

Reference nosilca / Lecturer's references:

1. FAJMUT, Aleš, EMERŠIČ, Tadej, DOBOVIŠEK, Andrej, ANTIĆ, Nataša, SCHÄFER, Dirk, BRUMEN, Milan. Dynamic model of eicosanoid production with special reference to non-steroidal anti-inflammatory drug-triggered hypersensitivity. *IET systems biology*, ISSN 1751-8849. [Print ed.], 2015, vol. 9, iss. 5, str. 204-215, doi: 10.1049/iet-syb.2014.0037. [COBISS.SI-ID 21404168]

2. GOSAK, Marko, MARKOVIČ, Rene, FAJMUT, Aleš, MARHL, Marko, HAWLINA, Marko, ANDJELIĆ, Sofija. The analysis of intracellular and intercellular calcium signaling in human anterior lens capsule epithelial cells with regard to different types and stages of the cataract. *PloS one*, ISSN 1932-6203, 2015, vol. 10, iss. 12. http://dx.doi.org/10.1371/journal.pone.0143781, doi: 10.1371/journal.pone.0143781. [COBISS.SI-ID 2645676]

3. DOBOVIŠEK, Andrej, FAJMUT, Aleš, BRUMEN, Milan. Strategy for NSAID administration to aspirin-intolerant asthmatics in combination with PGE [sub] 2 analogue: a theoretical approach. *Medical & biological engineering & computing*, ISSN 0140-0118. [Print ed.], 2012, vol. 50, no. 1, str. 33-42, doi: 10.1007/s11517-011-0844-x. [COBISS.SI-ID 18845192]

4. FAJMUT, Aleš, DOBOVIŠEK, Andrej, BRUMEN, Milan. Mathematical modelling in aspirin-induced asthma : theory and clinical applications. V: BISLIMI, Adelina H. (ur.), TOLKA, Lulezime C. (ur.). *Asthma : causes, complications and treatment*, (Pulmonary and respiratory diseases and disorders). New York: Nova Science Publishers, cop. 2012, str. 1-32. [COBISS.SI-ID 19556360]

5. ROUX, Etienne, MBIKOU, Prisca, FAJMUT, Aleš. Role of protein kinase network in excitation-contraction coupling in smooth muscle cell. V: SILVA XAVIER, Gabriela Da (ur.). *Protein kinases*. Rijeka: InTech, 2012, str. 287-320. http://www.intechopen.com/books/protein-kinases/role-of-protein-kinase-network-in-excitation-contraction-coupling-in-smooth-muscle-cell, doi: 10.5772/37805. [COBISS.SI-ID 19374344]