Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Nanobionika**
Course title:	**Nanobionics**

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:	**Karl Lohner**
Jeziki / Languages: Predavanja / Lectures:	Angleški / English
Vaje / Tutorial:	

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

Vsebina:	**Content (Syllabus outline):**
- Biopolimeri kot gradniki v nanotehnologiji - Stikala, pomnilnik in računanje s plavajočo vejico na osnovi DNA in drugih biomolekul - Razpoznava na osnovi lateralno heterogenih podprtih membrane - Neuronske mreže kot mikroelektronske naprave	- Biopolimers as building blocks in nanotechnology - Switches, memory and floating-operation based calculation on DNA and other biomolecules - Recognition based on laterally heterogeneous supported membranes - Neural networks as microelectronic devices

- Inžiniring na osnovi fotopolimerov - Magnetosomi: nanometrski magnetni materiali na osnovi železa v bakterijah - Sinteza insulina oz. encimov na površinah - Kosti – primer samoobnovljivega biomateriala	- Photopolimers-based engineering - Magnetosomes: Nanoscale Magnetic Iron Minerals in Bacteria - Insulin/Enzymes synthesis on surfaces - Bones – an example of self-renewable biomaterials

Temeljni literatura in viri / Readings:

1) Martyn Amos: Theoretical and Experimental DNA Computation, Springer, 2005
2) C. M. Niemeyer and C. A. Mirkin: Nanobiotechnology: Concepts, Applications and Perspectives, Wiley-VCH, 2004
3) C.A. Mirkin, C.M. Niemeyer: Nanobiotechnology II: More Concepts and Applications, Wiley-VCH, 2004

Cilji in kompetence:	**Objectives and competences:**
Študent je po uspešno opravljenem izpitu zmožen: - ustvariti novo znanje s področja aplikativne nanobiofizike na primerih prenosa v naravi izraženih in delujočih procesov v umetno okolje za namene nanotehnologije – torej izrazito miniaturiziranih tehnoloških procesov. - povezave področji naravoslovja in tehnike ter prenosa znanja in načina razmišljanja pri doseganju funkcionalnosti nanometrskih kompleksnih sistemov, ki posnemajo naravne biološke sisteme - raziskovalnega dela v raziskovalnih skupinah na tem področju v regiji.	After passing the exam, the student is able: - to create new knowledge in the field of applicative nanobiophysics on the examples of transfer of natural processes into artificial environment to achieve goals of nanotechnology, i.e. miniaturization of technological processes. - to link the fields of science and technology and to transfer the knowledge as well as the way of thinking while achieving the functionality of nanoscale complex systems that mimic natural biosystems - of research work in research groups in this field in the region.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Po zaključku predmeta je študent zmožen: - obravnavati in uporabljati najzahtevnejše biofizikalne koncepte in metode o interakcijah med komponentami v bioloških sistemih ter o naravnih procesih, ki se jih da uporabiti v nanotehnologijah, - razvijati nove nanobiotehnologije. Prenesljive/ključne spretnosti in drugi atributi:	Knowledge and understanding: Upon completion of the course, the student is able to: - to tackle and apply the most demanding biophysical concepts and methods of interactions between components in biological systems as well as of natural processes that can be used in nanotechnologies, - develop new nanobiotechnologies. Transferable/Key Skills and other attributes:

- sposobnost reševanja tehnoloških in biokompatibilnostnih problemov na področju novih (nano)materialov in (nano-,nanobio-, bio-)tehnologij s fizikalnimi, tehničnimi in bioničnimi pristopi na bioloških sistemih - sposobnost oblikovanja in implementacije izvirnih znanstvenih rešitev v danih biofizikalnih, nanotehnoloških in interdisciplinarnih problemih.	- ability of solving of technological and biocompatibility problems in the field of novel (nano)materials and (nano-, nanobio-, bio-)technologies with physical, technical and bionical approaches on biosystems. - ability of defining and implementing unique scientific solution within defined biophysical, nanotechnological and interdisciplinary problems.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, seminar in izdelava seminarske naloge iz področja nanobionike.	Lectures, seminar and project assignment from the field of nanobionics.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminarska naloga	**50**	Project assignment
Ustni izpit	**50**	Oral exam
Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.		Each of the listed commitments must be assessed with a positive grade.

Reference nosilca / Lecturer's references:

1. In vitro and in vivo cytotoxic activity of human lactoferricin derived antitumor peptide R-DIM-P-LF11-334 on human malignant melanoma. Riedl S, Rinner B, Schaider H, Liegl-Atzwanger B, Meditz K, Preishuber-Pflügl J, Grissenberger S, Lohner K, Zweytick D. Oncotarget. 2017 May 11. doi: 10.18632/oncotarget.17823.
2. Membrane-active Antimicrobial Peptides as Template Structures for Novel Antibiotic Agents. Lohner K. Curr Top Med Chem. 2017;17(5):508-519. Review.
3. Antimicrobial Peptides Targeting Gram-Positive Bacteria. Malanovic N, Lohner K. Pharmaceuticals (Basel). 2016 Sep 20;9(3). pii: E59. doi: 10.3390/ph9030059. Review.
4. Meta-analysis of 2,104 trios provides support for 10 new genes for intellectual disability. Lelieveld SH, Reijnders MR, Pfundt R, Yntema HG, Kamsteeg EJ, de Vries P, de Vries BB, Willemsen MH, Kleefstra T, Löhner K, Vreeburg M, Stevens SJ, van der Burgt I, Bongers EM, Stegmann AP, Rump P, Rinne T, Nelen MR, Veltman JA, Vissers LE, Brunner HG, Gilissen C. Nat Neurosci. 2016 Sep;19(9):1194-6. doi: 10.1038/nn.4352. Epub 2016 Aug 1.
5. Membrane-active Antimicrobial Peptides as Template Structures for Novel Antibiotic Agents. Lohner K. Curr Top Med Chem. 2016 Jul 13.
6. Antimicrobial peptides: Cell Membrane and Microbial Surface Interactions. Lohner K, Hilpert K. Biochim Biophys Acta. 2016 May;1858(5):915-7. doi: 10.1016/j.bbamem.2016.03.005. Epub 2016 Mar 8.
7. Peptides with dual mode of action: Killing bacteria and preventing endotoxin-induced sepsis. Brandenburg K, Heinbockel L, Correa W, Lohner K. Biochim Biophys Acta. 2016 May;1858(5):971-9. doi: 10.1016/j.bbamem.2016.01.011. Epub 2016 Jan 20. Review.