UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Karakterizacija molekularnih struktur
Course title:	Characterization of molecular structures

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika 2. st.		1,2	**2,3**
Physics 2nd degree		1,2	**2,3**

Vrsta predmeta / Course type izbirni/ optional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
30	0	30	0	0	90	**5**

Nosilec predmeta / Lecturer: Janez Štrancar

Jeziki / Languages:	**Predavanja / Lectures:**	Slovenski/Slovenian in/and angleški/English
	Vaje / Tutorial:	Slovenski/Slovenian in/and angleški/English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Predznanje klasične in moderne fizike ter biofizike

Prerequisits:

Preknowledge of classical and modern physics and biophysics

Vsebina:

Uvod - krajevne in časovne skale na molekularnem nivoju skozi prizmo različnih eksperimentalnih metod
Tema 1 – Lokalni pogoji v fiziki: temperatura, koncentracija, ozmotski tlak, itd.; interakcije, ki povzročijo separacijo snovi in vzorcev gibanja, samoorganizacija kompleksnih sistemov na molekularni skali ter na celični skali
Tema 2 – Vpliv časovnega okna na predstavo o stanjih in dinamiki molekularnega sistema - ločevanje efekta povprečevanja od porazdelitev, sklopitev krajevne skale in časovnega okna
Tema 3 – Razlike v eksperimentalnih pristopih karakterizacije heterogenih sistemov – razlike med analitskim in spektroskopskim pristopom, razlike med destruktivnimi in nedestruktivnimi raziskovalnimi pristopi
Tema 4 – Fiziološki pogoji pri raziskovanju molekularnih struktur - problem enostavnega približka komleksnega sistema, problem definiranja robnih pogojev
Tema 5 – Nanobionika - Supramolekularni sistemi iz narave z industrijsko/tehnološko uporabno vrednostjo - energetska učinkovitost molekularnih struktur

Content (Syllabus outline):

Introduction – spatial and time scales at molecular levels of different experiemntal methods
Topic 1 – Lokal conditions in physics: temperature, concentration, osmotic pressure, etc; interactions, that cause separation of mass and motional patterns, selforganisation in complex systems on molecular and cellular level
Topic 2 – Influence of the time scale on a perception of state and dynamics of molecular system – distinguishing between the effect of averaging and distributions, coupling betweem spatial and time frames
Topic 3 – Differences in experimental approaches to characterization of heterogeneous systems – difference between analitical and spectroscopical approach, between destructive and nondestructive research techniques
Topic 4 – Physiological conditions in exploring molecular structures – problem of simpifications of the complex system, problem of definition of boundary conditions
Topic 5 – Nanobionics – supramolecular systems from nature for industrial/technological application – energy efficiency of molecular structures

Temeljni literatura in viri / Readings:

1. Nossal, R., Lecar, H., Molecular & cell biophysics, Addison Wesley, 1991.
2. Israelaschvili, J., Intermolecular Interactions & Surface Forces. Academic Press, 1992.
3. Kauffman, S., At home in the universe: the search for laws of complexity. Penguin Science, 1995.
4. Selected topics in biophysics, Biophysics Textbook Online; http://www.biophysics.org/education/topics.htm
5. Duane, M., Molecular Biophysics: Structures in Motion, Oxford University Press, 1999.
6. Tuszynski, J.A. and Kurzynski, M., Introduction to Molecular Biophysics, CRC Press, Boca Raton, Florida, 2000.

Cilji in kompetence:

Pridobivanje širsega pogleda na problematiko karakterizacije kompleksnih bioloških sistemov na molekularni skali, primerjati različne lastnosti raziskovalnih metod ter razumeti lokalne količine, vlogo robnih pogojev, porazdelitev in dinamike kompleksnih sistemov.

Objectives and competences:

To gain and learn different aspects of characterization of complex biological systems on molecular scale, to gain ability to compare various properties of experimental methods and understand the local quantities, role of boundary conditions, distributions and dynamics of complex systems.

Predvideni študijski rezultati:

Znanje in razumevanje:
Razumevanje molekularnih sistemov in privzgojena kritična presoja eksperimentalnih podatkov o kompleksnih bioloških sistemih.

Prenesljive/ključne spretnosti in drugi atributi:
Sposobnost vključitve v poglobljeno raziskovalno delo z namenom nadaljevanja študija na različnih problemih fizike kompleksnih sistemov in biofizike.

Intended learning outcomes:

Knowledge and Understanding:
Understanding of molecular systems as well as learned to be able to critically judge the experimental data about complex biological systems

Transferable/Key Skills and other attributes:
Ability of being involved into intensive research work to continue studying of various problems of physics of complex systems and biopyhsics

Metode poučevanja in učenja:

Predavanja in seminarske vaje.
Problemsko učenje na primerih različnih biofizikalnih eksperimentov.

Learning and teaching methods:

Lectures and tutorials
Problem learning on various biophysical experiments

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ustni izpit	70	Oral exam
Seminarska naloga	30	Course work

Reference nosilca / Lecturer's references:

ARSOV, Zoran, URBANČIČ, Iztok, GARVAS, Maja, BIGLINO, Daniele, LJUBETIČ, Ajasja, KOKLIČ, Tilen, ŠTRANCAR, Janez. Fluorescence microspectroscopy as a tool to study mechanism of nanoparticles delivery into living cancer cells. *Biomedical optics express*, 2011, vol. 2, no. 8, str. 2083-2095, doi: 10.1364/BOE.2.002083. [COBISS.SI-ID 24859687]

KUŻDŻAŁ, Michał, WESOŁOWSKA, Olga, ŠTRANCAR, Janez, MICHALAK, Krystyna. Fluorescence and ESR spectroscopy studies on the interaction of isoflavone genistein with biological and model membranes. *Chem. phys. lipids*. [Print ed.], 2011, vol. 164, no. 4, str. 283-291, doi: 10.1016/j.chemphyslip.2011.03.001. [COBISS.SI-ID 24927271]

MLAKAR, Jana, ŠTRANCAR, Janez. Overheating in residential passive house : solution strategies revealed and confirmed through data analysis and simulations. *Energy build.*. [Print ed.], 2011, vol. 43, no. 6, str. 1443-1451, doi: 10.1016/j.enbuild.2011.02.008. [COBISS.SI-ID 24680743]

PAJK, Stane, GARVAS, Maja, ŠTRANCAR, Janez, PEČAR, Slavko. Nitroxide-fluorophore double probes: a potential tool for studying membrane heterogeneity by ESR and fluorescence. *Organic and Biomolecular Chemistry*. [Print ed.], 2011, vol. 9, issue 11, str. 4150-4159. http://pubs.rsc.org/en/content/articlelanding/2011/ob/c0ob01173h, doi: 10.1039/C0OB01173H. [COBISS.SI-ID 3007601]
KOKLIČ, Tilen, ŠTRANCAR, Janez. Lysolipid containing liposomes for transendothelial drug delivery. *BMC*

research notes, [in press] 2012, 9 str., doi: 10.1186/1756-0500-5-179. [COBISS.SI-ID 25811239]