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.		2	**3**
Physics 2nd degree		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
15	15		15		105	**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:	**Prerequisits:**
Ni	None

Vsebina:	**Content (Syllabus outline):**
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	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

Tema 5 – Nanobionika - Supramolekularni sistemi iz narave z industrijsko/tehnološko uporabno vrednostjo - energetska učinkovitost molekularnih struktur	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:	**Objectives and competences:**
Študenti so sposobni izbrati ustrezno skupino eksperimentalnih tehnik za učinkovito karakterizacijo molekularnih struktur.	Students can select the appropriate group of experimental techniques to address their molecular characterization most efficiently.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Definirati zahteve karakterizacije na molekularni skali Definirati časovne in krajevne skale problema Izbrati eksperimentalne tehnike glede na skale in tehnične možnosti (občutljivost, ločljivost, hitrost detekcije) Obdelati in razumeti rezultate meritev in na tej podlagi optimizirati eksperiment. **Prenesljive/ključne spretnosti in drugi atributi:** Obdelati rezultate meritev Izbrati ustrezne merilne metode in senzorske sisteme Presoditi smiselnost uporabe metod v izbranih časovnih in krajevnih okvirih Uporabiti splošna fizikalna znanja pri izbiranju eksperimentalnih tehnik in analizi rezultatov Rokovati s kompleksnimi napravami	**Knowledge and understanding:** Identifying the requirements of the characterization on molecular scale Identifying time and spatial scales of the problem Selecting experimental technique(s) with respect to the scales and the technical possibilities (sensitivity, resolution, speed of detection) Analyzing and understanding the results of the measurements and employ them to optimize the experimental setup(s) **Transferable/Key Skills and other attributes:** Processing of the measurement data Choosing the right measurement method and sensor systems Deciding if the selected methods fit reasonable well to the defined time and spatial frame(s) Using general physical knowledge to select experimental techniques and analyze results Handling with complex machines

Spoznati najbolj napredne tehnološke eksperimentalne pristope	Mastering the most advanced technological experimental approaches

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja Eksperimentalna predavanja Laboratorijske vaje Problemsko učenje	Lectures Experimental lectures Laboratory work Problem based learning

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
ustni izpit	50	oral exam
Ocenjevanje pristopa k eksperimentalnem delu in opravljeno eksperimentalno delo	50	Assessment of the approach to the experimental work and done experimental work

Reference nosilca / Lecturer's references:

1. HAVRDOVÁ, Markéta, URBANČIČ, Iztok, BARTOŇ TOMÁNKOVÁ, Kateřina, MALINA, Lukáš, POLÁKOVÁ, Kateřina, ŠTRANCAR, Janez, BOURLINOS, Athanasios B. Intracellular trafficking of cationic carbon dots in cancer cell lines MCF-7 and HeLa—time lapse microscopy, concentration-dependent uptake, viability, DNA damage, and cell cycle profile. International journal of molecular sciences. 2022, vol. 23, no. 3, str. 1077-1-1077-13. ISSN 1661-6596. DOI: 10.3390/ijms23031077. [COBISS.SI-ID 95168003]
2. SEDMAK, Ivan, PODLIPEC, Rok, URBANČIČ, Iztok, ŠTRANCAR, Janez, MORTIER, Michel, GOLOBIČ, Iztok. Spatially resolved temperature distribution in a rare-earth-doped transparent glass-ceramic. Sensors. Mar. 2022, vol. 22, iss. 5, str. 1-11, ilustr. ISSN 1424-8220. https://www.mdpi.com/1424-8220/22/5/1970, https://repozitorij.uni-lj.si/IzpisGradiva.php?id=135259, DOI: 10.3390/s22051970. [COBISS.SI-ID 99512067]
3. HAVRDOVÁ, Markéta, URBANČIČ, Iztok, BARTOŇ TOMÁNKOVÁ, Kateřina, MALINA, Lukáš, ŠTRANCAR, Janez, BOURLINOS, Athanasios B. Self-targeting of carbon dots into the cell nucleus : diverse mechanisms of toxicity in NIH/3T3 and L929 cells. International journal of molecular sciences. 2021, vol. 22, no. 11, str. 5608-1-5608-16. ISSN 1661-6596. DOI: 10.3390/ijms22115608. [COBISS.SI-ID 64593667]