



**UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION**

Predmet:	Napredne eksperimentalne metode v biofiziki
Subject Title:	Advanced experimental methods in biophysics

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
FIZIKA PHYSICS		1 ali 2	1 ali 2

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Labor work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
15			75		210	10

Nosilec predmeta / Lecturer:

Jeziki / Languages:	Predavanja / Lecture:	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:**

Ni posebnih zahtev.

**Prerequisites:**

No special prerequisites.

**Vsebina:**

1. Koncepti naprednih biofizikalnih eksperimentalnih metod (predavanja)  
 2. Reševanje biofizikalnih problemov z naprednimi eksperimentalnimi metodami (vaje):  
 - Karakterizacija makroskopskih lastnosti s kalorimetrijo  
 - Slikanje celic z elektronsko mikroskopijo  
 - Aplikacija UV-VIS spektroskopije v bioloških raziskavah  
 - IR in ramanska spektroskopija biopolimerov  
 - Karakterizacija celičnih membran s fluorescenčno in mikrospektroskopijo in spektroskopijo elektronsko paramagnetno resonanco  
 - Karakterizacija pretoka z in vivo s slikanjem z magnetno resonanco  
 - Merjenje kisika in vivo z elektronsko paramagnetno resonanco  
 - Raziskovanje lipidnih faz s SAXS in WAXS  
 - Detekcija vezave vode na površini biomembran z ATR-FTIR

**Content (Syllabus outline):**

1. Concepts of advanced biophysical experimental methods (lectures)  
 2. Biophysical problem solving with advanced experimental methods (lab. work):  
 - Characterization of macroscopic properties with calorimetry  
 - Electron microscopy of cells  
 - Practical applications of UV-VIS spectroscopy in biological research  
 - Infrared and Raman spectroscopy of biopolymers  
 - Characterization of cell membranes by fluorescent microspectroscopy and electron paramagnetic resonance  
 - Flow characterization with in vivo magnetic resonance imaging  
 - In vivo oxymetry with EPR spectroscopy  
 - Lipid phases exploration by SAXS and WAXS  
 - Bind-water detection on biomembrane surfaces with ATR-FTIR

**Temeljni literatura in viri / Textbook:**

- Hans-Ulrich Gremlich and Bing Yan: Infrared and Raman Spectroscopy of Biological Materials (Practical Spectroscopy)
- William R., Hendee, E. Russell Ritenour, Medical Imaging Physics, John Wiley & Sons, New York 2002.
- Berliner, Lawrence J. (ur./ed.), Hemminga, Marcus A (ur./ed.). ESR spectroscopy in membrane biophysics, (Biological magnetic resonance, vol. 27). New York: Springer, 2007.
- Ottova-Leitmannova, Angelica (ur./ed.). Advances in planar lipid bilayers and liposomes. Vol. 6. Amsterdam [etc.]:

**Cilji:**

Študenti poglobijo znanje s področja eksperimentalnih metod pri raziskovanju realnih biofizikalnih problemov s sodobno eksperimentalno infrastrukturo z vsemi podpornimi sistemi od priprave eksperimentalnih sistemov (vzorcev) do zahtevnih analiz eksperimentalnih podatkov na računalniških gručah. Razumejo kompleksnost interdisciplinarnih spretnosti ter način razmišljanja pri detekciji struktur in funkcij kompleksnih bioloških sistemov s čimanjšim vplivom na strukturiranost realnih bioloških sistemov. Poznajo najnovejše raziskave, delo in opremo raziskovalnih skupin na tem področju v regiji.

**Objectives:**

Students acquire advanced knowledge on experimental methods in exploring real biophysical problems with up-to-date experimental infrastructure including with all the supporting facilities from sample preparation laboratories to extensive experimental data analysis on computer clusters. Students understand complexity of interdisciplinary skills and the way of thinking while detecting structure and function of complex biological systems with smallest impact on the structure of real biological systems. Students learn up-to-date research work, equipment and research teams working in that field in the region.

**Predvideni študijski rezultati:**

Znanja in razumevanja:  
Poglobljanje in nadgradnja interdisciplinarnih znanj s področij eksperimentalnih metod v biofiziki, spektroskopijah, metodah slikanja in sipanja, metodah molekularne biologije in fizikalne biokemije.

Prenosljive/ključne spretnosti in drugi atributi:  
- sposobnost reševanja konkretnih raziskovalnih problemov ter razvoj eksperimentalnih veščin in spretnosti na področju biofizike ter sorodnih disciplin z uporabo moderne raziskovalne opreme R&R laboratorijev v regiji,  
- sposobnost oblikovanja in implementacije izvirnih znanstvenih rešitev v danih biofizikalnih in interdisciplinarnih problemih,  
- sposobnost predstavitve pridobljenih znanstvenih izsledkov s področja biofizike v obliki publikacij v mednarodni znanstveni periodiki,  
- poglobljeno razumevanje teoretskih in metodoloških fizikalnih konceptov pri eksperimentalnem in razvojnem delu v biofiziki.

**Intended learning outcomes:**

Knowledge and Understanding:  
Gaining additional knowledge and upgrading interdisciplinary approach in the fields of experimental methods in biophysics, spectroscopies, imaging and scattering methods as well as methods in molecular biology and physical biochemistry.  
Transferable/Key Skills and other attributes:  
- ability of solving research problems and development of experimental skills in the field of biophysics and relating fields with utilizing modern research infrastructure R&D laboratories in the region,  
- ability of defining and implementing unique scientific solution within defined biophysical and interdisciplinary problems  
- ability of presenting R&D results in the field of biophysics in a form of publication in international scientific journal  
- deeper understanding of theoretical and methodological physical concepts in experimental and development work in biophysics

**Metode poučevanja in učenja:**

Uvoden sklop predavanj, ki podajo koncepte eksperimentalnih metod v biofiziki. Eksperimentalno delo v profesionalnih razvojno-raziskovalnih laboratorijih ter individualna priprava na raziskovalno delo.

**Learning and teaching methods:**

Introductory lectures into the concepts of experimental methods in biophysics. Experimental work in professional research&development laboratories as well as individual work as an introduction to research work.

Delež (v %) /

Weight (in %)

**Načini ocenjevanja:**

**Assessment:**

Projektna naloga, ki vključuje pripravo, izvedbo in analizo petih izbranih eksperimentalnih problemov

100

Project including preparation, evaluation and analysis of 5 chosen experimental problems