UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	BIOFIZIKALNA KEMIJA 2
Course Title:	BIOPHYSICAL CHEMISTRY 2

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
MAG Biokemija, 2. stopnja	**/**	**2.**	**4.**
USP Biochemistry, 2nd Cycle	**/**	**2nd**	**4th**

Vrsta predmeta / Course Type: izbirni strokovni / Elective Professional

Univerzitetna koda predmeta / University Course Code: BI2I10

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	**20**	**25 LV**	**/**	**/**	**75**	**5**

Nosilec predmeta / Lecturer: prof. dr. Jurij Lah / Dr. Jurij Lah, Full Professor

Jeziki / Languages:

Predavanja / Lectures:	**slovenski / Slovenian**
Vaje / Tutorial:	**slovenski / Slovenian**

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	**Content (Syllabus outline):**
Termodinamika zvitja/razvitja proteinov in nukleinskih kislin: Problem zvitja proteinov in nukleinskih kislin. Konformacijske značilnosti razvitih (denaturiranih), vmesnih, in zvitih (nativnih) stanj. Termodinamski opis zvitja/razvitja proteinov in nukleinskih kislin z različnimi modeli. Eksperimentalno določanje termodinamske stabilnosti proteinov in nukleinskih kislin s pomočjo spektroskopskih in kalorimetričnih tehnik. Izračun termodinamske stabilnosti s pomočjo 3D strukture. Primerjava eksperiment-račun. **Termodinamika prepoznavanja bioloških makromolekul:**	**Thermodynamics of folding/unfolding of proteins and nucleic acids:** Protein and nucleic acid folding problem. Conformational characteristics of unfolded (denatured) , intermediate , and folded (native) states. Thermodynamic description of folding/unfolding of proteins and nucleic acids using various models. Experimental determination of the thermodynamic stability of proteins and nucleic acids using spectroscopic and calorimetric techniques. Structure-based calculation of thermodynamic stability and its comparison with experimental results **Thermodynamics of molecular recognition :** Basic binding models. Thermodynamics of

Osnovni modeli vezanja. Termodinamika prepoznavanja bioloških makromolekul v povezavi z njihovo 3D strukturo. Zvitje bioloških makromolekul inducirano z njihovim vezanjem. Termodinamika vezanja in načrtovanje novih zdravil. **Eksperimentalne metode v biofizikalni kemiji:** UV-absorbcijska spektroskopija, Spektropolarimetrija (CD), Fluorimetrija, Izotermna titracijska kalorimetrija (ITC), Diferenčna dinamična kalorimetrija (DSC). Fizikalne osnove signala, merjenje in analiza signala, uporabnost pri študiju vezanja in strukturnih sprememb bioloških makromolekul.	recognition of biological macromolecules in relation with their 3D structure . Folding of biological macromolecules induced by their binding . Thermodynamics of binding and design of novel drugs . **Experimental methods in biophysical chemistry:** UV-absorption spectroscopy, CD-spectroscopy, fluorimetry , isothermal titration calorimetry (ITC), differential scanning calorimetry (DSC). Physical basics of the measured signal, measurement and analysis, usefulness in the study of binding and structural changes of biological macromolecules.

Temeljna literatura in viri / Readings:

- Principles of Physical Biochemistry, K.E. van Holde Prentice Hall (1998), 657 str., (30 %)
- Mechanisms of protein folding, R.H. Pain (Editor), Oxford University Press (2000), 433. str, (10 %)
- Thermodynamics and Kinetics for the Biological Sciences, G.G. Hammes, J. Wiley & Sons (2000), 158 str. (20 %)
- Biophysical Chemistry, A. Cooper, RSC, Cambridge (2004), 184 str., (20 %)

Cilji in kompetence:	**Objectives and Competences:**
Cilj predmeta: Razumevanje gonilnih sil zvitja/razvitja bioloških makromolekul in njihovega prepoznavanja na molekularnem nivoju. **Predmetno specifične kompetence**: Vpogled v temeljne eksperimentalne tehnike, ki se uporabljajo pri termodinamski karakterizaciji omenjenih biokemijskih procesov. Sposobnost osnovne modelske analize merjenih signalov in njihova molekulska interpretacija.	The aim of the course: Understanding the driving forces of folding/unfolding of biological macromolecules and their recognition at the molecular level. Specific competencies: Insights into the basic experimental techniques used in the thermodynamic characterization of these biochemical processes. The ability to perform model-based analysis of the measured signals and their molecular interpretation.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
Znanje in razumevanje Predmet daje študentu poglobljeno teoretično (predavanja, seminar) in praktično (projekt) znanje iz biofizikalne kemije. Pridobljeno znanje je nujno potrebno pri poglobljenem razumevanju procesov zvitja in molekulskega prepoznavanja.	Knowledge and Comprehension The subject gives students an in-depth theoretical (lectures, seminars) and practical (laboratory exercises) knowledge of biophysical chemistry. Acquired knowledge is necessary for a thorough understanding of the processes of folding and molecular recognition.

Uporaba Pridobljeno teoretično in praktično znanje je potrebno za uspešno teoretično in praktično raziskovalno delo na področju biofizikalne kemije in uporabno v farmacevtski industriji in biotehnologiji.	Application Acquired theoretical and practical knowledge is necessary for a successful theoretical and practical research in the field of biophysical chemistry and can be applied in the pharmaceutical industry and biotechnology.
Refleksija Študent bo pridobil občutek, kako s povezavo eksperimentalne termodinamike in strukturnih značilnosti bioloških makromolekul lahko opišemo procese njihovega zvitja in medsebojnega prepoznavanja . S pridobljenim znanjem bo lahko kritično ovrednotil rezultate projektne vaje in ga uporabil v praksi.	Analysis Students will gain a feeling how to describe folding of biological macromolecules and their mutual recognition using experimental thermodynamic and structural characteristics. With the knowledge gained, they will be able to critically evaluate the results of the laboratory exercises and use it in practice.
Prenosljive spretnosti Študent se nauči nekaterih teoretičnih in eksperimentalnih pristopov, ki so osnova pri načrtovanju, spremljanju in vodenju eksperimentov v biokemiji.	Skill-transference Ability Students will learn some of the theoretical and experimental approaches, which set the basis for planning and monitoring experiments in biochemistry.v

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, seminarji, laboratorijake vaje.	Lectures, seminars, laboratory exercises.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit po uspešno opravljenih vajah. Ocene: pozitivno (6-10), negativno (1-5).		Written examination after successful completion of laboratory exercises. Grades: (6-10) pass, (1-5) fail.

Reference nosilca / Lecturer's references:

- DROBNAK, Igor, VESNAVER, Gorazd, **LAH, Jurij**. Model-based thermodynamic analysis of reversible unfolding processes. J. Phys. Chem. B, 2010, 114, 8713-8722.
- MARUŠIČ, Jaka, PODLIPNIK, Črtomir, JEVŠEVAR, Simona, KUZMAN, Drago, VESNAVER, Gorazd, **LAH, Jurij**. Recognition of human tumor necrosis factor α (TNF-α) by therapeutic antibody fragment : energetics and structural features. J. Biol. Chem., 2012, 287, 8613-8620.
- BUTS, Lieven, **LAH, Jurij**, DAO-THI, Minh-Hoa, WYNS, Lode, LORIS, Remy. Toxin-antitoxin modules as bacterial metabolic stress managers. Trends Biochem. Sci. 2005, 30, 672-679.