

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Izbrana poglavja iz biofizike
Course title:	Selected Topics in Biophysics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Nanoznanosti in nanotehnologije, 3. stopnja		1	1
Nanosciences and Nanotechnologies, 3 rd cycle		1	1

Vrsta predmeta / Course type

Izbirni / Elective

Univerzitetna koda predmeta / University course code:

NANO3-801

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
15	15			15	105	5

**Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

Nosilec predmeta / Lecturer:

Prof. dr. Gojmir Lahajnar

Jeziki /

Predavanja / Lectures: slovenščina, angleščina / Slovenian, English

Languages:

Vaje / Tutorial: slovenščina, angleščina / Slovenian, English

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

Diploma druge stopnje s področja fizike, kemije, biologije ali sorodnih področij.

Prerequisites:

Second cycle degree degree in Physics, Chemistry, Biology or related fields.

Vsebina:

- TERMODINAMIKA IN BIOLOGIJA:
Elementi klasične termodinamike.
Termodinamski potenciali. Termodinamsko ravnovesje: večkomponentni sistemi, kemijsko ravnotežje, vezava ligandov na makromolekule.
Termodinamika redoks procesov.
- GENERIRANJE IN SHRANJEVANJE PROSTE ENERGIJE BIOLOŠKE OKSIDACIJE:
Energijska bilanca glikolize. Energijski izplen citratnega cikla. Kvantitativni vidiki kemiosmotskega mehanizma: Sklopitev oksidativne energije elektronskega toka dihalne verige in fosforilacije s protonskim elektrokemijskim gradientom. Drugi primeri osrednje vloge kemiosmoze v energijskih pretvorbah živih organizmov.

Content (Syllabus outline):

- THERMODYNAMICS AND BIOLOGY:
Elements of classical thermodynamics.
Thermodynamic potentials. Thermodynamic equilibrium: multi-component systems. chemical equilibrium, ligand binding to macromolecules.
Thermodynamics of redox processes.
- FREE ENERGY OF BIOLOGICAL OXIDATION - GENERATION AND STORAGE:
Free energy yield: glycolysis, citric acid cycle.
Chemiosmotic mechanism.
- TRANSPORT PHENOMENA:
Diffusion: continuity equation, Fick's laws.
Diffusion across porous membranes, membrane permeability. Properties of biological membranes: permeability, selectivity, specificity.
Concept of active transport across

- TRANSPORTNI POJAVI:

Difuzija: kontinuitetna enačba, Fickova zakona. Difuzija skozi porozne membrane, membranska permeabilnost. Permeabilnost, selektivnost in specifičnost bioloških membran. Koncept aktivnega transporta skozi biološke membrane.

biomembranes.

Temeljni literatura in viri / Readings:

1. G. Lahajnar: Selected Topics in Biophysics, 149 pages, Teaching Material for the IPS students (2013).
2. P. W. Atkins: Physical Chemistry, 10-th Edition (W. H. Freeman, 2014).
3. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter: Molecular Biology of the Cell, 5-th Edition (Garland Science, New York, 2007).
4. J. M. Berg, J. L. Timoczko, L. Stryer: Biochemistry, 7-th Edition (W. H. Freeman, New York, 2010).
5. N. Price, R. Dwek, G. Ratcliffe, M. Wormald: Principles and Problems in Physical Chemistry for Biochemists, 3-rd Edition (Oxford University Press, USA, 2002).

Cilji in kompetence:

Študentje se seznanijo z načeli biofizike in se tako usposobijo za interdisciplinarno reševanje strokovnih problemov.

Splošne kompetence:

- obvladanje raziskovalnih metod, postopkov in procesov, razvoj kritične in samokritične presoje,
- razvoj kritičnega mišljenja,
- razvoj komunikacijskih sposobnosti in spretnosti, posebej komunikacije v mednarodnem okolju,
- kooperativnost, delo v skupini.

Predmetnospecifične kompetence:

Predmet pripravlja študente za raziskovalno delo s področja biofizike.

Objectives and competences:

Students learn principles of biophysics and thus become competent to solve the interdisciplinary research problems.

General Competences:

- The student will master research methods, procedures and processes.
- The student will develop critical thinking.
- The student will develop communications skills to present research achievement in the international environment.
- Work in team.

Course Specific Competences:

This course prepares students to do research in biophysics.

Predvideni študijski rezultati:

- osvojijo znanje o biofizikalnih načelih,
- znajo uporabiti načela biofizike v različnih interdisciplinarnih problemih,
- pojasnijo izbrane biološke probleme z načeli biofizike,
- rešijo enostavne termodinamske in transportne probleme v biologiji,
- povežejo dobljene rezultate za interdisciplinarno reševanje strokovnih problemov,
- vzpostavijo sposobnost komunikacije v angleškem jeziku na področju biofizike

Intended learning outcomes:

- Acquire knowledge of biophysical concepts
- Apply biophysical concepts in various interdisciplinary problems
- Explain selected biological problems with biophysical concepts
- Solve elementary thermodynamic and transport problems in biology
- Connect obtained results for solving the interdisciplinary research problems
- Establish the ability to communicate in English in the field of biophysics

Metode poučevanja in učenja:

- Predavanja
- Seminarji
- Konzultacije

Learning and teaching methods:

- Lectures
- Seminar work
- Consultations

Načini ocenjevanja:

- Seminar
- Ustni izpit

Delež (v %) /

Weight (in %)

Assessment:

- Seminar
- Oral exam

Reference nosilca / Lecturer's references:

- DESANDO, Michael A., LAHAJNAR, Gojmir, FRIEDRICH, Miha, PLAVEC, Janez, TAVČAR, Gašper. Influence of solvent chemistry on ¹H NMR spectral and relaxation properties of a long-chain ionic surfactant in chloroform-d. *Colloid and polymer science*, ISSN 0303-402X, 2015, vol. 293, no. 5, str. 1409-1423, doi: [10.1007/s00396-014-3494-3](https://doi.org/10.1007/s00396-014-3494-3). [COBISS.SI-ID [28393767](#)]
- STEPIŠNIK, Janez, LAHAJNAR, Gojmir, ZUPANČIČ, Ivan, MOHORIČ, Aleš. Study of translational dynamics in molten polymer by variation of gradient pulse-width of PGSE. *Journal of magnetic resonance*, ISSN 1090-7807, 2013, vol. 236, str. 41-46, doi: [10.1016/j.jmr.2013.08.003](https://doi.org/10.1016/j.jmr.2013.08.003). [COBISS.SI-ID [27404327](#)]
- STEPIŠNIK, Janez, MOHORIČ, Aleš, SERŠA, Igor, LAHAJNAR, Gojmir. Analysis of polymer dynamics by NMR modulated gradient spin echo. V: VOLOVŠEK, Vesna (ur.), BISTRJIČ, Lahorija (ur.). *Polymer spectroscopy July 2011*, (Macromolecular Symposia, ISSN 1022-1360, Special issue, Volume 305, Issue 1). Basel [etc.]: Hüting & Wepf Verlag. 2011, vol. 305, str. 55-62, doi: [10.1002/masy.201000120](https://doi.org/10.1002/masy.201000120). [COBISS.SI-ID [2362212](#)]
- LAHAJNAR, Gojmir, SOBOTIČ, Barbara, SEPE, Ana, JAZBINŠEK, Vojko, PEČAR, Slavko. Influence of sodium nitroprusside on human erythrocyte membrane water permeability : an NMR study. *General physiology and biophysics*, ISSN 0231-5882, 2010, vol. 29, no. 4, str. 373-380, doi: [10.4149/gpb_2010_04_373](https://doi.org/10.4149/gpb_2010_04_373). [COBISS.SI-ID [24290855](#)]
- DESANDO, Michael A., LAHAJNAR, Gojmir, SEPE, Ana. Proton magnetic relaxation and the aggregation of n-octylammonium n-octadecanoate surfactant in deuteriochloroform solution. *Journal of colloid and interface science*, ISSN 0021-9797, 2010, vol. 345, no. 2, str. 338-345. [COBISS.SI-ID [23669543](#)]