

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** ANORGANSKA KEMIJA  
**Course Title:** INORGANIC CHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	1.	2.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	2 <sup>nd</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:**

BK108

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	30	/	/	/	75	5

**Nosilec predmeta / Lecturer:**

prof. dr. Anton Meden / Dr. Anton Meden, Full Professor

**Jeziki / Languages:**

**Predavanja / Lectures:** slovenski / Slovenian

**Vaje / Tutorial:** /

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

**Periodni sistem** kot osnova sistematike elementov in anorganskih spojin.  
**Vodik in kisik.** Voda. Vodikov peroksid. Protolitske reakcije oksidnega peroksidnega in superoksidnega iona. Nomenklatura.  
**Elementi 17. skupine.** Spojine elementov 17. skupine z vodikom. Spojine s kisikom, oksokislina in oksosoli. Medhalogenske spojine. Reakcije disproporcionacije in vpliv sinteznih pogojev na kemijsko ravnotežje pri pripravi oksospojin halogenov. Nomenklatura.  
**Elementi 16. skupine.** Spojine elementov 16. skupine z vodikom. Protoliza sulfidnih ionov. Oksidi in oksospojine žvepla, selena in telurja. Primeri homogene in heterogene katalize pri

**Content (Syllabus outline):**

**Periodic table** as a basis of the systematic of elements and inorganic compounds.  
**Hydrogen, Oxygen,** Water, Hydrogen peroxide. Protolytic reactions of oxide, peroxide and superoxide ion, Nomenclature.  
**Elements of Group 17.** Compounds of Group 17 elements with hydrogen. Compounds with oxygen, oxo-acids and oxo-salts. Interhalogen compounds. Disproportionation reactions and the influence of synthesis conditions on the preparations of oxo-compounds of halogens. Nomenclature.  
**Elements of Group 16.** Compounds of Group 16 elements with hydrogen. Protolysis of sulfide ions. Oxides and oxo-compounds of sulfur, selenium and tellurium. Examples of

sintezi žveplove kisline. Spojine s halogeni.  
Nomenklatura.

**Elementi 15. skupine.** Spojine elementov 15. skupine z vodikom. Sinteza amoniaka: vpliv reakcijskih pogojev in katalizatorja na ravnotežje in hitrost reakcije. Oksidi in oksospojine. Spojine elementov V. skupine s halogeni in žveplom. Nomenklatura.

**Elementi 14. skupine.** Spojine elementov 14. skupine z vodikom. Oksidi, oksospojine in soli. Boudouardovo ravnotežje. Halogenidi in sulfidi elementov 14. skupine. Ogljikov dioksid v vodni raztopini: kombinacija molekularne in protolitske reakcije. Silikati. Nomenklatura.

**Elementi 13. skupine.** Bor in spojine bora. Razlaga strukture boranov z uporabo kombinacije teorije VV in MO. Aluminij in spojine aluminija. Pregled lastnosti spojin galija, indija in talija. Nomenklatura.

**Elementi 1. in 2. skupine.** Lastnosti zemeljskoalkalijskih kovin in njihovih spojin. Lastnosti alkalijskih kovin in njihovih spojin. Nomenklatura.

**Elementi 18. skupine.** Spojine žlahtnih plinov in njihove lastnosti.

**Pregled kemije prehodnih elementov.** d-orbitale in njihova vloga v kemiji prehodnih elementov. Pregled lastnosti prve vrste kovin prehoda. Pregled lastnosti druge in tretje vrste kovin prehoda. Lantanoidi in aktinoidi. Jedrske reakcije. Pregled elementov in njihovih spojin po skupinah. Oksidi, hidroksidi in oksokisljine prehodnih elementov. Koordinacijske spojine in njihova uporaba.

homogeneous and heterogeneous catalysis at the synthesis of sulfuric acid. Compounds with halogens. Nomenclature.

**Elements of Group 15.** Compounds of Group 15 elements with hydrogen. Synthesis of ammonia: the influence of reaction conditions and catalyst on the equilibrium and velocity of reaction. Oxides and oxo-compounds. Compounds of group 15 elements with halogens and sulfur. Nomenclature.

**Elements of Group 14.** Compounds of Group 14 elements with hydrogen. Oxides oxo-compounds and salts. Influence of reaction conditions on the equilibrium of CO and CO<sub>2</sub>. Halogenides and sulfides of the Group 14 elements. Carbonic acid in aqueous solution: combination of protolytic and molecular compounds. Silicates. Nomenclature.

**Elements of Group 13.** Boron and boron compounds. Explanation of the structures of boranes applying a combination of VB and MO theories. Aluminum and aluminum compounds. Survey of the properties of gallium, indium and thallium compounds. Nomenclature.

**Elements of Groups 1 and 2.** Properties of earth-alkali metals and their compounds. Properties of alkali metals and their compounds. Nomenclature.

**Elements of Group 18.** Compounds of noble gases and their properties.

**Survey of the chemistry of transition elements.** d-orbitals and their role in the transition elements chemistry. Survey of the properties of the first row of transition elements. Survey of the properties of the second and third row of transition elements. Lanthanoids and actinoids. Nuclear reactions. Survey of the groups of transition elements. Oxides, hydroxides and oxo-acids of the transition elements. Coordination compounds and their application.

### Temeljna literatura in viri / Readings:

#### Osnovni učbenik:

- F. Lazarini, J. Brenčič: Splošna in anorganska kemija, Visokošolski učbenik Založba FKKT, Ljubljana, 2004, str. 262-521.

#### Dodatna literatura:

- C. E. Housecroft, A. G. Sharpe, Inorganic Chemistry, Pearson, Prentice Hall, 2nd, 2005;  
(<http://files.rushim.ru/books/neorganika/housecroft.pdf>) (40%)

#### Cilji in kompetence:

**Cilji:** Študenti usvojijo temeljno in celotno znanje anorganske kemije, poznavanje določenih anorganskih spojin, njihovih lastnosti in reaktivnosti. Pri tem študent na specifičnih primerih utrjuje in pogloblja znanje splošnih kemijskih zakonitosti.

**Kompetence:** Študent bo pridobljeno znanje znal uporabiti pri nadaljnjem študiju in v praksi, znal se bo pogovarjati o kemijskih problemih s področja, ki ga obravnava predmet; znal bo povezati znanje splošne in anorganske kemije za reševanje, razlago ali analizo določenega problema. Poznal bo strukturne značilnosti in reaktivnost anorganskih spojin, značilne in pomembne kemijske reakcije anorganskih spojin ter nomenklaturu anorganskih spojin.

#### Objectives and Competences:

**Objectives:** students acquire basic and complete knowledge of inorganic chemistry, knowledge of given inorganic compounds, their properties and reactivity. Along with this, the student confirms and deepens the knowledge of general chemical principles.

**Competences:** student will be able to apply the acquired knowledge at further study and in practice, he will be able to discuss chemical problems in the field of the subject and will be able to integrate the knowledge of general and inorganic chemistry to solve, explain or analyze a given problem. He will know the structural characteristics and reactivity of inorganic compounds and the nomenclature thereof.

#### Predvideni študijski rezultati:

##### Znanje in razumevanje

Študent pozna osnovne značilnosti kemije elementov glavnih skupin in prehodnih elementov v periodnem sistemu ter pozna in razume osnovne kemijske zakonitosti, ki vplivajo na periodične lastnosti elementov in njihovih spojin (strukturne značilnosti, reaktivnost anorganskih spojin, značilne in pomembne kemijske reakcije anorganskih spojin ter nomenklaturu anorganskih spojin).

##### Uporaba

Pridobljeno znanje in razumevanje so potrebna osnovna znanja, ki jih študent uporablja za razlago eksperimentalno določenih ali drugače pridobljenih podatkov, povezanih s kemijo elementov glavnih skupin in prehodnih elementov periodnega sistema in je osnova za nadaljnji študij kemije. Prav tako je to znanje temeljno pri opravljanju poklica

##### Refleksija

Študent je sposoben oceniti pomen osnovnih kemijskih zakonitosti in teoretskega znanja za

#### Intended Learning Outcomes:

##### Knowledge and Comprehension

Student knows basic chemical characteristics of the main group elements and transition elements in the periodic system. He knows and understands the basic chemical principles that influence the periodic properties of the elements and their compounds (structural properties, reactivity of inorganic compounds, characteristic and important chemical reactions of the inorganic compounds and nomenclature of the inorganic compounds).

##### Application

Acquired knowledge and understanding are the necessary basis that is applied for explanation of experimental or otherwise acquired data, connected to the chemistry of the main group elements and the transition elements of the periodic system, which is the basis of the further study of chemistry. This knowledge is as well fundamental for the professional activity.

##### Analysis

Student is able to assess the meaning of basic chemical principles and theoretical knowledge

razlago eksperimentalnih dejstev in lastnosti anorganskih snovi in jih zna uporabiti v praksi.	for an explanation of experimental facts and properties of compounds and is able to use them in practice.
<b>Prenosljive spretnosti</b> Študent zna poiskati podatke iz strokovne literature, podatke iz virov medmrežja pa zna kritično oceniti. Zna uporabljati strokovni jezik (pisno in ustno).	<b>Skill-transference Ability</b> Student is able to find data from professional literature and is able to critically evaluate the data from the internet; he is able to use the professional language (written and spoken).

**Metode poučevanja in učenja:**

Predavanja; sodelovalno učenje/ poučevanje ter problemsko delo na seminarjih. Sprotno preverjanje znanja s testi.

**Learning and Teaching Methods:**

Lectures; cooperative learning/teaching and problem work at seminars; regular knowledge assessment using tests.

<b>Načini ocenjevanja:</b>	Delež (v %) / Weight (in %)	<b>Assessment:</b>
2 testa za sprotno preverjanje znanja in pisni izpit. Če študent na vsakem od obeh testov najmanj 51 % točk je lahko oproščen opravljanja izpita.  Ocenjevalna lestvica v skladu z enotno lestvico na Univerzi v Ljubljani: 6 – 10 opravil izpit, 1 – 5 ni opravil izpita.		2 test for during the semester and written exam. If the student collects at least 51 % of points at each of the tests, he can be excused from the exam.  Grades according to the standard levels of the University of Ljubljana: 6-10 passed, 1-5 insufficient.

**Reference nosilca / Lecturer's references:**

- ZUPANIČ, Franc, MARKOLI, Boštjan, NAGLIČ, Iztok, WEINGÄRTNER, Tobias, **MEDEN, Anton**, BONČINA, Tonica. Phases in the Al-corner of the Al-Mn-Be system. *Microscopy and microanalysis*, ISSN 1431-9276. [Print ed.], FirstView Article, online: 18 June 2013, doi: [10.1017/S1431927613001852](https://doi.org/10.1017/S1431927613001852). [COBISS.SI-ID [16956694](https://www.cobiss.si/id/16956694)]

- IPAVEC, Andrej, GABROVŠEK, Roman, VUK, Tomaž, KAUČIČ, Venčeslav, MAČEK, Jadran, **MEDEN, Anton**. Carboaluminate phases formation during the hydration of calcite-containing Portland cement. *Journal of the American Ceramic Society*, ISSN 0002-7820, 2011, vol. 94, no. 3, str. 1238-1242, doi: [10.1111/j.1551-2916.2010.04201.x](https://doi.org/10.1111/j.1551-2916.2010.04201.x). [COBISS.SI-ID [34764037](https://www.cobiss.si/id/34764037)]

- MALI, Gregor, **MEDEN, Anton**, DOMINKO, Robert. [sup] 6 Li MAS NMR spectroscopy and first-principles calculations as a combined tool for the investigation of Li [sub] 2 MnSiO [sub] 4 polymorphs. *Chemical communications*, ISSN 1359-7345, 2010, issue 19, str.3306-8, doi: [10.1039/c003065a](https://doi.org/10.1039/c003065a). [COBISS.SI-ID [4386074](https://www.cobiss.si/id/4386074)]

- KŪZMA, Mirjana, DOMINKO, Robert, HANŽEL, Darko, KODRE, Alojz, ARČON, Iztok, **MEDEN, Anton**, GABERŠČEK, Miran. Detailed in situ investigation of the electrochemical processes in Li[sub]2FeTiO[sub]4 cathodes. *Journal of the Electrochemical Society*, ISSN 0013-4651, 2009, vol. 156, no. 10, str. A809-A816. [COBISS.SI-ID [4219162](https://www.cobiss.si/id/4219162)]

- MOLČANOV, Krešimir, KOJIĆ-PRODIĆ, Biserka, **MEDEN, Anton**. [pi]-Stacking of quinoid rings in crystals of alkali diaqua hydrogen chloranilates. *CrystEngComm*, ISSN 1466-8033, 2009, vol. 11, iss. 7, str. 1407-1415, doi: [10.1039/b821011j](https://doi.org/10.1039/b821011j). [COBISS.SI-ID [516331545](https://www.cobiss.si/id/516331545)]

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** BIOKEMIJA  
**Course Title:** BIOCHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	2.	3.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	3 <sup>rd</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:**

BK116

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	45	/	/	/	75	5

**Nosilec predmeta / Lecturer:**

doc. dr. Gregor Gunčar / Dr. Gregor Gunčar, Assistant Professor

**Jeziki / Languages:**

**Predavanja / Lectures:** slovenski / Slovenian

**Vaje / Tutorial:** /

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

Biosignalizacija, receptorji, G-proteini, signalne kaskade Ser/Thr in Tyr kinaz, bioenergetika, principi regulacije metabolizma, katabolične poti, uravnavanje glikolize, glukoneogeneze, metabolizem glikogena, uravnavanje oksidacije maščobnih kislin in nastanka ketonskih telesc, oksidativna fosforilacija in fotofosforilacija, biosinteza ogljikovih hidratov, biosinteza lipidov, metabolizem aminokislin, nukleotidov in sorodnih molekul, hormonska regulacija in integracija metabolizma pri sesalcih.

**Content (Syllabus outline):**

Biosignaling, receptors, G-proteins, Ser/Thr kinases, Tyr kinases, signaling cascades, bioenergetics, principles of metabolic regulation, catabolic pathways, regulation of glycolysis, gluconeogenesis, glycogen metabolism, regulation of fatty acid oxidation and ketogenesis, oxidative phosphorylation and photophosphorylation, carbohydrate biosynthesis, lipid biosynthesis, metabolism of amino acids, nucleotides and related molecules, hormonal regulation and integration of mammalian metabolism.

**Temeljna literatura in viri / Readings:**

- Nelson, D.L. in Cox, M.M. (Lehninger), Principles of Biochemistry, zadnja izdaja (trenutno 6. izdaja), W.H. Freeman & Co. 2013, (50% od str. 433-975).

### Cilji in kompetence:

Cilji: Uporaba in nadgradnja znanja, ki so ga študenti dobili pri predmetu temelji biokemije.  
Kompetence: Študenti bodo razumeli koncepte metaboličnih procesov in njihovega uravnavanja, znali bodo uporabljati informacije o metaboličnih procesih, ki so dostopne na svetovnem spletu in v preglednih strokovnih člankih.

### Objectives and Competences:

Objectives: Application and upgrading of the knowledge gained by students at the course Fundamentals of Biochemistry  
Competences: Students will understand concepts of metabolic processes and their regulation, they will know how to use information about metabolic processes accessible on the Internet and in scientific review articles.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Študenti bodo imeli pregled čez metabolične procese, vedeli bodo kakšen je pomen posameznih procesov, v katerih tkivih in v kakšnih metaboličnih stanjih potekajo in kako so uravnavani.

#### Razumevanje:

Razumevanje organizacije encimsko kataliziranih reakcij v metabolične procese, povezave med metaboličnimi procesi in njihovega uravnavanja. Razumevanje metod, ki se uporabljajo za študij metaboličnih procesov. Razumevanje povezav med motnjami v poteku metaboličnih procesov in nekaterimi obolenji.

#### Uporaba

Znanje, ki ga bodo študenti pridobili pri tem predmetu je osnova za druge biokemijske predmete, saj študenti pridobijo pregled o poteku in uravnavanju procesov v živih organizmih.

#### Refleksija

Študenti se bodo zavedali pomena poznavanja poteka in uravnavanja metaboličnih procesov za ugotavljanje delovanja različnih snovi v živih organizmih. Zavedali se bodo tudi določenih dilem na področju etike v biomedicinskih raziskavah.

#### Prenosljive spretnosti

Spretnosti uporabe domače in tuje literature in drugih virov, zbiranja in interpretiranja podatkov, uporaba IKT, uporaba različnih postopkov, poročanje (ustno in pisno),

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Student will gain an overview of the metabolic processes, their importance, where and in what metabolic states they occur and how they are regulated.

They will understand the organisation of the enzyme catalysed reactions in the metabolic processes, metabolic pathways integration and regulation. They will also understand the methods used in metabolism research and link between metabolic disorders and diseases.

#### Application

Knowledge of the processes and their regulation in living organisms is fundamental for other biochemical courses.

#### Analysis

Students will be aware of the importance of metabolism and its regulation in knowing the pathways and modes of action of different molecules in our body. They will also be aware of the ethical concerns in biomedical research.

#### Skill-transference Ability

Ability to find and use current scientific literature in the field, data interpretation, use of information technologies, basic scientific writing and reporting, problem identification

identifikacija in reševanje problemov, osnove kritičnega branja raziskovalnih člankov na področju biokemije.

and solving, critical reading of the biochemistry scientific literature.

**Metode poučevanja in učenja:**

Predavanja, seminarji.

**Learning and Teaching Methods:**

Lectures, seminars.

**Načini ocenjevanja:**

Seminarska naloga  
Pisni izpit

Delež (v %) /

Weight (in %) **Assessment:**

Seminar work  
Written exam

**Reference nosilca / Lecturer's references:**

- **GUNČAR, Gregor**, PUNGERČIČ, Galina, KLEMENČIČ, Ivica, TURK, Vito, TURK, Dušan. Crystal structure of MHC class II-associated p41 li fragment bound to cathepsin L reveals the structural basis for differentiation between cathapsins L and S. EMBO j., 1999, vol. 18, str. 793-803.
- **GUNČAR, Gregor**, PODOBNIK, Marjetka, PUNGERČAR, Jože, ŠTRUKELJ, Borut, TURK, Vito, TURK, Dušan. Crystal structure of porcine cathepsin H determined at 2.1 Å resolution: location of the mini-chain C-terminal carboxyl group defines cathepsin H aminopeptidase function. Structure (London), 1998, vol. 6, no. 1, 51-61.
- Ching-I A. Wang\*, **Gregor Gunčar\***, Jade K. Forwood, Trazel Teh, Ann-Maree Catanzariti, Gregory J. Lawrence, Fionna E Loughlin, Joel P. Mackay, Horst Joachim Schirra, Peter A. Anderson, Jeffrey G. Ellis, Peter N. Dodds, Boštjan Kobe, Crystal Structures of Flax Rust Avirulence Proteins Avr L567-A and -D Reveal Details of the Structural Basis for Flax Disease Resistance Specificity. Plant Cell, 2007, 19, 2898-2912. \*authors contributed equally

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	BIOKEMIJSKA INFORMATIKA
<b>Course Title:</b>	BIOCHEMICAL INFORMATICS

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	2.	4.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	4 <sup>th</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK122

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	/	45 SV	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Gregor Anderluh / Dr. Gregor Anderluh, Full Professor

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

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**  
 Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**  
 The course has to be assigned to the student.

**Vsebina:**  
 Obdelava biokemijskih podatkov ter njihova statistična obravnava.  
 Biokemijske in biološke podatkovne baze: bibliografske baze, kemijske spojine, nukleotidna in aminokislinska zaporedja, geni in njihovo izražanje, genom, bolezni, taksonomija, metabolične poti in strukture makromolekul.  
 Nukleotidna zaporedja: sekvenciranje, analiza nukleotidnih zaporedij (restriksijska mesta, odprti bralni okviri in prevajanje v aminokislinsko zaporedje, geni in regulatorne regije, eksoni in introni) in verižna reakcija s polimerazo in načrtovanje začetnih oligonukleotidov.

**Content (Syllabus outline):**  
 Analysis of biochemical data and application of statistical methods.  
 Biochemical and biological databases: bibliographic databases, compounds, nucleotide and amino acid sequences, genes and gene expression, genome, diseases, taxonomy, metabolic pathways, and structure of macromolecules.  
 Nucleotide sequences: sequencing, analysis of nucleotide sequences (restriction sites, open reading frames, translation to an amino acid sequence, genes and regulatory regions, exons and introns), and polymerase chain reaction and construction of oligonucleotides.



Aminokislinska zaporedja: izračun/napoved lastnosti proteina na osnovi aminokislinskega zaporedja (molekulska masa, ekstinkcijski koeficient, izoelektrična točka, hidrofobnost in transmembranske regije), iskanje motivov (glikozilacija, mesta cepitve s peptidazami, ...) in napoved sekundarne strukture.  
Prileganje zaporedij: prileganje nukleotidnih in aminokislinskih zaporedij, lokalno in globalno prileganje, skupno zaporedje, iskanje podobnih zaporedij, grupiranje zaporedij in gradnja filogenetskih dreves.  
3D-struktura makromolekul: 3D-struktura proteinov in nukleinskih kislin, zapis in vizualizacija strukturnih podatkov, tipi zvitja, domene, podobnost struktur, modeliranje in umestitev.

Amino acid sequences: calculation/prediction of protein properties on the basis of its amino acid sequence (molecular mass, extinction coefficient, isoelectric point, hydrophobicity and transmembrane regions), motif search (glycosylation, peptidase cleavage sites, etc.), and secondary structure prediction.  
Sequence alignment: alignment of nucleotide and amino acid sequences, local and global alignment, consensus sequence, search for similar sequences, sequence grouping and construction of phylogenetic trees.  
3D structure of macromolecules: 3D structure of proteins and nucleic acids, format and visualization of structural data, folds, domains, structure similarity, modeling, and docking.

#### Temeljna literatura in viri / Readings:

Arthur M. Lesk: Introduction to Bioinformatics. 4. izdaja, Oxford University Press, 2014.  
Michael Agostino: Practical Bioinformatics. 1. izdaja, Garland Science, 2012.  
**Dodatna literatura/ Additional literature:** navodila za spletna orodja.

#### Cilji in kompetence:

Študenti bodo spoznali orodja in pristope pri računalniško podprti analizi biokemijskih podatkov. Po uspešno opravljenih obveznostih bodo sposobni samostojnega pridobivanja podatkov iz podatkovnih baz, njihove analize, povezovanja in interpretacije.

#### Objectives and Competences:

Students will familiarize themselves with tools and approaches in computer aided biochemical data analysis. Upon successful completion of the course they will be able to independently perform data collection from databases, its analysis, integration and interpretation.

#### Predvideni študijski rezultati:

##### Znanje in razumevanje

Študenti bodo spoznali osnove iskanja, zbiranja in analize podatkov ter njihove in interpretacije. Preko poznavanja algoritmov, na katerih ti računalniški pristopi temeljijo, bodo postopke tudi razumeli in jih tako znali ustrezno uporabiti.

##### Uporaba

Znanje biokemijske informatike je danes pomembno na vseh področjih biokemije. V okviru vaj in seminarske naloge študent pridobi tudi praktična znanja.

#### Intended Learning Outcomes:

##### Knowledge and Comprehension

Knowledge of modern computer approaches in data collection and analysis is critical for every biochemist. Students will apply the acquired knowledge and skills in other courses during their study as well as during their independent research work.

##### Application

Knowledge of biochemical informatics and its tools is important in all fields of biochemistry. Applicable knowledge is achieved through practical exercises and project work.

<u>Refleksija</u> Študenti bodo pridobili pregled biokemijskih podatkovnih baz in računalniških orodij, ob poznavanju uporabnosti pa se bodo zavedali tudi njihovih omejitev.	<u>Analysis</u> Students will get an overview of the biochemical databases and computer tools, their functionality and, importantly, their limitations.
<u>Prenosljive spretnosti</u> Izkušnje pri reševanju problemov in projektnem delu. Principi računalniških algoritmov. Zbiranje podatkov, njihova analiza, povezovanje, interpretacija ter predstavitev.	<u>Skill-transference Ability</u> Skills in problem solving and project work. Principles of computer algorithms. Data collection, its analysis, integration, interpretation, and presentation.

**Metode poučevanja in učenja:**

Predavanja.  
Laboratorijske vaje.

**Learning and Teaching Methods:**

Lectures.  
Computer exercises.

	Delež (v %) / Weight (in %)	Assessment:
<b>Načini ocenjevanja:</b> Kolokvij iz vaj. 40 % Pisni izpit in seminarska naloga. 60 % Ocene: 6-10 (pozitivno), 1-5 (negativno).	<b>40%</b> <b>60%</b>	Practical exam. Written exam and seminar work. Grades: 6-10 (positive), 1-5 (negative).

**Reference nosilca / Lecturer's references:**

- **Anderluh, G.**, Jerala, R., in Hafner, I. (2004). Tečaj bioinformatike. Ljubljana: Slovensko biokemično društvo.  
- Brvar, M., Perdih, A., Hodnik, V., Renko, M., **Anderluh, G.**, Jerala, R., in Solmajer, T. (2012). In silico discovery and biophysical evaluation of novel 5-(2-hydroxybenzylidene) rhodanine inhibitors of DNA gyrase B. *Bioorganic & Medicinal Chemistry*, 20 (8), 2572-80.  
- Brvar, M., Perdih, A., Renko, M., **Anderluh, G.**, Turk, D., & Solmajer, T. (2012). Structure-based discovery of substituted 4,5'-bithiazoles as novel DNA gyrase inhibitors. *Journal of Medicinal Chemistry*, 55 (14), 6413-6426.  
- De Colibus, L., Sonnen, A. F.-P., Morris, K. J., Siebert, C. A., Abrusci, P., Plitzko, J., Hodnik, V., Leippe, M., Volpi, E. **Anderluh, G.**, in Gilbert, R. J. C. (2012). Structures of lysenin reveal a shared evolutionary origin for pore-forming proteins and its mode of sphingomyelin recognition. *Structure*, 20 (9), 1498-1507.

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	BIOKEMIJSKI PRAKTIKUM
<b>Course Title:</b>	PRACTICAL COURSE IN BIOCHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	1.	2.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	2 <sup>nd</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:**

BK111

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
/	15	60 LV	/	/	75	5

**Nosilec predmeta / Lecturer:**

prof. dr. Brigita Lenarčič / Dr. Brigita Lenarčič, Full Professor

**Jeziki / Languages:****Predavanja / Lectures:** slovenski / Slovenian**Vaje / Tutorial:** slovenski / Slovenian**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

Varnost v biokemijskem laboratoriju, pisanje laboratorijskega dnevnika in delovnega poročila, čiščenje laboratorijske posode, priprava in shranjevanje reagentov, kvantitativni prenos tekočin  
 statistična analiza eksperimentalnih rezultatov, pH, pufri, elektrode, biosenzorji, merjenje koncentracije proteinov  
 merjenje koncentracije nukleinskih kislin, dializa, ultrafiltracija, liofilizacija, kromatografske metode v biokemiji: ionska izmenjevalna, gelska, afinitetna, FPLC, elektroforetske metode v biokemiji, spektroskopske analize biomolekul, uporaba izotopov v biokemiji, centrifugiranje v biokemijskem laboratoriju

**Content (Syllabus outline):**

Safety in the biochemical laboratory, writing laboratory journals and work reports, cleaning of laboratory glassware, preparation and storage of reagents, quantitative transfer of liquids, statistical analysis of experimental results, pH, buffers, electrodes, biosensors, measuring the concentration of proteins and nucleic acids, dialysis, ultrafiltration, lyophilisation, chromatographic methods in biochemistry: ion exchange chromatography, size-exclusion chromatography, affinity chromatography, FPLC, electrophoretic methods in biochemistry, spectroscopic analysis of biomolecules, the use of isotopes in biochemistry, centrifugation in the biochemical laboratory.

**Temeljna literatura in viri / Readings:**

- Kuhelj R: Biokemija v praksi: načela in tehnike, 3. izdaja, FKKT, Ljubljana, 2003, 100 strani  
 - Boyer R: Biochemistry Laboratory: Modern Theory and Techniques, 2nd ed. Prentice Hall, 2011, 350 strani (50%)

**Cilji in kompetence:**

Študent bo spoznal osnovne biokemijske tehnike in pravila, ki veljajo za delo v biokemijskih laboratorijih. Po opravljenih obveznostih bo sposoben samostojno izvesti

**Objectives and Competences:**

Students will learn the basic biochemical techniques and rules for safe work in a biochemical laboratory. After successful completion of the course students will be able

osnovne biokemijske analize na osnovi pisnih navodil.	to independently perform essential biochemical analyses following written instructions.
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**Predvideni študijski rezultati:**

<u>Znanje in razumevanje</u> Študent bo poznal osnovne tehnike, ki se najpogosteje uporabljajo v biokemijskih laboratorijih in razumel njihove teoretične osnove.
<u>Uporaba</u> Študent bo znal uporabljati osnovne biokemijske tehnike.
<u>Refleksija</u> Študent se bo zavedal uporabnosti in omejitev posameznih metod ter pomena upoštevanja pravil pri delu v laboratoriju
<u>Prenosljive spretnosti</u> Osnovne spretnosti za delo v biokemijskem laboratoriju, spretnosti uporabe domače in tuje literature in drugih virov, zbiranja in interpretiranja podatkov, uporaba IKT, uporaba različnih postopkov, poročanje (ustno in pisno), identifikacija in reševanje problemov, sposobnost organiziranega in natančnega dela.

**Intended Learning Outcomes:**

<u>Knowledge and Comprehension</u> Students will get acquainted with the basic techniques most often used in biochemical laboratories and understand their theoretical basis.
<u>Application</u> Students will be able to use basis biochemical techniques.
<u>Analysis</u> Students will reflect on the use and restrictions of different methods and the importance of following safety procedures during laboratory work.
<u>Skill-transference Ability</u> Basic skills for working in a biochemical laboratory, use of domestic and foreign literature and other sources, collecting and interpreting data, use of ICT, use of protocols, reporting (oral and written), problem identification and solving, ability of organized and precise work.

**Metode poučevanja in učenja:**

Seminarji in laboratorijske vaje.
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**Learning and Teaching Methods:**

Seminars and laboratory courses.
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**Načini ocenjevanja:**

Opravljene vaje so pogoj za pristop k izpitu. Pisni izpit Ocene: 6-10 (pozitivno), 1-5 (negativno).
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Delež (v %) /  
Weight (in %)

**Assessment:**

Completed laboratory course is prerequisite for the exam. Written exam Grades: 6-10 (positive), 1-5 (negative)
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**Reference nosilca / Lecturer's references:**

- KLEMENČIČ, Marina, NOVINEC, Marko, MAIER, Silke, HARTMANN, Ursula, <b>LENARČIČ, Brigita</b> . The heparin-binding activity of secreted modular calcium-binding protein 1 (SMOC-1) modulates its cell adhesion properties. PloS one, 2013, vol. 8, no. 2, art. no. e56839 (doi: 10.1371/journal.pone.0056839). - NOVINEC, Marko, PAVŠIČ, Miha, <b>LENARČIČ, Brigita</b> . A simple and efficient protocol for the production of recombinant cathepsin V and other cysteine cathepsins in soluble form in Escherichia coli. Protein expression and purification, 2012, vol. 82, no. 1, str. 1-5.
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- PAVŠIČ, Miha, **LENARČIČ, Brigita**. Expression, crystallization and preliminary x-ray characterization of the human epithelial cell-adhesion molecule ectodomain. Acta crystallographica. Section F, Structural biology and crystallization communications, 2011, vol. F67, no. 11, str. 1363-1366.

UL  
EFKKT

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	BIOLOGIJA CELICE
<b>Course Title:</b>	CELL BIOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	2.	3.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	3 <sup>rd</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK115

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	/	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** izr. prof. dr. Peter Veranič / Dr. Peter Veranič, Associate 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:**

Celica kot osnovni gradnik vsega živega, primerjava med prokariotsko in evkariotsko celico.

Evkariotska celica.

Plazemska membrana – značilnosti lipidnega dvosloja; proteini v membrani, glikokaliks; komunikacija z okoljem in prenos sporočil.

Principi transporta majhnih molekul skozi membrano; sklopljenost različnih transportnih sistemov v celici.

Plazemska membrana v vlogi povezovanja s sosednjimi celicami in zunajceličnim

**Content (Syllabus outline):**

Cell as a basic brick stone of organism, comparison between prokaryotic and eukaryotic cell

Eukaryotic cell and its membranes, membrane domains, compartmentalization of eukaryotic cell

Intercellular communication and transport of messages

Cell junctions in connecting cell and extracellular matrix

Molecules of extracellular matrix

matriksom; vrste povezovalnih molekul in vrste medceličnih stikov.

Citoskelet in gibanje celic; mikrotubuli, aktinski filamenti in intermediarni filamenti.

Znotrajcelični predelki in prenos proteinov na tarčna mesta v celici; pomen sporočilnih zaporedij.

Biosintetsko – sekrecijska pot in endomembranski sistemi; endoplazemski retikulum, Golgijev aparat, vezikularni transport.

Lizosomi in njihova vloga pri razgradnji makromolekul.

Eksocitoza; različne poti prenosa produktov iz celice na njeno površino.

Endocitoza; različne poti in mehanizmi prenosa makromolekul in delcev v celico, zgodnji in pozni endosomi.

Organeli energijskih pretvorb; mitohondriji, kloroplasti, semiavtonomni organeli. Jedro kot krmilo celice in nosilec genoma; jedro v interfazi, kromatin in nivoji kondenzacije kromatina, kromosomi, jedrce.

Celične delitve; mitoza, mejoza. Celični ciklus; faze in kontrolne točke v celičnem ciklu, mehanizmi regulacije. Celična smrt kot ravnotežje celičnim delitvam; nekroza, apoptoza. Diferenciacija celic; matične celice, nastanek različnih celic. Morfološke značilnosti rakasto transformirane celice.

Cytoskeleton: microtubules, actin filaments and intermediary filaments

Protein targeting and the meaning of signal sequences

Endomembrane system and biosynthetic pathway of proteins. Exocytosis

Endosome – lysosome system in degradation of biomolecules

Mitochondria: energy conversion and protein entry

Nucleus as a cell carrier of genome; interphase nucleus, chromatin and its condensation into chromosomes, nucleolus

Regulation of transport in and out of nucleus.

Differences between genetic and epigenetic changes in the genome, tumour suppressor genes, oncogenes

Cell cycle, phases and checkpoints in the cell cycle

Mechanisms of the regulation of cell cycle, cell division: mitosis, meiosis

Cell-biological characteristic of cancer cells, causes for transformation from normal to cancer cell

Types and characteristics of stem cells, cell differentiation and development of a variety of cells

Cell aging, cell death as the balance to cell division: necrosis, apoptosis

### Temeljna literatura in viri / Readings:

- Kristijan Jezernik, Peter Veranič, Maksimiljan Sterle: Celična biologija, DZS, 2012

### Cilji in kompetence:

### Objectives and Competences:

<p><b>Cilji:</b> pridobiti znanje o celici kot osnovnemu gradniku vsega živega</p> <p><b>Predmetno specifične kompetence:</b>                  poznavanje in razumevanje povezanosti zgradbe celic s funkcijo;                  razumevanje specifičnosti procesov v celičnih organelih; razumevanje komunikacije celic z okoljem;                  poznavanje mehanizmov, ki regulirajo različne celične aktivnosti.</p>	<p>Students are familiar with basic characteristics of cell structure, cell organelle structure and function, as well with the elements of complex molecular structure and function, especially about the communication cell to cell and cell with the extracellular environment. They learn the techniques of cell biology.</p>
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<p><b>Predvideni študijski rezultati:</b></p>	<p><b>Intended Learning Outcomes:</b></p>
<p><u>Znanje in razumevanje</u>                  Poznavanje zgradbe celice in razumevanje povezanosti zgradbe s funkcijo, razumevanje specifičnosti procesov v celičnih organelih, razumevanje komunikacije celice z okoljem, poznavanje metod v celični biologiji.</p>	<p><u>Knowledge and Comprehension</u>                  Understanding of concepts, and principles necessary for the studies of fundamental processes at the level of cells, tissues, organs and organisms.</p>
<p><u>Uporaba</u>                  Poznavanje vloge celice in celičnih organelov za razumevanje zgradbe in nastanka makromolekul in potek biokemičnih procesov v celici.</p>	<p><u>Application</u>                  Knowledge of the role of cells and organelles in formation of macromolecules. Knowledge of the location of biochemical process in cells and tissues as a crucial factor for effective modulation of processes in cells.</p>
<p><u>Refleksija</u>                  Poznavanje nivojev organizacije v celici, zmožnost razumevanja pomena kompartmentalizacije v evkariontski celici ter razumevanje mehanizmov, ki regulirajo različne celične aktivnosti.</p>	<p><u>Analysis</u>                  Comprehension of the levels of cell organisation, the benefits of cell compartmentalisation, and mechanisms controlling biochemical processes in cells.</p>
<p><u>Prenosljive spretnosti</u>                  Spособnost samostojnega mikroskopiranja, izbira metod za načrtovanje eksperimentalnega dela, interpretacija mikrografij, povezovanje znanja celične biologije z vsebinami molekularne biologije, biokemije in splošne biologije, uporaba literature v tujih jezikih.</p>	<p><u>Skill-transference Ability</u>                  Sovereignty in the use of microscopes, choosing proper methods in experimental work with cells and tissues, linking of the knowledge of cell biology with molecular biology and biochemistry.</p>

<p><b>Metode poučevanja in učenja:</b></p>	<p><b>Learning and Teaching Methods:</b></p>
<p>Predavanja, laboratorijske vaje</p>	<p>Lectures, laboratory exercises</p>

<p><b>Načini ocenjevanja:</b></p>	<p>Delež (v %) / Weight (in %) <b>Assessment:</b></p>
<p>Kolokvij iz vaj 30 %                  Pisni in ustni izpit 70 %                  Ocene: 6-10 (pozitivno), 1-5 (negativno).</p>	<p>Laboratory practical exam 30%                  Written and oral exam 70 &amp;                  Grades: 6-10 (positive), 1-5 (negative)</p>



**Reference nosilca / Lecturer's references:**

1. DRAGIN, Urška, **VERANIČ, Peter**, ERDANI-KREFT, Mateja. Amniotic membrane scaffolds enable the development of tissue-engineered urothelium with molecular and ultrastructural properties comparable to that of native urothelium. *Tissue engineering*, ISSN 1076-3279, 2013, kategorija: 1A1 (Z1, A', A1/2);
- 2.. BREGAR, Vladimir Boštjan, LOJK, Jasna, ŠUŠTAR, Vid, **VERANIČ, Peter**, PAVLIN, Mojca. Visualization of internalization of functionalized cobalt ferrite nanoparticles and their intracellular fate. *International journal of nanomedicine*, ISSN 1178-2013. [Online ed.], 2013, vol. 8, str. 919-931, kategorija: 1A1 (Z1, A', A1/2)
3. ERMAN, Andreja, KEREC KOS, Mojca, ŽAKELJ, Simon, RESNIK, Nataša, ROMIH, Rok, **VERANIČ, Peter**. Correlative study of functional and structural regeneration of urothelium after chitosan-induced injury. *Histochemistry and cell biology*, ISSN 0948-6143, Nov. 2013, kategorija: 1A1 (Z1, A'', A', A1/2);
4. RESNIK, Nataša, SEPČIČ, Kristina, PLEMENITAŠ, Ana, WINDOFFER, Reinhard, LEUBE, Rudolf, **VERANIČ, Peter**. Desmosome assembly and cell-cell adhesion are membrane raft-dependent processes. *The Journal of biological chemistry*, ISSN 0021-9258, 2011, vol. 286, issue 2, str. 1499-1507, 1A1 (Z1, A', A1/2);
5. **VERANIČ, Peter**, ERMAN, Andreja, KEREC KOS, Mojca, BOGATAJ, Marija, MRHAR, Aleš, JEZERNIK, Kristijan. Rapid differentiation of superficial urothelial cells after chitosan induced desquamation. *Histochemistry and cell biology*, ISSN 0948-6143, 2009, vol. 131, no. 1, str. 129-139, 1A1 (Z1, A'', A', A1/2);
6. **VERANIČ, Peter**, LOKAR, Maruša, SCHÜTZ, Gerhard J., WEGHUBER, Julian, WIESER, Stefan, HÄGERSTRAND, Henry, KRALJ-IGLIČ, Veronika, IGLIČ, Aleš. Different types of cell-to-cell connections mediated by nanotubular structures. *Biophys. j.*, 2008, letn. 95, št. 9, str.593-607. 1A1 (Z1, A', A1/2);

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	CELIČNA IN MOLEKULARNA IMUNOLOGIJA
<b>Course Title:</b>	CELL AND MOLECULAR IMMUNOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	5.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	5 <sup>th</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK133

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	/	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** doc. dr. Gregor Gunčar / Dr. Gregor Gunčar, Assistant 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:**

Splošne značilnosti imunskega sistema, nomenklatura, komponente imunskega sistema. Strukturne značilnosti protiteles in njihove biološke lastnosti. Organizacija imunoglobulinskih genov. Ogljikovi hidrati in njihova vloga pri delovanju imunskega sistema. Antigeni. Monoklonska protitelesa in njihova uporaba. Reakcije med antigeni in protitelesi. Pregled imunoloških metod. Zorenje in aktivacija limfocitov B. Poglavitni sistem tkivne skladnosti. Predstavljanje in T-celično spoznavanje antigena. Presajanje tkiv in organov. T-celični receptor. Zorenje, aktivacija in diferenciacija limfocitov T. Citokini in njihova vloga pri boleznih. Uravnavanje imunskega odziva. Imunska toleranca in avtoimunost.

**Content (Syllabus outline):**

Introduction to the immune system. Nomenclature. Basic concepts in immunology. Cells involved in the immune response. Antibodies and their structure. Generation of diversity. Organization of the immunoglobulin genes. Antigens. Monoclonal antibodies and their use. Reaction between antigens and antibodies. An overview of the immunological methods. Development of B lymphocytes. Major Histocompatibility Complex (MHC). Transplantation and rejection. T-cell receptor. Development of T-lymphocytes. Cytokines and their role in diseases. Regulation of the immune response. Immune tolerance and autoimmunity. Complement. Vaccination.

Sistem komplementa. Cepljenje. Alergija in preobčutljivost. Imunske pomanjkljivosti. Imunski sistem in rak.

Laboratorijske vaje:

Struktura protiteles in proteolitična razgradnja IgG, posredna in neposredna ELISA, komplement: aktivacija, litična faza, liza bakterijskih celic, prenos western- uporaba poliklonskih protiteles za detekcijo določenih antigenov v bakterijskem lizatu, točkovni nanos IgG za analizo hrane, imunološka bioinformatika: struktura nekaterih makromolekul imunskega sistema (IgG, MHC, TCR) in njihove interakcije, načrtovanje peptidov in napoved njihove vezave na molekule MHC

Allergy and hypersensitivity. Immune deficiencies. Immune system and cancer.

Laboratory practical courses:

Antibody structures and proteolytic degradation of IgG, ELISA, complement: activation, lytic phase, Western blot- use of polyclonal antibodies for detection of antigens in bacterial lysate, dot blot for food analysis, bioinformatics: structure of the molecules of the immune system- IgG, MHC, TCR, their interactions, peptide design and their binding to the MHC.

#### Temeljna literatura in viri / Readings:

- Abbas, Abul K., Andrew H. Lichtman, Shiv Pillai. Cellular and Molecular Immunology, Saunders, 2011 (60% vsebine)

Dodatna literatura / additional readings:

- Murphy, Kenneth, Paul Travers, and Mark Walport. Janeway's immunobiology. Taylor & Francis, 2011.

- Več avtorjev: Laboratorijske vaje iz celične in molekularne imunologije, FKKT, 2013

#### Cilji in kompetence:

Molekularna imunologija z imunokemijo je predmet s področja biomedicine, ki povezuje osnovne kemijske in biokemijske zakonitosti ter spoznanja na področju biologije in medicine, od koder imunologija izvira, zato je nepogrešljiva pri naravoslovno usmerjenih študijih. Predmet usmerja študenta k samostojnemu teoretičnemu in eksperimentalnemu delu. Omogoča mu, da rešuje probleme, razume načrtovanje in izvedbo projektov s tega področja ter pridobi znanje, ki je pomembno tudi v vsakdanjem življenju.

#### Objectives and Competences:

Objectives: Molecular immunology with immunochemistry is the area of biomedicine and brings together basic knowledge of chemistry, biochemistry, biology and medicine (from the last immunology originates). It is thus indispensable for the study of life sciences. Competences: Students are encouraged to be independent in their theoretical and practical work. They are able to solve the problems, understand the design and implementation of the projects from the field and to learn the topics, which are also important for everyday life.

#### Predvideni študijski rezultati:

##### Znanje in razumevanje

Študent se pri predmetu najprej seznani z osnovami imunologije ter z nomenklaturo. Po uvodnih predavanjih pridobi dovolj znanja, da

#### Intended Learning Outcomes:

##### Knowledge and Comprehension

Basics of immunology and nomenclature. After introductory lectures the ability to understand the principles of immunochemistry methods,

<p>razume princip imunokemijskih metod, ki jih nato uporablja pri vajah za reševanje problemov. V nadaljevanju spozna mehanizme in dejavnike, ki sodelujejo pri imunskem odzivu. V zadnjem delu predavanj spozna osnove cepljenja ter pridobi osnovna znanja o alergijah, imunskih pomanjkljivostih ter imunskem sistemu in raku.</p>	<p>which are then utilized in laboratory practical courses to solve the problems. Gain knowledge about mechanisms and cells/molecules of the immune response. Basics of vaccinations, allergies, immune deficiencies and the role of immune system in cancer.</p>
<p><u>Uporaba</u> Vsebine predmeta spadajo med znanja, ki zaokrožujejo naravoslovno izobrazbo. Poleg teoretičnih vsebin nudi predmet mnogo praktičnih znanj, tudi takšnih, ki jih potrebujemo ne le v strokovnem, temveč tudi v vsakdanjem življenju. Zasnovan je tako, da študente vzpodbuja k razmišljanju, k povezovanju ter k reševanju problemov.</p>	<p><u>Application</u> Course topics add to the basic knowledge in life sciences. Besides the theoretical fundamentals the students also learn about practical knowledge and methods that are needed not only in the professional environment but also in everyday life. Students are encouraged to think and integrate knowledge to solve the problems.</p>
<p><u>Refleksija</u> Poleg pregleda znanj s področja imunologije in imunokemije pridobi študent občutek za način dela in razmišljanja na področju biomedicine in biotehnologije.</p>	<p><u>Analysis</u> Besides the overview of the immunology and immunochemistry, the student is directed towards biomedical and biotechnological way of work and problem solving.</p>
<p><u>Prenosljive spretnosti</u> Izkušnje pri reševanju problemov. Timsko delo, predvsem pri vajah. Zbiranje, analiza in interpretacija rezultatov ter njihovo kritično vrednotenje. Uporaba domače in tuje literature. Podajanje poročil o opravljenem delu.</p>	<p><u>Skill-transference Ability</u> Problem solving skills, team work in laboratory, collecting data, data analysis, interpretation and critical assessment, use of English scientific literature, writing laboratory reports.</p>

**Metode poučevanja in učenja:**

Predavanja, laboratorijske vaje.

**Learning and Teaching Methods:**

Lectures, laboratory practical courses.

**Načini ocenjevanja:**

Delež (v %) /

Weight (in %)

**Assessment:**

<p>Opravljenе vaje so pogoj za pristop k izpitu. Kolokvij iz vaj Seminarska naloga Pisni izpit</p>		<p>Laboratory practical completion is required to attend written exams. Laboratory practical written exam Seminar work Written exam</p>
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**Reference nosilca / Lecturer's references:**

- WANG, Ching-I. A.\*, GUNČAR, Gregor\*, FORWOOD, Jade K., TEH, Trazel, CATANZARITI, Ann-Maree, LAWRENCE, Gregory J., LOUGHLIN, Fiona E., MACKAY, Joel P., SCHIRRA, Horst Joachim, ANDERSON, Peter A., ELLIS, Jeffrey G., DODDS, Peter N., KOBÉ, Boštjan. Crystal structures of flax

rust avirulence proteins AvrL567-A and -D reveal details of the structural basis for flax disease resistance specificity. *Plant cell.*, 2007, vol. 19, no. 9, str. 2898-2912. \*deljeno prvo avtorstvo

- MIHELIČ, Marko, DOBERŠEK, Andreja, **GUNČAR, Gregor**, TURK, Dušan. Inhibitory fragment from the p41 form of invariant chain can regulate activity of cysteine cathepsins in antigen presentation. *J Biol Chem*, 2008, vol. 283, no. 21, str. 14453-14460.

- **GUNČAR, Gregor**, PUNGERČIČ, Galina, KLEMENČIČ, Ivica, TURK, Vito, TURK, Dušan. Crystal structure of MHC class II-associated p41 li fragment bound to cathepsin L reveals the structural basis for differentiation between cathapsins L and S. *EMBO j.*, 1999, vol. 18, str. 793-803.

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**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	DIPLOMSKO DELO
<b>Course Title:</b>	DIPLOMA THESIS

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	6.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	6 <sup>th</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** D1BI

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
/	/	/	/	225	225	15

**Nosilec predmeta / Lecturer:** /

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

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** Odobrena tema diplomskega dela.

**Prerequisites:** Approved topic.

**Vsebina:**

Diplomsko delo se opravlja iz področja biokemije. Vsebina in naslov se določata v soglasju z izbranim mentorjem. Mentor je lahko učitelj na UL FKKT [t.j. zaposleni na fakulteti na učiteljskem delovnem mestu ali zaposleni na fakulteti na delovnem mestu asistenta, ki ima učiteljski naziv (docent, izredni ali redni profesor) ali nosilec predmeta na študijskem programu 1. ali 2. stopnje UL FKKT, ki ni zaposlen na fakulteti]. Mentor je praviloma učitelj na programu, ki ga je študent vpisal.

**Content (Syllabus outline):**

The diploma thesis is performed in the field of biochemistry. The topic and title of the thesis are chosen in agreement with the chosen mentor. The mentor is an UL FCCT teacher (i.e. employee at the faculty occupying a teaching position or occupying a teaching assistant position and holding a teaching degree [assistant professor, associate professor, full professor] or any lecturer who lectures a course as part of a 1st or 2nd cycle study programme of the UL FCCT and is not an employee of the faculty). As a rule, the mentor is a teacher in the programme of the student's enrolment.

**Temeljna literatura in viri / Readings:**

Knjige in članki, ki so povezani z vsebino diplomskega dela.  
Books and paper, associated with the topic of the thesis.

**Cilji in kompetence:**

Dokončno oblikovanje pričakovanega lika diplomanta. Študent bodo ob izdelavi diplomske naloge pokazal sposobnosti iskanja in zaznavanja problemov in znal poiskati rešitev za tak problem. Pri delu bodo pokazal, da je pridobil večino kompetenc navedenih v programu študija.

**Objectives and Competences:**

Final shaping of the expected characteristics of the diploma student. Students will demonstrate the skills to search for and detect problems as well as found the solutions for the problems. They will demonstrate the majority of the competences described in the study programme.

**Predvideni študijski rezultati:**

Znanje in razumevanje

Pri izdelavi diplomskega dela bo slušatelj pridobil naslednje kompetence:

- sposobnost samostojne izvedbe biokemijskih analiz na osnovi ustnih ali pisnih navodil;
- razumevanje meja zanesljivosti svojih eksperimentalnih podatkov;
- sposobnost izvedbe manjšega projekta, za katerega ni nujno, da njegov rezultat zadošča kriterijem za objavo;
- sposobnost v posredovanja informacij, idej, problemov in rešitev dobro informirani publiki;
- sposobnost prilagajanja novim situacijam in sprejemanja odločitev;
- sposobnost načrtovanja in upravljanja s časom;

razvita profesionalna etična in okoljska odgovornost.

Uporaba

Znanje in pridobljene veščine bo diplomant lahko uporabil pri opravljanju poklica.

Refleksija

Povezovanje vseh pridobljenih teoretičnih znanj z reševanjem problemov na področju biokemije ter kritični pogled na uporabnost teh znanj.

Prenosljive spretnosti

Pri delu bo diplomant pridobil znanja o metodah reševanja problemov, o načinu prezentacije teh znanj v pisani in govorni obliki povezani z ostalimi metodami posredovanja raziskav ugotovitev itd.

**Intended Learning Outcomes:**

Knowledge and Comprehension

During the preparation of the diploma thesis, the student will gain the following competences:

- The ability to independently perform biochemical analyses based on written and oral instructions,
- Understanding the margins of confidence of experimental data,
- Ability to perform a minor project, which does not necessarily produce publishable results,
- Ability to transmit information, ideas, problems and solutions to a well-informed audience
- Ability to adapt to novel situations and make decisions,
- Ability to plan and manage time.
- Developed professional ethical and environmental responsibility.

Application

Students will use the acquired knowledge and skills in their profession.

Analysis

Integrations of theoretical knowledge with biochemical problem solving and a critical perspective on the usefulness of this knowledge.

Skill-transference Ability

Students will acquire knowledge on the methods of problem solving, presentation of knowledge in written and oral form in connection with other methods, etc.

**Metode poučevanja in učenja:**

Študijsko in raziskovalno delo pod vodstvom mentorja, po možnosti tudi delo v laboratoriju.

**Learning and Teaching Methods:**

Study and research work under the supervision of the mentor, if possible also laboratory work.

**Načini ocenjevanja:**

Ocenjuje se diplomsko delo in zagovor diplomskega dela pred komisijo, ki jo sestavljajo predsednik, mentor in en član. Lestvica ocen vsakega dela je od 1 do 10. Ocene 1 do 5 so negativne, ocene 6 do 10 pa pozitivne in sicer: 6-zadostno, 7-dobro, 8 in 9-prav dobro, 10-odlično.

Delež (v %) /

Weight (in %) /

**Assessment:**

Evaluation includes the thesis and the oral presentation in front of a commission, consisting of the chair, the mentor and one member.

**Reference nosilca / Lecturer's references:**

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**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	ENCIMATIKA
<b>Course Title:</b>	ENZYMOLGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	5.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	5 <sup>th</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK132

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Brigita Lenarčič / Dr. Brigita Lenarčič, Full Professor

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

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:** The course has to be assigned to the student.

**Vsebina:** Nomenklatura in klasifikacija encimov: razredi encimov, reakcije, izoenzimi, ribocimi, abcimi. Encimska kataliza: teorija prehodnega stanja, različne oblike kataliz, eksperimentalni pristopi za določanje mehanizma reakcije, primeri. Osnove encimske kinetike: pridobivanje in obdelava kinetičnih podatkov, encimske enote, simboli, kinetika enosubstratnih in dvosubstratnih reakcij, kinetika predravnotežnega stanja. Regulacija encimske aktivnosti: inhibitorji, razpoložljivost substrata, ireverzibilne in reverzibilne kovalentne modifikacije, inhibicija s končnim produktom, kontrola aktivnosti

**Content (Syllabus outline):** Nomenclature and classification of enzymes: classes of enzymes, types of reactions, isoenzymes, ribozymes, abzymes. Enzyme catalysis: transition state theory, different forms of catalysis, experimental approaches to the determination of enzyme mechanisms, examples. An introduction to enzyme kinetics: obtaining and analysing the kinetic data, enzyme units, symbols, kinetics of one-substrate and two-substrate reactions, pre-steady state kinetics. The control of enzyme activity: inhibitors, substrate availability, irreversible and reversible covalent modifications, end-product inhibition, control of activity by ligand-induced

preko vezave liganda (alosterični in kooperativni efekt), primeri.  
Encimi v organiziranih sistemih: klasifikacija multiencimskih sistemov, primeri.  
Razgradnja proteinov: lizosomska in nelizosomska pot (ubikvitinacija, proteasom).

conformational changes (allosteric and cooperative effects), examples.  
Enzymes in organized systems: classification of multienzyme systems, examples.  
Protein degradation: lysosomal and non-lysosomal pathways (ubiquitination, proteasome).

### Temeljna literatura in viri / Readings:

- Fundamentals of Enzymology, Price N.C. & Stevens L., 3rd ed, Oxford University Press, 1999. 478 strani (60 %)

### Cilji in kompetence:

Študentje spoznajo lastnosti in delovanje encimov. Na izbranih primerih se na strukturnem nivoju spoznajo z različnimi mehanizmi encimske katalize in tudi z različnimi strategijami kontrole njihove aktivnosti.

Študent bo sposoben samostojno izvesti encimske teste s pomočjo pripravljenih protokolov in kritično ovrednotiti rezultate.

### Objectives and Competences:

#### Objectives:

Learning the functional properties of enzymes. Familiarizing students with the structural basis of the mechanisms of enzyme catalysis and regulation in selected examples.

#### Competences:

Ability to independently perform enzyme reaction experiments according to prepared protocols and to critically evaluate the obtained results.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Pridobljeno znanje omogoča razumevanje encimsko kataliziranih reakcij in njihove regulacije na nivoju strukturno-funkcijskih lastnosti encimov.

#### Uporaba

Poznavanje delovanja encimov ima široko uporabnost v vseh panogah, kjer so vključeni encimi (znanost, medicina, industrija).

#### Refleksija

Študent poveže pridobljeno znanje s strategijami uporabnosti encimov.

#### Prenosljive spretnosti

Sposobnost uporabe domače in tuje literature, kritično branje raziskovalnih člankov, sposobnost ustnega in pisnega poročanja.

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Acquired knowledge enables the understanding of enzyme-catalysed reactions and their regulation at the structural and functional levels.

#### Application

Knowledge of enzyme function is widely applicable in various fields, such as research, medicine and industry.

#### Analysis

Students are able to link the acquired knowledge with the strategies of the use of enzymes.

#### Skill-transference Ability

Ability to use Slovenian and foreign literature, critical reading of scientific papers, ability of oral and written reporting.

### Metode poučevanja in učenja:

### Learning and Teaching Methods:

Predavanja, raziskovalni seminar, laboratorijske vaje	Lectures, research seminar, laboratory courses
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Delež (v %) /

**Načini ocenjevanja:**Weight (in %) **Assessment:**

Opravljene vaje so pogoj za pristop k izpitu. Seminarska naloga Pisni izpit Ocene: 6-10 (pozitivno), 1-5 (negativno)		Completed laboratory course is prerequisite for the exam. Seminar work Written exam Grades: 6-10 (positive), 1-5 (negative)
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**Reference nosilca / Lecturer's references:**

- NOVINEC, Marko, **LENARČIČ, Brigita**, BAICI, Antonio. Clusterin is a specific stabilizer and liberator of extracellular cathepsin K. *FEBS letters*, 2012, 586, 1062-1066.
- NOVINEC, Marko, GRASS, Robert N., STARK, Wendelin J., TURK, Vito, BAICI, Antonio, **LENARČIČ, Brigita**. Interaction between human cathepsins K, L, and S, Mechanism of elastinolysis and inhibition by macromolecular inhibitors. *The Journal of Biological Chemistry*, 2007, 282, 7893-78902.
- MEH, Primož, PAVŠIČ, Miha, TURK, Vito, BAICI, Antonio, **LENARČIČ, Brigita**. Dual concentration-dependent activity of thyroglobulin type-1 domain of testican: specific inhibitor and substrate of cathepsin L. *Biological chemistry*, 2005, 386, 75-83.

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	FIZIKA I
<b>Course Title:</b>	PHYSICS I

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	1.	1.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	1 <sup>st</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK102

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	/	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Janez Bonča / Dr. Janez Bonča, 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:** **Kinematika:** premo enakomerno in pospešeno gibanje točkastega telesa, gibanje v prostoru. **Dinamika:** sila in masa. Ocena sile v tetivi. Newtonovi zakoni, izrek o gibanju težišča, izrek o gibalni količini, sila curka, izrek o kinetični energiji, delo, potencialna energija, prožnost, prožnostna energija, vrtenje togega telesa okoli nepremične osi, navor, Newtonov zakon pri vrtenju, izrek o vrtilni količini. Vrtenje molekul. **Mehanika tekočin:** hidrostatika, hidrostatični tlak, vzgon, hidrodinamika, opis toka tekočin, Bernoullijeva enačba, viskoznost, sila upora. Viskozno pretakanje krvi po žilah, padec pritiska, kontrola pretoka po žilah.

**Content (Syllabus outline):** **Kinematics:** uniform and accelerated motion of a particle, motion in space **Dynamics:** Force and mass; Chord force; Newton's laws; the theorem on the system of particles and velocity of the centre of mass; drag force; kinetic energy theorem; work; potential energy; elasticity; rotation of a rigid body around a fixed axis; torque; Newton's law on rotation; theorem on conservation of angular momentum; Rotation of molecules. **Fluid mechanics:** hydrostatics, hydrostatic pressure; buoyancy; hydrodynamics; description of fluid flow; Bernoulli's equation;

**Nihanje in valovanje:** amplituda, frekvenca in nihajni čas, sinusno nihanje, nihanja molekul, vsiljeno nihanje, sklopljeno nihanje, spekter nihanja, longitudinalno in transverzalno valovanje, energijski tok, gostota energijskega toka, valovna dolžina, hitrost valovanja, interferenca, stoječe valovanje, spekter valovanja, lastna nihanja, osnove akustike.

**Vsebina vaj:**

Na vajah študenti preko reševanja fizikalnih računskih vaj utrdijo snov podano na predavanjih, spoznajo računске pristope, potrebne za reševanje različnih tipov fizikalnih problemov in ob tem utrdijo analitični način razmišljanja.

Viscosity; Resistance force; Viscous blood flow in veins; pressure fall; vein blood flow control.

**Oscillation and wave motions:** amplitude, frequency and oscillation intervals; harmonic oscillation; oscillation of molecules, forced oscillation; oscillation of coupled oscillators; oscillation spectrum; longitudinal and transversal waves, radiant flux, radiant flux density, wave length; the speed of a travelling wave, interference, standing waves; motion spectrum; fundamentals of acoustics.

**Temeljna literatura in viri / Readings:**

**Glavna literatura:**

- J.Strnad: Fizika I, DZS, Ljubljana, 1977, str. 281, (80%)
- R.Kladnik: Visokošolska fizika I, DZS, Ljubljana, 1989, str. 285 (20%)

**Dopolnilna literatura:**

- Boye K. Ahlborn: Zoological Physics, Springer, 2004, str. 430
- D. Halliday, R. Resnick, J. Walker: Fundamentals of Physics (Extended), John Wiley, New York, 1993.
- R. A. Serway in J. S. Faughn, College Physics, Saunders College Publishing, 1999.

**Cilji in kompetence:**

Pri predmetu Fizika študenti pridobijo razumevanje osnovnih fizikalnih pojmov in fizikalnih količin, spoznajo osnovne zakone narave ter se ob reševanju problemov navadijo osnov analitičnega mišljenja. Predmet je podlaga za pridobitev kompetenc s področja biokemije.

**Objectives and Competences:**

The course represents the basis to reach competences in the area of material preparation for research and quality control that is composed of instrument calibration, work quality control and cooperation in controlling the reliability of results.

**Predvideni študijski rezultati:**

Znanje in razumevanje

Študentje pri predmetu pridobijo teoretska znanja in utrdijo sposobnost analitičnega razmišljanja, kar omogoči razumevanje osnovnih naravnih pojavov. Razumevanje pridobljenih znanj izkažejo s sposobnostjo reševanja preprostih fizikalnih problemov.

Uporaba

**Intended Learning Outcomes:**

Knowledge and Comprehension

During the physics course students obtain the understanding of basic physical concepts and quantities, they obtain the understanding of the basic laws of nature and through problem solving acquire the basics principles of analytical thinking.

Application

<p>Dobro poznavanje osnovnih fizikalnih zakonitosti olajša študentu delo s sodobno laboratorijsko opremo, mu omogoča poglobljeno razumevanje njenega delovanja in s tem poveča učinkovitost njene uporabe pri vsakdanjem delu. Fizikalno znanje je tudi nujno potrebno pri izvajanju, obdelavi in kritičnem ovrednotenju dobljenih meritev, kar predstavlja osnovo laboratorijskega dela. Predmet Fizika se neposredno navezuje na predmete: Fizikalna kemija, Instrumentalne metode analize, Struktura atomov in molekul, Spektroskopske metode, Biofizikalna kemija in Splošna fiziologija</p>	<p>In depth understanding of basic physics laws empowers the student to operate modern laboratory equipment and enables better understanding the quality of measurements. This in turn increases the efficiency of operating the equipment. Physical knowledge is as well crucial in critical analysis of results that represent the basis of laboratory work. Physics connects to the following classes: Physical chemistry, Instrumental methods of analysis, Structure of atoms and molecules, biophysical chemistry and general physiology.</p>
<p><u>Refleksija</u> Pridobljeno znanje fizikalnih osnov bo študentu omogočilo kritično ovrednotiti rezultate laboratorijskih meritev in omogočilo poglobljeno razumevanje predpisanih postopkov pri izvajanju meritev.</p>	<p><u>Analysis</u> The acquired knowledge of physics will enable the student to critically evaluate the outcomes of laboratory measurements and rigorous understanding of prescribed measurement procedures.</p>
<p><u>Prenosljive spretnosti</u> Sposobnost samostojnega spremljanja novih spoznanj in literature s področja laboratorijske tehnike. Razumevanje fizikalnih meritev in sposobnost njihovega ovrednotenja. Kritičen odnos do standardov kakovosti.</p>	<p><u>Skill-transference Ability</u> The ability to autonomously follow the latest advances in the field of modern laboratory techniques. Understanding of physical measurements and the ability of critical evaluation of quality standards and procedures.</p>

**Metode poučevanja in učenja:**

Predavanja s prikazom eksperimentov.  
Računske vaje.

**Learning and Teaching Methods:**

Lectures with demonstration of experiments.  
Problem solving.

Delež (v %) /

**Načini ocenjevanja:**

Weight (in %) **Assessment:**

<p>Izpit pisni in ustni. Ocene: 6-10 pozitivno. Vaje: Opravljeni kolokviji iz vaj.</p>		
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**Reference nosilca / Lecturer's references:**

- VIDMAR, Lev, **BONČA, Janez**, TOHYAMA, Takami, and MAEKAWA, Sadamichi, Quantum Dynamics of a Driven Correlated System Coupled to Phonons, Phys. Rev. Lett. 107, 246404-1-246404-4 (2011).  
- MIERZEJEWSKI, Marcin, **BONČA, Janez**, PRELOVŠEK, Peter. Integrable Mott insulators driven by a finite electric field. Phys. Rev. Lett., 107, 126601-1-126601-4, (2011).  
- MIERZEJEWSKI, Marcin, VIDMAR, Lev, **BONČA, Janez**, PRELOVŠEK, Peter. Nonequilibrium quantum dynamics of a charge carrier doped into a Mott insulator. Phys. Rev. Lett. 106, 196401-1-196401-4 (2011).

- VIDMAR, Lev, **BONČA, Janez**, MIERZEJEWSKI, Marcin, PRELOVŠEK, Peter, TRUGMAN, Stuart A. Nonequilibrium dynamics of the Holstein polaron driven by an external electric field. Phys. Rev., B 83, 134301-1-134301-7 (2011).
- VIDMAR, Lev, **BONČA, Janez**, MAEKAWA, Sadamichi, TOHYAMA, Takami. Bipolaron in the t-J model coupled to longitudinal and transverse quantum lattice vibrations. Phys. Rev. Lett. 103, 186401 (2009).
- **BONČA, Janez**, MAEKAWA, Sadamichi, TOHYAMA, T. Numerical approach to the low-doping regime of the t-J model. Phys. Rev. B 76, 035121 (2007).

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## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	FIZIKA II
<b>Course Title:</b>	PHYSICS II

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	1.	2.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	2 <sup>nd</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK107

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	/	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Janez Bonča / Dr. Janez Bonča, 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:**

**Električno polje in električni tok:** Coulombov zakon, statično električno polje, električno polje točkastega naboja, električno polje v okolici električnega dipola, električni potencial, napetost, Gaussov zakon, Poissonova enačba, kondenzator, kapaciteta kondenzatorja, dielektrik v električnem polju, izoliran prevodnik v električnem polju, influenza, Ohmov zakon, enosmerni in izmenični tok, izmenični tok skozi ohmski upor in kondenzator, merjenje električnega toka in napetosti, električno delo in moč.

**Magnetno polje:** statično magnetno polje, gostota magnetnega polja, sila na vodnik v magnetnem polju, magnetni navor na tokovno

**Content (Syllabus outline):**

**Electric field and electric current:** Coulomb's law, static electric field; electric field of a point charge, electric field of an electric dipole, electric potential, voltage, Gauss's law, Poisson's equation, capacitor, capacitance, dielectric in electric field, insulated conductor in electric field, influence, Ohm's law, direct and alternating current, alternating current through Ohm's resistor and capacitor, measuring electric current and voltage, electrical work and power.

**Magnetic field:** static magnetic field, density of magnetic field, magnetic force on a current-carrying conductor, magnetic torque on a



zanko, magnetni moment, bio-magnetna orientacija (preko kristalov magnetita), Amperov zakon, magnetno polje v okolici ravnega vodnika, v tuljavi, induktivnost tuljave, izmenični tok skozi tuljavo, indukcija, električni nihajni krog, dušeno nihanje.

**Svetloba:** nastanek elektromagnetnega valovanja, hitrost elektromagnetnega valovanja, odboj, lom in interferenca svetlobe, svetlobni energijski tok, absorpcija svetlobe, fotometrija, spekter svetlobe, elektromagnetno sevanje segretyh teles (Wiennov in Stefanov zakon).

**Geometrijska optika:** zrcala in leče enačba zrcal in leč, oko, napake očes, optične naprave: povečevalno steklo in mikroskop.

**Izbrana poglavja iz moderne fizike:** fotoefekt, uklonska slika curka elektronov, de Brogliejeva valovna dolžina, Bohrov model atoma.

current loop, magnetic moment, bio-magnetic orientation (via magnetite crystals), Amper's law, magnetic field in the vicinity of a long straight wire, in the coil, inductivity of a coil, alternating current through a coil, induction, alternating current in an undamped and damped electric circuit.

**Light:** formation of electromagnetic radiation, speed of electromagnetic radiation, reflection, refraction and interference, radiant energy, absorption of light, photometry, light spectrum, electromagnetic radiation of black bodies (Wienn's and Stefan's law).

**Geometrical optics:** reflectors and lenses, equation of mirrors and lenses, eye, vision corrections, optical devices, magnifying glass and microscope.

**Selected topics in modern physics:** photo effect, electron beam diffraction, de Broglie's wave length, Bohr's model of atom.

#### Temeljna literatura in viri / Readings:

##### Glavna literatura:

- J.Strnad: Fizika II, DZS, Ljubljana, 1977. str. 288, (50%)
- R.Kladnik: Visokošolska fizika II, DZS, Ljubljana, 1989. str. 335 (30%)

##### Dodatna literatura:

- Boye K. Ahlborn: Zoological Physics, Springer, 2004.
- D. Halliday, R. Resnick, J. Walker: Fundamentals of Physics (Extended), John Wiley, New York, 1993.
- R. A. Serway in J. S. Faughn, College Physics, Saunders College Publishing, 1999.

#### Cilji in kompetence:

Pri predmetu Fizika študenti pridobijo razumevanje osnovnih fizikalnih pojmov in fizikalnih količin, spoznajo osnovne zakone narave ter se ob reševanju problemov navadijo osnov analitičnega mišljenja. Predmet je podlaga za pridobitev kompetenc s področja Biokemije.

#### Objectives and Competences:

The course represents the basis to reach competences in the area of material preparation for research and quality control that is composed of instrument calibration, work quality control and cooperation in controlling the reliability of results.

#### Predvideni študijski rezultati:

#### Intended Learning Outcomes:

<p><b><u>Znanje in razumevanje</u></b> Študentje pri predmetu pridobijo teoretska znanja in utrdijo sposobnost analitičnega razmišljanja, kar omogoči razumevanje osnovnih naravnih pojavov. Razumevanje pridobljenih znanj izkažejo s sposobnostjo reševanja preprostih fizikalnih problemov.</p>	<p><b><u>Knowledge and Comprehension</u></b> During the physics course students obtain the understanding of basic physical concepts and quantities, they obtain the understanding of the basic laws of nature and through problem solving acquire the basics principles of analytical thinking.</p>
<p><b><u>Uporaba</u></b> Dobro poznavanje osnovnih fizikalnih zakonitosti olajša študentu delo s sodobno laboratorijsko opremo, mu omogoča poglobljeno razumevanje njenega delovanja in s tem poveča učinkovitost njene uporabe pri vsakdanjem delu. Fizikalno znanje je tudi nujno potrebno pri izvajanju, obdelavi in kritičnem ovrednotenju dobljenih meritev, kar predstavlja osnovo laboratorijskega dela. Predmet Fizika se neposredno navezuje na predmete: Fizikalna kemija, Instrumentalne metode analize, Struktura atomov in molekul, Spektroskopske metode, Biofizikalna kemija in Splošna fiziologija</p>	<p><b><u>Application</u></b> In depth understanding of basic physics laws empowers the student to operate modern laboratory equipment and enables better understanding the quality of measurements. This in turn increases the efficiency of operating the equipment. Physical knowledge is as well crucial in critical analysis of results that represent the basis of laboratory work. Physics connects to the following classes: Physical chemistry, Instrumental methods of analysis, Structure of atoms and molecules, biophysical chemistry and general physiology.</p>
<p><b><u>Refleksija</u></b> Pridobljeno znanje fizikalnih osnov bo študentu omogočilo kritično ovrednotiti rezultate laboratorijskih meritev in omogočilo poglobljeno razumevanje predpisanih postopkov pri izvajanju meritev.</p>	<p><b><u>Analysis</u></b> The acquired knowledge of physics will enable the student to critically evaluate the outcomes of laboratory measurements and rigorous understanding of prescribed measurement procedures.</p>
<p><b><u>Prenosljive spretnosti</u></b> Sposobnost samostojnega spremljanja novih spoznanj in literature s področja laboratorijske tehnike. Razumevanje fizikalnih meritev in sposobnost njihovega ovrednotenja. Kritičen odnos do standardov kakovosti.</p>	<p><b><u>Skill-transference Ability</u></b> The ability to autonomously follow the latest advances in the field of modern laboratory techniques. Understanding of physical measurements and the ability of critical evaluation of quality standards and procedures.</p>

**Metode poučevanja in učenja:**

Predavanja s prikazom eksperimentov.  
Računske vaje.

**Learning and Teaching Methods:**

Lectures with demonstration of experiments.  
Problem solving.

Delež (v %) /

Weight (in %) **Assessment:**

<p>Izpit pisni in ustni. Ocene: 6-10 pozitivno. Vaje: Opravljeni kolokviji iz vaj.</p>		
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**Reference nosilca / Lecturer's references:**

- VIDMAR, Lev, **BONČA, Janez**, TOHYAMA, Takami, and MAEKAWA, Sadamichi, Quantum Dynamics of a Driven Correlated System Coupled to Phonons, Phys. Rev. Lett. 107, 246404-1-246404-4 (2011).
- MIERZEJEWSKI, Marcin, **BONČA, Janez**, PRELOVŠEK, Peter. Integrable Mott insulators driven by a finite electric field. Phys. Rev. Lett., 107, 126601-1-126601-4, (2011).
- MIERZEJEWSKI, Marcin, VIDMAR, Lev, **BONČA, Janez**, PRELOVŠEK, Peter. Nonequilibrium quantum dynamics of a charge carrier doped into a Mott insulator. Phys. Rev. Lett. 106, 196401-1-196401-4 (2011).
- VIDMAR, Lev, **BONČA, Janez**, MIERZEJEWSKI, Marcin, PRELOVŠEK, Peter, TRUGMAN, Stuart A. Nonequilibrium dynamics of the Holstein polaron driven by an external electric field. Phys. Rev., B 83, 134301-1-134301-7 (2011).
- VIDMAR, Lev, **BONČA, Janez**, MAEKAWA, Sadamichi, TOHYAMA, Takami. Bipolaron in the t-J model coupled to longitudinal and transverse quantum lattice vibrations. Phys. Rev. Lett. 103, 186401 (2009).
- **BONČA, Janez**, MAEKAWA, Sadamichi, TOHYAMA, T. Numerical approach to the low-doping regime of the t-J model. Phys. Rev. B 76, 035121 (2007).

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## UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** FIZIKALNA KEMIJA I  
**Course Title:** PHYSICAL CHEMISTRY I

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	2.	3.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	3 <sup>rd</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:**

BK113

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
65	10	/	/	/	75	5

**Nosilec predmeta / Lecturer:**

prof. dr. Ksenija Kogej / Dr. Ksenija Kogej, Full Professor

**Jeziki / Languages:**

**Predavanja / Lectures:** slovenski / Slovenian

**Vaje / Tutorial:** slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

**Plini.** Lastnosti plinov. Enačbe stanja, idealni in realni plini. Kritični pojavi, utekočinjanje plinov.

**Prvi zakon termodinamike.** Delo in toplota. Notranja energija, entalpija. Toplotne kapacitete. Kalorimetrija. Termokemija. Odvisnost entalpije od temperature.

**Drugi zakon termodinamike.** Obrnljivi in neobrnljivi procesi. Entropija. Računanje entropijskih sprememb pri reverzibilnih in ireverzibilnih procesih. Tretji termodinamični zakon. Gibbsova in Helmholtzova prosta energija. Odprti sistemi. Kemijski potencial. Kriterij za snovno ravnotežje. Fazna ravnotežja. Clausius-Clapeyronova enačba. Fazni diagrami.

**Content (Syllabus outline):**

**Gasses.** Properties of gasses. Equations of state, ideal and real gasses. Critical phenomena, condensation of gasses.

**The first law of thermodynamics.** Work and heat. The internal energy and enthalpy. Heat capacities. Calorimetry. Thermochemistry. Dependence of enthalpy on temperature.

**The second law of thermodynamics.** Reversible and irreversible processes. Entropy. Calculation of entropy changes in reversible and irreversible processes. The third law of thermodynamics. Gibbs and Helmholtz free energy. Open systems. Chemical potential and the criterion for equilibrium. The phase rule. Phase equilibria. The Clausius-Clapeyron equation. Phase diagrams.

**Raztopine.** Parcialne molske količine. Idealne in neidealne raztopine. Termodinamika mešanja. Raoultov in Henryjev zakon. Koligativne lastnosti. Raztopine elektrolitov. Ionske aktivnosti. Limitni Debye-Hückel zakon. Vsoljevanje in izsoljevanje. Koligativne lastnosti raztopin elektrolitov, Donnanov efekt. Biološke membrane.

**Kemijsko ravnotežje.** Termodinamična konstanta kemijskega ravnotežja. Vpliv temperature in tlaka na ravnotežje. Vežanje ligandov na makromolekule. Bioenergetika. Diferenčna dinamična kalorimetrija.

**Solutions.** Partial molar quantities. Ideal and non-ideal solutions. Thermodynamics of mixing. Raoult's and Henry's law. Colligative properties. Electrolyte solutions. Ionic activities. Debye-Hückel theory. Salting-in and salting-out. Colligative properties of electrolytes. The Donnan effect. Biological membranes.

**Chemical equilibrium.** Thermodynamic equilibrium constant. Effect of temperature and pressure on equilibrium. Binding of ligands to macromolecules. Bioenergetics. Differential scanning calorimetry.

### Temeljna literatura in viri / Readings:

#### Temeljna literatura:

- Raymond Chang: Physical Chemistry for the Biosciences, University Science Books, Sausalito, California, 2005; 190 strani (29 %).

- P. W. Atkins: Physical Chemistry, 7th Edition, Oxford University Press, Oxford, 2002, 150 strani (23 %).

#### Dopolnilna literatura:

- W. J. Moore: Physical Chemistry, 5th Edition, Harlow: Longman, 1996; 950 strani.

### Cilji in kompetence:

Fizikalna kemija je osnovni naravoslovni predmet, pri katerem študenti spoznajo temeljne fizikalno-kemijske zakonitosti in njihovo uporabo pri reševanju zelo različnih problemov iz naravoslovja. Predmet usmerja študenta k samostojnemu in kritičnemu razmišljanju o fizikalno kemijskih zakonitostih s poudarkom na teoriji. Razvija abstrakten način mišljenja in s tem študentu pomaga razumeti in interpretirati pojave v naravi. S pridobljenim znanjem bo študent sposoben razmišljati široko in poglobljeno, pojave na področju biokemije bo povezoval z drugimi naravoslovnimi vedami.

### Objectives and Competences:

Physical chemistry is a fundamental natural science course where students learn basic physical principles and their application in solving various problems in chemistry and nature. Students learn to think critically about their observations, with an emphasis on fundamentals and theory. They develop abstract way of thinking, understanding, and interpreting phenomena in nature. The acquired knowledge enables students to think in a broader context and to relate biochemistry with other natural sciences.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Študent pri predmetu pridobi razumevanje osnovnih naravnih zakonitosti sistemov in fizikalno kemijskih količin. Spozna pojme obrnljivi in neobrnljivi procesi, kriterije za spontanost procesov in za ravnotežje. Nauči se razmišljati v okviru različnih enostavnih

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Students learn to understand basic natural laws/principles for various systems and physical and chemical quantities. They become aware of reversible and irreversible processes, about spontaneity and equilibrium. They acquire critical thinking in the framework of simple

<p>modelov. Osnovne termodinamične zakonitosti se nauči uporabljati na primerih iz biokemijskega področja. Pri študiju predmeta študent razvije kritičen in analitičen način razmišljanja, ki je nujen za razumevanje kompleksnih pojavov na področju biokemije.</p>	<p>models and learn to apply basic thermodynamic principles to solving problems in biochemistry. They develop a critical and analytical way of thinking necessary for understanding complex phenomena in the field of biochemistry.</p>
<p><u>Uporaba</u> Študij tega predmeta je nujna podlaga za to, da bo študent razumel principe raziskovalnih metod, ki jih bo uporabljal na različnih strokovnih področjih, saj moderne eksperimentalne tehnike v veliki meri temeljijo na fizikalno-kemijskih procesih. Pridobljeno znanje mu bo pomagalo pri interpretaciji dobljenih rezultatov in pri razumevanju pojavov na biokemijskem in drugih področjih.</p>	<p><u>Application</u> The course in Physical Chemistry is the necessary basis for understanding fundamentals of research methods that are used in various fields, because modern experimental techniques are frequently based on physical and chemical processes treated within this subject. The knowledge of physical chemistry helps students to interpret phenomena in biochemistry and in other fields.</p>
<p><u>Refleksija</u> Študent pridobi občutek za fizikalno-kemijski način razmišljanja in razvije zmožnost abstraktne predstave o fizikalno-kemijskih količinah. To mu mogoča interpretacijo pojavov v naravi ter pravilno odločanje pri reševanju praktičnih problemov. Študent bo s pridobljenim znanjem sposoben kritičnega vrednotenja dobljenih rezultatov in smiselnosti uporabe posameznih teorij v praksi.</p>	<p><u>Analysis</u> Students acquire the physicochemical way of thinking and develop abstract conceptions of physical properties. This enables them to interpret phenomena in nature and to solve practical problems. They develop critical approach to assessment of results of their work and learn to use appropriate theories.</p>
<p><u>Prenosljive spretnosti</u> Študent se nauči uporabljati domačo in tujo literaturo ter zbirati in interpretirati rezultate. Predmet ga navaja na samostojno delo in ga spodbuja h kritičnemu in analitičnemu načinu razmišljanja.</p>	<p><u>Skill-transference Ability</u> Students learn to use Slovene and English (international) literature and to collect and interpret results. They are trained in independent work and critical and analytical way of thinking.</p>

**Metode poučevanja in učenja:**

Predavanja. Seminarji, kjer študenti preverijo razumevanje snovi z reševanjem računskih in teoretičnih problemov.

**Learning and Teaching Methods:**

Lectures. Seminars where students verify their understanding of the subject by solving exercises and theoretical problems.

Delež (v %) /

**Načini ocenjevanja:**

Weight (in %)

**Assessment:**

<p>Pisni (nadomestita ga lahko dva pozitivno ocenjena kolokvija) in ustni izpit.</p>		<p>Written (which can be passed by two written tests with a positive grade) and oral exam.</p>
<p>Ocene: pozitivno 6-10; negativno 1-5</p>		<p>Grades: positive 6-10; negative 1-5</p>

**Reference nosilca / Lecturer's references:**

-PRELESNIK, Simona, ASEYEV, Vladimir, **KOGEJ, Ksenija**. Differences in association behavior of isotactic and atactic poly(methacrylic acid). *Polymer*, ISSN 0032-3861. [Print ed.], 2014, vol. 55, no. 3, str. 848-854, [COBISS.SI-ID [1675823](#)]

-ANKO, Maja, MAJHENC, Janja, **KOGEJ, Ksenija**, SILLARD, Rannard, LANGEL, Ülo, ANDERLUH, Gregor, ZORKO, Matjaž. Influence of stearyl and trifluoromethylquinoline modifications of the cell penetrating peptide TP10 on its interaction with a lipid membrane. *Biochimica et biophysica acta, Biomembranes*, ISSN 0005-2736. [Print ed.], 2012, vol. 1818, iss. 3, str. 915-924, ilustr. [COBISS.SI-ID [4881434](#)]

-**KOGEJ, Ksenija**. Association and structure formation in oppositely charged polyelectrolyte-surfactant mixtures. *Advances in colloid and interface science*, ISSN 0001-8686. [Print ed.], 2010, vol. 158, no. 1/2, str. 68-83, [COBISS.SI-ID [34100741](#)]

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<b>UČNI NAČRT PREDMETA / COURSE SYLLABUS</b>
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<b>Predmet:</b>	FIZIKALNA KEMIJA II
<b>Course Title:</b>	PHYSICAL CHEMISTRY II

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	2.	4.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	4 <sup>th</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory
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**Univerzitetna koda predmeta / University Course Code:**

BK114
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Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
25	5	45 LV	/	/	75	5

**Nosilec predmeta / Lecturer:**

prof. dr. Ksenija Kogej / Dr. Ksenija Kogej, Full Professor
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**Jeziki / Languages:**

<b>Predavanja / Lectures:</b>	slovenski / Slovenian
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<b>Vaje / Tutorial:</b>	slovenski / Slovenian
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**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.
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**Prerequisites:**

The course has to be assigned to the student.
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**Vsebina:**

<p><b>Elektrokemija.</b> Elektrokemijski členi, termodinamika. Biološka oksidacija. Membranski potencial.</p> <p><b>Disociacijska ravnotežja.</b> Kisline in baze. Puferske raztopine. Nevtralizacijske titracije. Amino kisline: disociacija, izoelektrična točka in titracija proteinov.</p> <p><b>Kemijska kinetika.</b> Hitrostni zakon, red reakcije in konstanta reakcijske hitrosti. Razpolovni čas. Vzoredne, postopne in obojesmerne reakcije. Vpliv temperature na reakcijsko hitrost. Kataliza. Aktivacijska energija. Encimska kinetika Encimska inhibicija.</p> <p><b>Laboratorijske vaje:</b> Kalorimetrija. Parni tlak in izparilna entalpija. Krioskopija. Heterogeno ravnotežje. Napetost in notranja upornost</p>
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**Content (Syllabus outline):**

<p><b>Electrochemistry.</b> Electrochemical cells. Thermodynamics of electrochemical cells. Applications of EMF measurements. Biological oxidation. Membrane potential.</p> <p><b>Dissociation equilibria.</b> Acids and bases. Buffers. Acid-base titrations. Amino acids: dissociation, isoelectric point and titration of proteins.</p> <p><b>Chemical kinetics.</b> Reaction rates, reaction order and the rate constant. The half-life. Reversible, consecutive and chain reactions. The effect of temperature on reaction rate. Catalysis. Activation energy. Enzyme kinetics and inhibition.</p> <p><b>Laboratory practice.</b> Calorimetry. Vapour pressure and heat of vaporization. Cryoscopy.</p>
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galvanskih členov, merjenje pH. Termodinamika galvanskega člena. Prevodnost šibkih in močnih elektrolitov. Protolitsko ravnotežje. Kemijska kinetika.

Heterogeneous equilibrium. Electromotive force and internal resistance of galvanic cells, measurement of pH. Thermodynamics of galvanic cells. Conductivity of weak and strong electrolytes. Protolytic equilibrium. Chemical kinetics.

### Temeljna literatura in viri / Readings:

#### Temeljna literatura:

- Raymond Chang: Physical Chemistry for the Biosciences, University Science Books, Sausalito, California, 2005; 66 strani (10 %).
- Matjaž Bončina, Janez Cerar, Andrej Godec, Barbara Hribar Lee, Andrej Jamnik, Jurij Lah, Andrej Lajovic, Miha Lukšič, Črtomir Podlipnik, Iztok Prislán, Jurij Reščič, Bojan Šarac, Matija Tomšič in Gorazd Vesnaver: FIZIKALNA KEMIJA – PRAKTIKUM, interno študijsko gradivo, Ljubljana, 2011, 260 strani (40 %).

#### Dopolnilna literatura:

- P. W. Atkins: Physical Chemistry, 7th Edition, Oxford University Press, Oxford, 2002; 1000 strani.
- W. J. Moore: Physical Chemistry, 5th Edition, Harlow: Longman, 1996; 950 strani.

### Cilji in kompetence:

Ker je predmet nadaljevanje predmeta Fizikalna kemija I, so splošni cilji in predmetno specifične kompetence za oba enaki. Med dodatnimi cilji drugega dela tega predmeta je najprej podati manjkajoče vsebine, ki bodo zaokrožile študentovo znanje fizikalne kemije. Poleg tega je pomemben cilj še demonstracija pridobljenega teoretičnega znanja o fizikalnih zakonitosti v laboratoriju. Pri tem bo študent preveril svoje razumevanje osnovnih principov termodinamike in kinetike, spoznal se bo z meritvami pomembnih fizikalnih lastnosti snovi, dobljene rezultate bo povezal z ustreznimi teorijami.

### Objectives and Competences:

Physical chemistry II is a continuation of Physical chemistry I, therefore objectives and competences are the same for both. Part II covers chapters that are not included in Part I. In addition, the course includes laboratory practice, where students check their knowledge and understanding of the subjects by measuring several thermodynamic properties and following reaction kinetics.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Študent pri predmetu dopolni svoje znanje o osnovnih naravnih zakonitostih in fizikalno kemijskih količinah, ki ga je dobil pri študiju predmeta Fizikalna kemija I. Razširi ga na poznavanje raztopin elektrolitov, seznanjen se s procesi, ki potekajo na meji med kovinsko elektrodo in elektrolitom ter spozna ustrezne primere pri kemijskih in biokemijskih procesih. Spozna razliko med termodinamiko in kinetiko in osvoji matematične osnove za obravnavo

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Students complete their knowledge obtained in the first part (Physical chemistry I) and extend it to solutions of electrolytes and to processes at the metal electrode-electrolyte interface involved in galvanic cells. Practical chemical and biochemical examples of galvanic cells are presented. Students understand the difference between thermodynamics and kinetics and acquire the mathematical principles for treating enzyme kinetics. Emphasis of the course is on

<p>encimske kinetike. Velik poudarek predmeta je na pridobivanju spretnosti za kvalitetno izvajanje fizikalno-kemijskih meritev. Študent se nauči pravilnega izvajanja meritev in ustreznega podajanja rezultatov, ki jih interpretira v skladu s teoretičnim znanjem, ki ga je osvojil pri predavanjih v prvem in drugem delu Fizikalne kemije.</p>	<p>laboratory practice where students learn about how to correctly measure thermodynamic and kinetic quantities and how to correctly report the results of their measurements. They interpret the results in frames of theories which they learned in both courses.</p>
<p><u>Uporaba</u> V celoti gledano, je študij predmeta (Fizikalne kemije I in II) nujna podlaga za to, da bo študent razumel principe raziskovalnih metod, ki jih bo uporabljal na različnih strokovnih področjih. Poudarek v drugem delu je zato na uporabi teoretičnega znanja pri meritvah v laboratoriju in pri interpretaciji dobljenih rezultatov. Študent bo osvojil veščine, ki so potrebne za kvalitetno izvajanje meritev fizikalno-kemijskih količin. Spretnosti, ki jih bo osvojil pri delu v laboratoriju, mu bodo koristile pri nadaljnjem strokovnem razvoju in predvsem pri vključevanje v delo v interdisciplinarnih raziskovalnih skupinah. Dandanes se v praksi pogosto ugotavlja, da so potrebna ravno znanja o pravilnem in kvalitetnem opravljanju meritev ter nadaljnjem kompetentnem interpretiranju rezultatov, za kar je potrebno temeljito razumevanje osnovnih principov in teorij. Študent se pri izvajanju vaj v skupinah navadi na timsko delo in na posredovanje znanja in rezultatov drugim.</p>	<p><u>Application</u> Both courses in Physical Chemistry (I and II) are the basis for understanding principles of research methods that are used various fields. The emphasis in the second part is on the application of theoretical knowledge to measurements and interpretation of experimental results. Students learn the correct way of carrying out measurements. The skills they acquire will be useful in their potential work in larger interdisciplinary research groups or in teams in companies. In this way they experience team work and the transfer of knowledge among group members.</p>
<p><u>Refleksija</u> Študent bo na osnovi pridobljenega znanja sposoben izvajati zahtevnejše meritve v fizikalno-kemijskem laboratoriju ne le na področju biokemije, temveč v naravoslovju splošno. Pridobil bo občutek za optimalno izvedbo meritev in za to, kako natančno jih je izvedel. Preveril bo lastno razumevanje konceptov/teorij, ki jih je osvojil pri teoretičnem delu predmeta in se naučil povezovanja znanja.</p>	<p><u>Analysis</u> After completing the course students will be able to carry out complex physical chemical measurements in different laboratories. They will acquire the feeling for rational accomplishment of measurements and for their reliability. They will verify their understanding of theories and learn to combine knowledge from various fields.</p>
<p><u>Prenosljive spretnosti</u> Študent se nauči varnega dela v laboratoriju, dela z različnimi aparaturami ter zbiranja, obdelave in interpretiranja rezultatov. Pri tem</p>	<p><u>Skill-transference Ability</u> Students learn to work in laboratory, to handle with instruments and to collect, treat and interpret results of their measurements. They</p>

se nauči uporabljati računalnik tako za obdelavo kot za prikaz rezultatov. Ker je poseben poudarek pri predmetu na laboratorijskih vajah, kjer študenti delajo v skupinah, predmet študentu nudi tudi izkušnjo s timskim delom. Nauči se podajati pregledna in eksaktna poročila o opravljenem delu.

learn to use the computer for calculations and graphical presentation of results. They also get experience in teamwork and in clear and exact writing of reports of their work.

**Metode poučevanja in učenja:**

Predavanja, seminarji z računskimi vajami in laboratorijske vaje.

**Learning and Teaching Methods:**

Lectures. Seminars where students verify their understanding of the subject by solving exercises and theoretical problems. Laboratory practice.

**Načini ocenjevanja:**

Predavanja: pisni in ustni izpit.  
Laboratorijske vaje: vodenje dnevnika, pisni kolokvij.  
Ocene: 6-10 (pozitivno), 1-5 (negativno).  
H končni oceni prispeva:  
- 50 % ocena iz izpita pri predmetu in -  
- 50 % ocena iz vaj.  
Če je dobljena vrednost med ocenami, se zaključí v prid ocene iz vaj.

Delež (v %) /

Weight (in %) /

**Assessment:**

Written and oral examination: 50 %  
Laboratory diary and a written exam from laboratory practice: 50 %

50 %

50 %

Grades: positive 6-10; negative 1-5.

**Reference nosilca / Lecturer's references:**

-PRELESNIK, Simona, ASEYEV, Vladimir, **KOGEJ, Ksenija**. Differences in association behavior of isotactic and atactic poly(methacrylic acid). *Polymer*, ISSN 0032-3861. [Print ed.], 2014, vol. 55, no. 3, str. 848-854, [COBISS.SI-ID [1675823](#)]

-ANKO, Maja, MAJHENC, Janja, **KOGEJ, Ksenija**, SILLARD, Rannard, LANGEL, Ülo, ANDERLUH, Gregor, ZORKO, Matjaž. Influence of stearyl and trifluoromethylquinoline modifications of the cell penetrating peptide TP10 on its interaction with a lipid membrane. *Biochimica et biophysica acta, Biomembranes*, ISSN 0005-2736. [Print ed.], 2012, vol. 1818, iss. 3, str. 915-924, ilustr. [COBISS.SI-ID [4881434](#)]

-**KOGEJ, Ksenija**. Association and structure formation in oppositely charged polyelectrolyte-surfactant mixtures. *Advances in colloid and interface science*, ISSN 0001-8686. [Print ed.], 2010, vol. 158, no. 1/2, str. 68-83, [COBISS.SI-ID [34100741](#)]

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	FUNKCIJSKA GENOMIKA
<b>Course Title:</b>	FUNCTIONAL GENOMICS

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	6.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	6 <sup>th</sup>

**Vrsta predmeta / Course Type:** izbirni strokovni / Elective Professional

**Univerzitetna koda predmeta / University Course Code:** BKS17

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** izr. prof. dr. Uroš Petrovič / Dr. Uroš Petrovič, Associate 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:**

**Genom:** Projekt Človeški genom - zgodovinski pregled, kloniranje in kartiranje; drugi genomi. **Metode preiskave vloge posameznega gena** - tehnologija izničenja genov, utišanje genov z siRNA in protismiselno tehnologijo. **Celostne genomske analize z mikromrežami** - genotipiziranje in SNP čipi, re-sekvenciranje, CGH mikromreže, mutacijska analiza, iskanje promotorskih zaporedij. **Genomika** - primerjalna in evolucijska genomika, metagenomika. **Transkriptom:** Načini izražanja genov, tehnike za merjenje transkriptoma. **Proteom:** Interakcije protein-protein in protein-DNA; visoko zmogljivostne tehnike za karakterizacijo proteinov in njihovih interakcij.

**Content (Syllabus outline):**

**Genome:** Human Genome Project – historical overview, cloning and mapping; other genomes. Methods of analysing the role of genes – production of knockouts, siRNA silencing and antisense technology. Comprehensive genome analyses using microarrays - genotyping and SNP chips, resequencing, CGH microarrays, mutation analysis, promoter sequencing. Genomics – comparative and evolutionary genomics, metagenomics. **Transcriptome:** ways of genomic expression, transcriptome measuring techniques. **Proteome:** protein-protein and protein-DNA interactions; high performance techniques for protein characterisation and their interactions.

**Metabolom:** sistemske študije kemičnih prstnih odtisov metaboličnih procesov v celici (metabolično profiliranje), separacijske in identifikacijske metode.

**Fenom:** metode za določitev različnih vrst fenotipov na genomski ravni modelnih mikroorganizmov.

**Osnove sistemske biologije:** teorija sistemov v biologiji, uporaba načela mrež (teorije grafov) v sistemske biologiji, osnove modeliranja bioloških mrež, orodja bioinformatike v funkcijski genomiki in sistemske biologiji.

**Modelni organizmi v sistemske biologiji in funkcijski genomiki:** zgodovinski okvir razvoja sistemske biologije, kvasovka *S. cerevisiae*, nematoda *C. elegans*.

**Funkcijska genomika in družba** - varstvo podatkov, pravni in etični vidiki, patentiranje.

**Metabolome:** system studies of chemical fingerprints of metabolic processes in a cell (metabolic profiling), separation and identification methods.

**Phenome:** methods for determining different phenotypes at the genome level of model microorganisms.

**Fundamentals of systems biology:** theory of systems in biology, graph theory in systems biology, fundamentals of modelling biological networks, bioinformatics tools used in functional genomics and systems biology.

**Model organisms in systems biology and functional genomics:** historical background of systems biology, *S. cerevisiae* yeast, *C. elegans* nematode.

**Functional genomics and the society** – data protection, legal and ethical aspects, patenting.

#### **Temeljna literatura in viri / Readings:**

##### **Izbrana poglavja iz:**

- Prevsner J., Bioinformatics and Functional Genomics 2009, Blackwell & Willey, 992 strani (~20%)
- Klipp, E., Herwig, R., Kowald, A., Wierling, C., Lehrach, H. 2005 Systems Biology in Practice: Concepts, Implementation and Application. John Wiley & Sons.; 496 strani (~30%)

##### **Dodatna literatura:**

- Debeljak, N., Horvat, S., Juvan, P., Kunej, T., Petrovič, U., Režen, T. 2014 Funkcijska genomika – praktikum. Center za funkcijsko genomiko in bio-čipe, Infrastrukturni center medicinske fakultete Univerze v Ljubljani.
- Članki iz tekoče periodike.

#### **Cilji in kompetence:**

**Cilji predmeta:** pridobivanje osnovnih znanj o genomiki in študijah funkcije genov; spoznavanje (teoretično in praktično) eksperimentalnih in računskih tehnik, ki se uporabljajo v funkcijski genomiki; seznanjanje z modelnimi organizmi in njihovo uporabnostjo; pridobivanje osnovnih znanj o funkcijski genomiki in sistemske biologiji pri sesalcih in modelnih organizmih.

**Predmetno specifične kompetence:** sposobnost načrtovanja eksperimentov s področja funkcijske genomike; sposobnost uporabe eksperimentalnih in bioinformatičnih orodij, sposobnost razumevanja in interpretacije podatkov.

#### **Objectives and Competences:**

**Learning outcomes:** Acquiring basic knowledge on genomics and studies on gene functions; Acquiring (theoretical and practical) knowledge on experimental and computational techniques used in functional genomics; Learning about model organisms and their application; Acquiring basic knowledge on functional genomics and systems biology in mammals and model organisms.

**Competences:** subject specific competencies: planning experiments in functional genomics, use of experimental bioinformatics tools, understanding and interpreting data.

**Predvideni študijski rezultati:**

Znanje in razumevanje  
 - Poznavanje zgradbe in vloge človeškega genoma.  
 - Poznavanje in razumevanja osnov transkriptomke, proteomike, metabolomike in fenomike.  
 - Poznavanje in razumevanja mrež in modelov bioloških sistemov.  
 - Poznavanje modelnih organizmov v funkcijski genomiki in njihovih specifičnosti.  
 - Poznavanje osnovnih načel modeliranja bioloških sistemov.  
 - Poznavanje in razumevanje problematike pravnih in etičnih vidikov pogenomskega obdobja.

Uporaba  
 - Sposobnost uporabe specifičnih eksperimentalnih metod funkcijske genomike.  
 - Sposobnost uporabe specifičnih bioinformatičnih orodij.

Refleksija  
 Študentje bodo razvili sposobnost kompleksnega vpogleda v biološke sisteme. Pridobili bodo sposobnost abstraktnjšega dojetja organizacije in delovanje genoma ter celic in organizmov.

Prenosljive spretnosti  
 - Sposobnost interpretacije eksperimentalnih podatkov.

**Intended Learning Outcomes:**

Knowledge and Comprehension  
 - Know the structure and function of human genome  
 - Know and understand the basics of transcriptomics, proteomics, metabolomics and phenomics  
 - Know and understand the concept of biological networks and systems  
 - Know model organisms in functional genomics and their specificities  
 - Know the basics of modelling in biology  
 - Know and understand the issues and importance of legal and ethical aspects of the post-genome era

Application  
 - Ability to use specific experimental methods of functional genomics  
 - Ability to use specific bioinformatics tools

Analysis  
 Students will be capable of a complex insight into biological systems. They will also obtain the capacity of abstract understanding of genome and cell/organism organization and functioning.

Skill-transference Ability  
 - Ability to interpret experimental data

**Metode poučevanja in učenja:**

Predavanja, seminarji, laboratorijsko delo.

**Learning and Teaching Methods:**

Lecture, seminars, laboratory-based practical work

**Načini ocenjevanja:**

Seminarska naloga  
 Pisni izpit  
 Ocene: 6-10 (pozitivno), 1-5 (negativno).

Delež (v %) /  
 Weight (in %)

**Assessment:**

Seminar work  
 Written exam  
 Grades: 6-10 (positive), 1-5 (negative)

**Reference nosilca / Lecturer's references:**

- Mattiazzi Ušaj M, Kaferle P, Toplak A, Trebše P, **Petrovič U.** (2013) Determination of toxicity of neonicotinoids on the genome level using chemogenomics in yeast. Chemosphere. (v tisku; doi: 10.1016/j.chemosphere.2013.10.063)

- Mattiazzi M, Sun Y, Wolinski H, Bavdek A, Petan T, Anderluh G, Kohlwein SD, Drubin DG, Križaj I, **Petrovič U.** (2012) A neurotoxic phospholipase A2 impairs yeast amphiphysin activity and reduces endocytosis. *PLoS One.* 7(7):e40931
- Mattiazzi M, Curk T, Križaj I, Zupan B, **Petrovič U.** (2010) Inference of the molecular mechanism of action from genetic interaction and gene expression data. *OMICS.* 14(4):357-367
  
- Polymorphisms of CYP51A1 from Cholesterol Synthesis: Associations with Birth Weight and Maternal Lipid Levels and Impact on CYP51 Protein Structure. Lewińska M, Zelenko U, Merzel F, Golic Grdadolnik S, Murray JC, **Rozman D.** *PLoS One.* 2013 Dec 17;8(12):e82554. doi: 10.1371/journal.pone.0082554. eCollection 2013., PMID:24358204
- Inducible cAMP early repressor regulates the Period 1 gene of the hepatic and adrenal clocks. Zmrzljak UP, Korenčič A, Košir R, Goličnik M, Sassone-Corsi P, **Rozman D.** *J Biol Chem.* 2013 Apr 12;288(15):10318-27. doi: 10.1074/jbc.M112.445692. Epub 2013 Feb 25., PMID: 23443664
- Novel insights into the downstream pathways and targets controlled by transcription factors CREM in the testis. Kosir R, Juvan P, Perse M, Budefeld T, Majdic G, Fink M, Sassone-Corsi P, **Rozman D.** *PLoS One.* 2012;7(2):e31798. doi: 10.1371/journal.pone.0031798. Epub 2012 Feb 22., PMID:22384077

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	INSTRUMENTALNE METODE ANALIZE
<b>Course Title:</b>	INSTRUMENTAL ANALYTICAL METHODS

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	2.	3.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	3 <sup>rd</sup>

Vrsta predmeta / Course Type:

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

BK117

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	/	30 LV	/	/	75	5

Nosilec predmeta / Lecturer:

prof. dr. Marjan Veber / Dr. Marjan Veber, Full Professor

Jeziki / Languages:

Predavanja / Lectures: slovenski / Slovenian

Vaje / Tutorial: slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Pregled pomembnih kemijskih ravnotežij v analizi kemiji, puferske raztopine. Klasične analize metode; njihove značilnosti in omejitve.

Instrumentalne analize metode: delitev, osnovni principi metod, kvantitativno vrednotenje meritev (umeritvena krivulja, standardni dodatek).

**Pregled spektroskopskih analize metod:**

Molekularna absorpcijska spektrometrija (UV in VIS) osnove metode (Beer-Lambertov zakon) in instrumentacije, primeri uporabe v biokemijski analitiki.

Molekulska fluorescenčna spektroskopija; osnove metode, instrumentacija

Content (Syllabus outline):

Survey of chemical equilibria important in analytical chemistry. Classical analytical techniques; their properties and limitations.

Instrumental methods: classification, principles, quantitative evaluation of results (calibration curve, standard addition approach).

**Spectroscopic methods:** UV-VIS molecular absorption spectrometry; theoretical basis (Beer-Lambert law), instrumentation and practical examples of its application.

Molecular fluorescence spectrometry; theoretical basis, instrumentation and application in biochemical analysis.



karakteristike; primeri uporabe v analitiki biološko aktivnih spojin.

Atomska absorpcijska spektrometrija načini atomizacije (plamen, elektrotermična atomizacija, hidridne tehnike).

Atomska emisijska spektrometrija (vzbujanje v plamenu in induktivno sklopljeni plazmi), uporaba metod atomske spektrometrije v analitiki bioloških vzorcev.

Masna spektrometrija osnovni načini ionizacije, masni spektrometri, interpretacija enostavnih masnih spektrov:

Elementna masna spektrometrija (ICP-MS); osnovni principi in pomen v analitiki sledov.

**Pregled elektrokemijskih analiznih metod:** Osnove potenciometrije (ionoselektivne elektrode) in voltametrije, elektrokemijski senzori.

**Separacijske metode v analizni kemiji:** Osnovni principi kromatografske separacije, parametri kromatografskih separacij (retencijski čas, število teoretskih podov, ločljivost, načini kvantifikacije), plinska kromatografija, tekočinska kromatografija visoke ločljivosti (izbira mobilne in stacionarne faze, gradientno in izokratsko eluiranje), kapilarna elektroforeza.

Sklopljene metode v biokemijski analitiki.

**Statistično vrednotenje analiznih rezultatov:** napake, statistični testi, regresija in korelacija.

**Laboratorijske vaje:** Molekularna absorpcijska spektrometrija (merjenje spektrov v UV-VIS področju, uporaba spektrofotometrije za kvantitativno določevanje organskih in anorganskih zvrsti). Molekularna fluorescenca; določevanje biološko aktivnih substanc.

Atomska emisijska spektrometrija.

Plamenska in elektrotermična atomska absorpcijska spektrometrija (določevanje težkih kovin v bioloških materialih)

Uporaba potenciometrije v analitiki (ionoselektivne elektrode, potenciometrične titracije).

Atomic absorption spectroscopy: flame and electrothermal atomization, hydride generation.

Atomic emission spectroscopy; excitation in flame and inductively coupled plasma.

Application of atomic spectroscopy in biochemical analysis.

Mass spectrometry: modes of ionization, analysis and detection of ions, identification of compounds, instrumentation.

Elemental mass spectrometry (ICP-MS), basic principles and its importance in trace analysis.

**Electroanalytical techniques:** principles, instrumentation and application of potentiometry, voltammetry and electrochemical sensors.

**Separation methods in analytical chemistry:** Fundamental parameters in chromatography; retention time, number of theoretical plates, resolution, quantification), gas chromatography (GC), high-performance liquid chromatography (HPLC), selection of mobile and stationary phase, isocratic and gradient elution, capillary electrophoresis (CE).

Hyphenated techniques in biochemical analysis.

**Statistical evaluation of analytical results** (errors, statistical tests, regression, correlation).

**Laboratory exercises:** Molecular absorption spectrometry (measurement of UV-VIS spectra, quantitative determination of organic and inorganic species). Molecular fluorescence (quantitative determination of biologically active compounds). Flame emission spectrometry

Flame and electrothermal atomic absorption spectrometry (determination of metals in biological samples).

Potentiometry (Ionoselective electrodes, potentiometric titrations).

The application of chromatography in analysis (GC and HPLC).

Plinska (GC) in tekočinska kromatografija visoke ločljivosti (HPLC).

### Temeljna literatura in viri / Readings:

#### OSNOVNI UČBENIK:

- D.A. Skoog, D.M. West, Holler, Fundamentals of Analytical Chemistry, Holt-Saunders Int. Ed. New York (izbrana poglavja / selected chapters, v obsegu 175 strani / 175 pages)
- D.C.Harris, Quantitative Chemical analysis, W.H.Freeman N.Y (1008 str. / pages 15%)

#### DODATNA LITERATURA / ADDITIONAL LITERATURE:

- Navodila za vaje / Instructions for laboratory exercises
- M. Veber: Študijski materiali (prosojnice, izpitne naloge in vprašanja) – dostop na spletu / M. Veber: Notes to lectures (available on internet)

### Cilji in kompetence:

Pri predmetu Instrumentalne metode analize bodo študentje biokemije spoznali osnovne koncepte sodobne analizne kemije, principe pomembnejših instrumentalnih analiznih metod ter se seznanili z nekaterimi pristopi v analitiki bioloških materialov.

Metode bodo znali uporabiti pri reševanju analiznih problemov ter kritično vrednotiti in interpretirati rezultate meritev.

### Objectives and Competences:

**Objectives:** To understand basic concepts in modern analytical chemistry and fundamental principles of important instrumental analytical techniques; To get knowledge on some approaches used for the analysis of biological materials.

**Competences:** Students will acquire practical skills and experiences for the use of some instrumental techniques in analytical chemistry and will be able to evaluate and present analytical results.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Študentje bodo pridobili osnovna teoretska in praktična znanja, ki so potrebna za razumevanje pomembnejših analiznih postopkov, ki jih biokemik potrebuje pri vsakodnevnih odločitvah (kontrola kakovosti!) in so temelj za izvedbo praktičnih analiz. Prav tako bodo sposobni kritično presoditi zmogljivosti nekaterih analiznih metod, primerjati klasične in instrumentalne pristope v analitiki ter ustrezno obravnavati rezultate kemijskih analiz. Razen teoretskih temeljev bodo pridobili tudi praktične laboratorijske spretnosti.

#### Uporaba

Poleg fizikalno-kemijskih osnov, ki so osnova razumevanje analiznih postopkov, bodo

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Students will get fundamental theoretical and practical knowledge which is important for understanding of analytical procedures. They will be able to compare analytical methods and critically evaluate analytical results. Besides theoretical knowledge they will get practical skills for the work in the analytical laboratory.

#### Application

Besides theoretical physical and chemical knowledge, which is the basis for the

<p>pridobili tudi praktična znanja, ki so potrebna pri zasnovi in izvedbi analiz ter kritični interpretaciji podatkov in dobljenih rezultatov.</p>	<p>understanding of analytical procedures, they will get also practical knowledge which is important for planning and performing of analysis and interpretation of analytical data.</p>
<p><u>Refleksija</u> Teoretska in praktična znanja bo lahko študent uporabil pri reševanju praktičnih in teoretskih problemov (v času študija in praksi). Poznavanja zmogljivosti in omejitev analiznih metod v praksi so lahko osnova za mnoge pomembne strokovne odločitve.</p>	<p><u>Analysis</u> Students will be able to use knowledge on analytical chemistry to solve some practical and theoretical problems during later study and practice. The knowledge of abilities and limitations of instrumental analytical methods play an important role in many professional decisions.</p>
<p><u>Prenosljive spretnosti</u> Pri predmetu bo študent pridobil laboratorijske spretnosti, naučil se bo dela z instrumenti v laboratoriju ter izvedbe pomembnih kemijskih meritev znal bo uporabljati ustrezno literaturo, eksperimentalne podatke bo znal ustrezno obdelati ter primerno interpretirati.</p>	<p><u>Skill-transference Ability</u> Students will gain practical skills, they will be able to perform basic instrumental measurements, they will be able to find and use the relevant literature and to evaluate data obtained by measurements using analytical instrumentation.</p>

**Metode poučevanja in učenja:**

Eksperimentalna predavanja in laboratorijske vaje.

**Learning and Teaching Methods:**

Lectures and laboratory exercises

Delež (v %) /

Weight (in %) **Assessment:**

<p>Pogoj za izpit so uspešno opravljene vaje s pisnim testom. 25 %</p>	<p>25%</p>	<p>Completed laboratory course with written test is prerequisite for the exam.</p>
<p>Pisni in ustni izpit 75 % Ocene: 6-10 pozitivno</p>	<p>75%</p>	<p>Written and oral examination Marks: 6-10 positive</p>

**Reference nosilca / Lecturer's references:**

- M. P. Beeston, A. Pohar, J. van Elteren, I. Plazl, Z. Šlejkovec, **M. Veber**, H. Glas, Assessment of physical leaching processes of some elements in soil upon ingestion by continuous leaching and modeling. Environ. sci. technol.. [Print ed.], 2010, vol. 44, issue 16, str. 6242-6248.

- Z. Bubnič, U. Urleb, K. Kreft, **M. Veber**, The application of atomic absorption spectrometry for the determination of residual active pharmaceutical ingredients in cleaning validation samples. Drug dev. ind. pharm., 2011, vol. 37, no. 3, str. 281-289

- G. Arh, L. Klasinc, **M. Veber**, M. Pompe, Calibration of mass selective detector in non-target analysis of volatile organic compounds in the air. J. chromatogr., A, 2011, vol. 1218, issue 11, str.

- Z. Kitanovski, I. Grgić, **M. Veber**, Characterization of carboxylic acids in atmospheric aerosols using hydrophilic interaction liquid chromatography tandem mass spectrometry. J. chromatogr., A, 2011, vol. 1218, issue 28, str. 4417-4425,

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	KEMIJSKA ANALIZA ŽIVIL
<b>Course Title:</b>	CHEMICAL ANALYSIS OF FOODSTUFFS

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	6.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	6 <sup>th</sup>

**Vrsta predmeta / Course Type:** izbirni strokovni / Elective Professional

**Univerzitetna koda predmeta / University Course Code:** BKSI6

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** doc. dr. Irena Kralj Cigić / Dr. Irena Kralj Cigić, Assistant 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:**

1. Analizne metode za ugotavljanje vsebnosti osnovnih sestavin živil: vlaga, proteini, sladkorji, maščobe.
2. Klasične analizne metode (gravimetrija, volumetrija) v kombinaciji z ekstrakcijo, destilacijo, obarjanjem
3. Instrumentalne metode: (IR, molekulska spektrometrija, GC, HPLC).
4. Določanje anorganskih mikrokomponent v živilih . Razkroji vzorcev.
5. Spektroskopske metode za določanje sledov kovin in organskih spojin
6. Organske mikrokomponente v živilih: uporaba kromatografskih metod z različnimi detektorji.

**Content (Syllabus outline):**

1. Analytical methods for the determination of basic ingredients in foodstuffs: moisture, proteins, sugars, lipids.
2. Classical analytical methods (gravimetry, volumetry) in combination with extraction, distillation, precipitation.
3. Instrumental methods: infrared and molecular spectrometry, gas and liquid chromatography.
4. Determination of inorganic microcomponents and digestion of the samples.
5. Spectroscopic methods for the determination of trace metals and trace organic compounds.
6. Determination of organic microcomponents by chromatographic methods with various detectors.

7. Določanje sestavin arom
8. Metode za izolacijo spojin iz posameznih živil: ekstrakcija s topili, ekstrakcija na trdno fazo, mikroekstrakcija, ekstrakcija iz plinske faze, mikrovalovna ekstrakcija, ekstrakcija s superkrično tekočino itd.,
9. Izbira analizne metode, presejalne metode, hitri testi
10. Vrednotenje rezultatov analiz in validacija analiznih metod.

7. Determination of aroma constituents.
8. Isolation methods from selected foodstuffs: solvent extraction, solid-phase extraction, microextraction, headspace extraction, microwave extraction, supercritical fluid extraction, etc.
9. Choice of an analytical method, screening methods, rapid screening assays.
10. Evaluation of analytical results and analytical methods.

#### Temeljna literatura in viri / Readings:

- Navodila za vaje pri predmetu Kemijska analiza živil, H. Prosen, I. Kralj Cigić, UL FKKT, 2006.
- Food Analysis, S.S. Nielsen, 4th ed., Springer, New York, 2010.

#### Dodatna literatura:

- AOAC – standardni postopki za analizo živil
- Članki iz znanstvenih in strokovnih revij

#### Cilji in kompetence:

Cilj predmeta je, da študentje poznajo in znajo uporabljati analizne metode, ki se uporabljajo za ugotavljanje sestave in spremljanje kvalitete živil.

Študentje si pri predmetu pridobijo naslednje specifične kompetence:

- zmožnost izbire najprimernejšega analiznega pristopa za določanje glavnih in mikrokomponent živil
- zmožnost praktične uporabe primerne analiznega pristopa za določanje specifičnih sestavin živil v laboratoriju
- zmožnost poiskati v razpoložljivi primarni in sekundarni literaturi problemu primerno analizno metodo/postopek
- kritično vrednotenje rezultatov, dobljenih z apliciranimi metodami/postopki
- zmožnost, da izboljšajo in razvijejo nove analizne metode in postopke
- usposobljenost za pisanje poročil, kritično vrednotenje in interpretacijo eksperimentalnih rezultatov

#### Objectives and Competences:

##### Learning outcomes:

Understanding and application of analytical methods for the determination of ingredients and quality screening of the foodstuffs.

##### Competences:

- ability to choose the appropriate analytical technique for determination of macro- or micro- components of foodstuffs
- ability of practical application of suitable analytical procedure for determination of specific food ingredients in the laboratory
- ability to find the appropriate method/procedure in primary and secondary literature
- critical evaluation and interpretation of experimental results
- ability to develop or improve analytical methods and procedures
- preparation of analytical report, critical evaluation and interpretation of experimental data.

**Predvideni študijski rezultati:**

<u>Znanje in razumevanje</u> Študenti spoznajo glavne analizne metode za določanje makro- in mikroestavin živil in jih znajo kritično uporabiti: poznajo prednosti in omejitve posameznih metod, motnje, vire napak.
<u>Uporaba</u> Študenti znajo izbrati in v laboratoriju uporabiti primerne analizne metode. Zna rokovati z enostavnejšimi analiznimi inštrumenti.
<u>Refleksija</u> Študentje kritično ovrednotijo analizne metode, prav tako tudi rezultate, ki jih dobijo z njihovo uporabo.
<u>Prenosljive spretnosti</u> Študentje se naučijo uporabljati strokovno literaturo, znajo zbrati in interpretirati podatke. Znajo pisati povzetke in pisna poročila ter predstaviti rezultate analiz in raziskav v pregledni obliki.

**Intended Learning Outcomes:**

<u>Knowledge and Comprehension</u> To gain knowledge about main analytical methods for determination of macro- and micro- components of foodstuffs and to critically perform them: advantages and limitations of specific methods, interferences, sources of errors.
<u>Application</u> To choose and perform suitable analytical method in the laboratory. To handle with simple analytical instruments.
<u>Analysis</u> To critically evaluate different analytical methods and also evaluation of results.
<u>Skill-transference Ability</u> To use specialised literature, to collect and interpret data. To write abstracts and report and to present analysis results and investigations in transparent form.

**Metode poučevanja in učenja:**

Predavanja, vaje, seminar.
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**Learning and Teaching Methods:**

Lectures, laboratory exercises, seminar.
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Delež (v %) /

Weight (in %)

**Načini ocenjevanja:**

Opravljene vaje so pogoj za pristop k izpitu. Kolokvij iz vaj 30 % Pisni izpit 30 % Ustni izpit 40 % Ocene: 6-10 (pozitivno), 1-5 (negativno).
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**30 %**

**30 %**

**40 %**

**Assessment:**

Completed laboratory course is prerequisite for the exam. Test from laboratory course Written exam Oral exam Grades: 6-10 (positive), 1-5 (negative)
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**Reference nosilca / Lecturer's references:**

<ul style="list-style-type: none"> <li>- Navodila za vaje pri predmetu Kemijska analiza živil, H. Prosen, <b>I. Kralj Cigić</b>, UL FKKT, 2006.</li> <li>- <b>I. Kralj Cigić</b>, M. Strlič, A. Schreiber, M. Kocjančič, B. Pihlar, Ochratoxin A in wine: its determination and photostability, Anal. Lett., 39 (2006) 1475-1488.</li> <li>- <b>I. Kralj Cigić</b>, T. Vrščaj Vodošek, T. Košmerl, M. Strlič, Amino acid quantification in the presence of sugars using HPLC and pre-column derivatization with 3-MPA/OPA and FMOC-Cl. Acta Chim. Slov., 55 (2008) 660-664.</li> <li>- <b>I. Kralj Cigić</b>, H. Prosen, An overview of conventional and emerging analytical methods for the determination of mycotoxins. Int. J. Mol. Sci., 10 (2009) 62-115.</li> </ul>
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## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	KEMIJSKI PRAKTIKUM
<b>Course Title:</b>	PRACTICAL COURSE IN CHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	1.	1.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	1 <sup>st</sup>

Vrsta predmeta / Course Type:

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

BK104

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
/	30	45 LV	/	/	75	5

Nosilec predmeta / Lecturer:

doc. dr. Romana Cerc Korošec /  
Dr. Romana Cerc Korošec, Assistant Professor

Jeziki / Languages:

Predavanja / Lectures: slovenski / Slovenian

Vaje / Tutorial: slovenski / Slovenian

Pogoji za vključitev v delo oz. za opravljanje  
študijskih obveznosti:Študent oz. kandidat mora imeti predmet  
opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Študentje se najprej seznanijo z varnostnimi pravili dela v laboratoriju. Nato samostojno izvedejo 11 praktičnih vaj, ob katerih se naučijo osnovne veščine praktičnega laboratorijskega dela kot so npr: izparevanje, filtracija, sušenje, sinteza preprostih spojin, merjenje prostornine plinov in tekočin, priprava raztopin, merjenje gostote tekočin, titracija, itd ter na podlagi opazovanj pri kvalitativnih poskusih znajo povezati praktične izkušnje z osnovnimi kemijskimi zakonitostmi.

**Vsebine praktičnih vaj:** Formule kemijskih spojin; Kemijska reakcija, presežek reaktantov, izkoristek kemijske reakcije; Plini, kemijske

Content (Syllabus outline):

Safety rules for work in a laboratory; Practical work in a laboratory: by independently performing 11 laboratory practiced students acquire practical laboratory procedures and operations, e.g. evaporation, filtration, drying, synthesis of simple compounds, measuring the volume of gases and liquids, preparation of solutions, measuring the density of liquids, titration, etc. They are able to link practical experience, obtained during observation of qualitative experiments, with basic chemical principles.

**Practical exercises - contents:** Formulae of chemical compounds; Chemical reaction,

enačbe; Priprava raztopin iz trdnih topljencev, Reakcije med raztopinami kislin in baz; Destilacija in retitracija; Kemijsko ravnotežje; Ravnotežna konstanta kemijske reakcije; Topnost; Ionske reakcije, topnostni produkt; Protolitska ravnotežja v vodnih raztopinah; Puferske raztopine; Redoks reakcije; Koordinacijske spojine  
Ob posameznih vajah se vsebina osnovnega kemijskega računanja smiselno nadgrajuje: osnovni kemijski zakoni, množina snovi, molska masa snovi, formule spojin, računanje povezano s kemijsko reakcijo, parcialni tlaki, množinski deleži (molski ulomki), prostorninski deleži, povprečne molske mase, koncentracije raztopin; računanje pri titraciji, topnosti snovi, kemijskem ravnotežju, protolitskih ravnotežjih in redoks reakcijah.

limiting reactant, yield of chemical reaction; Gases, Chemical equations; Preparation of solutions, starting from solid solutes; Reactions between acids and bases; Distillation and retitration; Chemical equilibrium; Equilibrium constant, Solubility; Ionic reactions, solubility product; Ionization equilibria in aqueous solutions; Buffer solutions; Redox reactions; Coordination compounds.  
The content of basic chemical calculations is built upon: basic chemical principles, mole concept, molar mass, chemical formula, calculations connected with chemical reaction, partial pressure, mole fraction, volume fraction, average molar mass, solution concentration and titration calculation, solubility of substances, chemical equilibrium, ionization and redox reactions.

#### Temeljna literatura in viri / Readings:

- N. Bukovec, R. Cerc Korošec, E. Tratar Pirc: Praktikum iz splošne in anorganske kemije, Založba UL FKKT, Ljubljana, 2010 (druga dopolnjena izdaja), 113 str.
- N. Bukovec, R. Cerc Korošec, A. Golobič, N. Lah in E. Tratar Pirc: Osnove kemijskega računanja, zbirka nalog, Založba UL FKKT, Ljubljana, 2011, 191 str.

#### Cilji in kompetence:

**Cilji:** Spoznati principe varnega dela v laboratoriju, različne metode dela, oziroma pristope pri praktičnem delu v laboratoriju. z uporabo osnovnega kemijskega računanja, oziroma osnovnih kemijskih zakonitosti.  
**Kompetence:** Zna varno ravnati z kemikalijami, pozna varnostne zahteve in ukrepe v laboratoriju; spozna in obvlada različne osnovne metode laboratorijskega dela; zna samostojno izvajati posamezne eksperimente; je sposoben kritično ovrednotiti določene meritve in/ ali dobljene rezultate pri osnovnem kemijskem računanju.

#### Objectives and Competences:

**Objectives:** Knowledge of the basic principles of safety work. Knowledge of different methods of work in laboratory. Knowledge of basic chemical calculations in solving practical problems.  
**Competences:** Ability to work safely and autonomously in laboratory. Ability to use different methods of basic laboratory work. Ability to apply knowledge of basic chemical calculations in solving practical problems in laboratory. Ability to critically evaluate measurements and the results obtained in chemical calculations.

#### Predvideni študijski rezultati:

Znanje in razumevanje  
Študent usvoji osnovne principe varnega dela v kemijskem laboratoriju ter zna osnove kemijskega računanja uporabiti pri

#### Intended Learning Outcomes:

Knowledge and Comprehension  
Knowledge of the basic principles of safety at work and different methods of work in a



kvantitativnem vrednotenju določenih eksperimentov.	laboratory. Application of basic chemical calculations in solving practical problems.
<u>Uporaba</u> Pridobljene znanje oziroma spretnosti pri laboratorijskem delu in znanje osnovnega kemijskega računanja so temelji predmetom pri nadaljnjem študiju.	<u>Application</u> Knowledge and skills gained through laboratory practice, and the knowledge of basic chemical provide a foundation for further studies.
<u>Refleksija</u> Študent je sposoben kritično ovrednotiti izvedene meritve in oceniti dobljene rezultate pri tem pa razvija sposobnosti za samostojno laboratorijsko delo.	<u>Analysis</u> The student can critically evaluate measurements and results while developing the skills required for independent laboratory work.
<u>Prenosljive spretnosti</u> Študent pridobi praktične laboratorijske spretnosti in izkušnje, znanje osnovnega kemijskega računanja ter, zna uporabljati strokovni jezik (pisno in ustno)	<u>Skill-transference Ability</u> The student gains practical laboratory skills and experience, a knowledge of chemical calculation, and can use correct terminology in both written and spoken form.

**Metode poučevanja in učenja:**

Laboratorijske vaje, zasnovane na individualnem delu študenta ter delno s timskim delom. Pisanje laboratorijskega dnevnika. Sodelovalno učenje/ poučevanje ter problemsko delo na seminarjih. Sprotno preverjanje znanja s pisnimi preglednimi vajami.

**Learning and Teaching Methods:**

Laboratory practice based on the students' individual work and group work. Laboratory journal. Collaborative learning/teaching and problem solving at seminars. Short written evaluation of the students' knowledge.

**Načini ocenjevanja:**

Opravljene vaje so pogoj za pristop k izpitu.  
Pisni izpit (nadomestita ga lahko dva pozitivno ocenjena kolokvija).  
Ocene: pozitivno 6-10; negativno 1-5

Delež (v %) /

Weight (in %) **Assessment:**

Completed laboratory practice is prerequisite for the examination.  
Written examination (can be replaced by two positively evaluated midterm exams)  
Grades: 6-10 pass, 1-5 fail.

**Reference nosilca / Lecturer's references:**

- N. Bukovec, **R. Cerc Korošec**, E. Tratar Pirc: Praktikum iz splošne in anorganske kemije, Založba UL FKKT, Ljubljana, 2010 (druga dopolnjena izdaja), 113 str.  
- N. Bukovec, **R. Cerc Korošec**, A. Golobič, N. Lah in E. Tratar Pirc: Osnove kemijskega računanja, zbirka nalog, Založba UL FKKT, Ljubljana, 2011, 191 str.  
- B. Genorio, K. Pirnat, **R. Cerc Korošec**, R. Dominko, M. Gaberšček: Electroactive organic molecules immobilized onto solid nanoparticles as a cathode material for lithium-ion batteries. – *Angewandte Chemie*, 2010, 49, 7222-7224.

UL EFKT

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

**Predmet:** MATEMATIKA I  
**Course Title:** MATHEMATICS I

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	1.	1.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	1 <sup>st</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:**

BK101

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	/	30 SV	/	/	75	5

**Nosilec predmeta / Lecturer:**

prof. dr. Petar Pavešič / Dr. Petar Pavešič, Full Professor

**Jeziki / Languages:**

**Predavanja / Lectures:** slovenski / Slovenian

**Vaje / Tutorial:** slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

**Števila:** približno računanje, realna števila.

**Linearna algebra:** vektorji v prostoru, skalarni in vektorski produkt. Ravnine in premice v prostoru. Matrike, determinante, lastne vrednosti. Gaussova metoda za reševanje sistemov linearnih enačb.

**Funkcije:** odvisnost od ene in od več spremenljivk, lastnosti, podajanje, graf. Pregled elementarnih funkcij.

**Limite:** zaporedja, vrste, diskretni dinamični sistemi, limite funkcij, zveznost, lastnosti zveznih funkcij.

**Content (Syllabus outline):**

Real numbers. Vectors, scalar and vector product, geometry of Euclidean space, determinants, eigenvalues, solving linear equations. Functions of one and several variables, basic properties, graphs, elementary functions. Limits of sequences and functions, properties of continuous functions. Ordinary and partial derivatives, gradient, extrema of functions, constrained extrema, the least squares method.

**Odvod:** navadni in parcialni odvodi, gradient.  
Uporaba: računanje limit, risanje grafov, ekstremi funkcij ene in več spremenljivk, vezani ekstremi, izravnavanje numeričnih podatkov.



**Temeljna literatura in viri / Readings:**

**DODATNA LITERATURA:**

1. DOBOVIŠEK, M. Matematika za farmacevte, DMFA-založništvo, Ljubljana 2007.
2. MIZORI-OBLAK, P. Matematika za študente tehnike in naravoslovja. Ljubljana : Fakulteta za strojništvo, 2001.
3. JAMNIK, R. Matematika. Ljubljana : Društvo matematikov, fizikov in astronomov Slovenije, 1994.
4. CALTER, P.A., CALTER, M.A. Technical mathematics with calculus. New York etc. : J. Wiley, 2000.

**Cilji in kompetence:**

Študent spozna osnovne pojme linearne algebre in diferencialnega računa. Predmet je temeljni in predstavlja osnovo za matematiko, fiziko, kemijo, in druge strokovne predmete. Študent razvija sposobnost analitičnega premišljevanja in povezovanja, nauči se formulirati probleme v matematičnem jeziku in razvijati matematične modele za probleme iz stroke.

**Objectives and Competences:**

Understanding the basic principles and computational techniques of linear algebra and differential calculus.  
Students learn how to model and solve complex problems from physics and chemistry using mathematical concepts and methods.

**Predvideni študijski rezultati:**

Znanje in razumevanje

Vektorski in matrični račun.  
Lastnosti elementarnih funkcij, analitično in numerično odvajanje, uporaba računalniških orodij za bolj zapletene primere, določanje ekstremov, regresija; primeri uporabe v stroki. Numerično računanje, linearnost, geometrija prostora, limite in zveznost, odvod.

Uporaba

Matematika 1 je osnova za Matematiko 2 in za ostale naravoslovne in strokovne predmete.

Refleksija

Razumevanje osnovnih pojmov linearne algebre, diferencialnega računa in numerične matematike; razumevanje osnovnih prijemov matematičnega modeliranja problemov v drugih vedah.

Prenosljive spretnosti

**Intended Learning Outcomes:**

Knowledge and Comprehension

Vectors and matrices. Elementary functions, analytical and numerical differentiation, extrema, application to (bio)chemical problems. Numerical methods, linearity, space geometry, limits and continuity, derivatives.

Application

Mathematics 1 is a prerequisite for Mathematics 2 and several other courses.

Analysis

Understanding of basic concepts of linear algebra and numerical mathematics, understanding of basic methods for mathematical modelling in practice.

Skill-transference Ability

Postavitev problema, formulacija problema v matematičnem jeziku, izbira ustrezne metode za reševanje, analiza doseženega rezultata. Uporaba računalnika ter domače in tuje literature.

Mathematical formulation of a problem, ability to choose appropriate solution method and to analyse the result. Use of computers and of scientific literature.

**Metode poučevanja in učenja:**

Predavanja, vaje, domače naloge, konzultacije.

**Learning and Teaching Methods:**

Lectures, tutorials, homework, consultations.

**Načini ocenjevanja:**

(a) izpit iz vaj, izpit iz teorije  
(b) 1-5 (negativno), 6-10 (pozitivno)

Delež (v %) /

Weight (in %)

**Assessment:**

(a) written and oral exam  
(b) 1-5 (failed), 6-10 (passed)

**Reference nosilca / Lecturer's references:**

- **PAVEŠIĆ, Petar**, PICCININI, Renzo A.. Fibrations and their classification, (Research and exposition in mathematics, vol. 33). Lemgo: Heldermann, cop. 2013. XIII, 158 str., ilustr. ISBN 978-3-88538-233-1. [COBISS.SI-ID 16616793]
- **PAVEŠIĆ, Petar**. Reducibility of self-homotopy equivalences. Proceedings. Section A, Mathematics, ISSN 0308-2105, 2007, vol. 137, iss 2, str. 389-413. [COBISS.SI-ID 14371929]
- FRANETIČ, Damir, **PAVEŠIĆ, Petar**. H-spaces, semiperfect rings and self-homotopy equivalences. Proceedings. Section A, Mathematics, ISSN 0308-2105, 2011, vol. 141, iss. 6, str. 1263-1277. [COBISS.SI-ID 16077401]
- **PAVEŠIĆ, Petar**. Induced liftings, exchange rings and semi-perfect algebras. Journal of Pure and Applied Algebra, ISSN 0022-4049. [Print ed.], 2010, vol. 214, iss 11, str. 1901-1906. [COBISS.SI-ID 15627865]
- **PAVEŠIĆ, Petar**. Kaj naj študente naučimo o funkcijah?. Obzornik za matematiko in fiziko, ISSN 0473-7466, 2007, letn. 54, št. 5, str. 166-172. [COBISS.SI-ID 14461273]

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	MATEMATIKA II
<b>Course Title:</b>	MATHEMATICS II

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	1.	2.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	2 <sup>nd</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK106

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	/	30 SV	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Petar Pavešič / Dr. Petar Pavešič, Full Professor

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

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**  
 Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**  
 The course has to be assigned to the student.

**Vsebina:**

**Integral:** konstrukcija integrala, integrabilnost zveznih funkcij; analitično in numerično integriranje, računanje nedoločenih integralov; dolžine, ploščine, prostornine, uporaba v fiziki; funkcije definirane z integralom, večkratni integrali, krivuljni in ploskovni integrali; Taylorjeva in Fourierova vrsta.

**Diferencialne enačbe:** rešitev diferencialne enačbe, geometrični in fizikalni pomen, ločljive spremenljivke, LDE 1. reda, rešljivost DE 1. reda, LDE 2. reda, s konstantnimi koeficienti, sistemi LDE, nihanja, električni krog; primeri PDE (nihanje strune, prevajanje toplote).

**Content (Syllabus outline):**

Integral calculus, analytical and numerical methods of computation, applications (areas, volumes, curve length), multiple integrals, line and surface integrals. Taylor and Fourier series.

Differential equations, basic examples, linear differential equations, second order differential equations with constant coefficients, applications (oscillations, electrical circuits, predator-prey models), examples of partial differential equations.

Probability and conditional probability, random variables, distributions, mean and variance, random vectors, covariance, central limit theorem. Data representation, population and

**Verjetnost in statistika:** definicija verjetnosti, odvisnost dogodkov, slučajne spremenljivke, porazdelitvene funkcije in gostote; povprečna vrednost in razpršenost; skupne porazdelitve, korelacija; zakoni velikih števil. Osnovni problem statistike, predstavljanje podatkov, populacijski in vzorčni parametri, intervali zaupanja, statistični testi.

sample parameters, confidence intervals, hypotheses testing.

**Temeljna literatura in viri / Readings:**

**DODATNA LITERATURA:**

- DOBOVIŠEK, M. Matematika za farmacevte, DMFA-založništvo, Ljubljana 2007.
- MIZORI-OBLAK, P. Matematika za študente tehnike in naravoslovja. Ljubljana : Fakulteta za strojništvo, 2001.
- JAMNIK, R. Verjetnostni račun. Ljubljana : Društvo matematikov, fizikov in astronomov Slovenije, 1994.
- KREYSZIG, E.. Advanced engineering mathematics. J. Wiley and sons, New York, 2006.

**Cilji in kompetence:**

Študent spozna osnovne pojme integralnega računa, diferencialnih enačb ter verjetnosti in statistike. Predmet je temeljni in predstavlja osnovo za fiziko, kemijo, in druge strokovne predmete. Študent razvija sposobnost analitičnega premišljevanja in povezovanja, nauči se formulirati probleme v matematičnem jeziku in razvijati matematične modele za probleme iz stroke.

**Objectives and Competences:**

Learning outcomes: Understanding of the basic principles and computational techniques of integral calculus, differential equations and statistics.

Competences: Students learn how to model and solve complex problems from physics and chemistry using mathematical concepts and methods.

**Predvideni študijski rezultati:**

Znanje in razumevanje

Integralni račun in njegova uporaba, razvoj funkcije v vrsto. Diferencialne enačbe, matematično modeliranje problemov iz stroke, uporaba računalniških orodij za bolj zapletene primere; določanje verjetnosti dogodkov pri različnih predpostavkah, izvedba in interpretacija statističnih testov.

Integral, rešitev diferencialne enačbe, odvisnost slučajnih dogodkov, zakoni velikih števil, statistične ocene

Uporaba

Matematika 2 je temeljni predmet in osnova za ostale naravoslovne in strokovne predmete.

Refleksija

**Intended Learning Outcomes:**

Knowledge and Comprehension

Integral calculus and its application, series expansion, differential equations, mathematical modelling, probability, computation and interpretation of statistical tests. Integrals, solution of a differential equation, conditional probability, laws of big numbers, statistical estimates.

Application

Mathematics 2 is a prerequisite for several other courses.

Analysis

Razumevanje osnovnih pojmov integralnega računa, diferencialnih enačb, verjetnosti in statistike. Razumevanje osnovnih prijemov matematičnega modeliranja problemov.	Understanding of basic concepts of linear algebra and numerical mathematics, understanding of basic methods for mathematical modelling in practice.
<u>Prenosljive spretnosti</u> Postavitve problema, formulacija problema v matematičnem jeziku, izbira ustrezne metode za reševanje, analiza doseženega rezultata. Uporaba računalnika ter domače in tuje literature.	<u>Skill-transference Ability</u> Mathematical formulation of a problem, ability to choose appropriate solution method and to analyse the result. Use of computers and of scientific literature.

**Metode poučevanja in učenja:**

Predavanja, vaje, domače naloge, konzultacije.

**Learning and Teaching Methods:**

Lectures, tutorials, homework, consultations.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
(a) izpit iz vaj, izpit iz teorije (b) 1-5 (negativno), 6-10 (pozitivno)		(a) written and oral exam (b) 1-5 (failed), 6-10 (passed)

**Reference nosilca / Lecturer's references:**

- **PAVEŠIĆ, Petar**, PICCININI, Renzo A.. Fibrations and their classification, (Research and exposition in mathematics, vol. 33). Lemgo: Heldermann, cop. 2013. XIII, 158 str., ilustr. ISBN 978-3-88538-233-1. [COBISS.SI-ID 16616793]

- **PAVEŠIĆ, Petar**. Reducibility of self-homotopy equivalences. Proceedings. Section A, Mathematics, ISSN 0308-2105, 2007, vol. 137, iss 2, str. 389-413. [COBISS.SI-ID 14371929]

- FRANETIČ, Damir, **PAVEŠIĆ, Petar**. H-spaces, semiperfect rings and self-homotopy equivalences. Proceedings. Section A, Mathematics, ISSN 0308-2105, 2011, vol. 141, iss. 6, str. 1263-1277. [COBISS.SI-ID 16077401]

- **PAVEŠIĆ, Petar**. Induced liftings, exchange rings and semi-perfect algebras. Journal of Pure and Applied Algebra, ISSN 0022-4049. [Print ed.], 2010, vol. 214, iss 11, str. 1901-1906. [COBISS.SI-ID 15627865]

- **PAVEŠIĆ, Petar**. Kaj naj študente naučimo o funkcijah?. Obzornik za matematiko in fiziko, ISSN 0473-7466, 2007, letn. 54, št. 5, str. 166-172. [COBISS.SI-ID 14461273]



**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

**Predmet:** MIKROBIOLOGIJA  
**Course Title:** MICROBIOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	2.	4.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	4 <sup>th</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:**

BK120

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	/	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:**

prof. dr. Nina Gunde-Cimerman /  
Dr. Nina Gunde-Cimerman, Full Professor

**Jeziki / Languages:**

**Predavanja / Lectures:** slovenski / Slovenian

**Vaje / Tutorial:** slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

Pri predmetu se bodo seznanili s kratko zgodovino mikrobiologije, s poimenovanjem in uvrščanjem mikroorganizmov, s prikazom biotske raznovrstnosti mikroorganizmov, z njihovim biotehnoškimi pomenom in potencialom kot tudi s patogenimi interakcijami mikroorganizmov. Proučevanje mikroorganizmov bo potekalo s pomočjo različnih mikroskopskih, biokemijskih in molekularno-bioloških tehnik.

Predmet je organiziran v več sklopih:  
- prokariotska celica: velikost, oblika in organizacija bakterijske celice, strukture na zunanji strani celične stene, celična stena,

**Content (Syllabus outline):**

Students will be acquainted with short history of microbiology, nomenclature and classification of microorganisms, presentation of microbial biodiversity, biotechnological value and potential of microorganisms, as well as microbial pathogenic interactions. Study of microorganisms will be performed using different microscopic, biochemical and molecular techniques. The course covers several topics:

- prokaryotic cell: size, shape and organization, cell surface structures, cell wall, specific cell inclusions, and differences between the functional anatomy of prokaryotic and eukaryotic cell,

specifične znotrajcelične strukture, razlike med funkcionalno anatomijo prokariotske in evkariotske celice,

- virusi: velikost, oblika, struktura, razmnoževanje, predstavitev izbranih skupin bakteriofagov, različnih živalskih in rastlinskih virusov,

- mikrobna rast: rastne zahteve (fizikalne, kemijske), gojišča (kemijsko definirana, kompleksna, diferencialna), metode gojenja, rast mikroorganizmov, vpliv fizikalnih in kemijskih dejavnikov na rast,

- mikrobna ekologija: vloga mikroorganizmov v naravi, ekstremofili, negojljivi mikroorganizmi, osnovne ekološke metode v mikrobiologiji,

- osnove klasifikacije mikroorganizmov in mikrobne taksonomije, ki temeljijo na morfologiji, fiziologiji in molekularnih značilnostih.

- viruses; size, shape, structure, viral replication, viral diversity (overview of bacterial, animal and plant viruses)

- microbial growth; physicochemical growth requirements, media (chemically defined, complex, differential), methods of cultivation, growth of microorganisms, influence of physical and chemical parameters on the microbial growth, genetically stable preservation of microorganisms,

- microbial ecology: role of microorganisms in nature, extremophiles, uncultivable microorganisms, basic ecological methods in microbiology, molecular biological and biochemical methods for the detection of microorganisms in the environment,

- classification of microorganisms: phylogenetic relations, taxonomical hierarchy, criteria for the classification and identification of microorganisms based on morphology, physiology, and molecular characteristics, presentation of the main groups of archaea, bacteria, fungi and viruses.

### Temeljna literatura in viri / Readings:

#### Temeljna literatura:

- Madigan M.T., Martinko J.M., Stahl D.A., Clark D.P., Brock Biology of Microorganisms. 1105 pages, Prentice Hall, 13th edition (2012), ISBN: 978-0-321-73551-5

#### Dodatna literatura:

- Tortora G.J., Funke B.R., Case C.L. Microbiology: An introduction. 944 pages, Benjamin Cummings, 8th edition (2003), ISBN: 0805376143.

- Bauman R. W., Machunis-Masuoka E., Tizar I. R., Bauman R., Bauman Microbiology,. 896 pages, Benjamin-Cummings Publishing Company; Bk&CD-Rom edition (2003), ISBN: 0805376526.

#### Spletne strani:

<http://www.personal.psu.edu/faculty/j/e/jel5/micro/>

<http://www.microbeworld.org/>

<http://www.textbookofbacteriology.net/>

<http://www.microbiological-garden.net>.

<http://www.mycolog.com/fifthtoc.html>

Dodatna /seminarska ipd. literatura bo dosegljiva preko nosilke predmeta.

### Cilji in kompetence:

Mikrobiologija je eden od naravoslovnih predmetov, pri katerem se študenti spoznajo z osnovami celične strukture prokariotske celice v primerjavi z evkariotsko; s parametri in kontrolo mikrobne rasti; z metabolnimi

### Objectives and Competences:

Students will be acquainted with the basics of microbiology; prokaryotic cell structure in comparison with the eukaryotic cell; parameters and control of microbial growth; metabolic characteristics of different groups of

značilnostmi posameznih skupin mikroorganizmov (bakterij, arheobakterij, gliv in virusov); z osnovami mikrobne ekologije, evolucije, sistematike in taksonomije mikroorganizmov.

microorganisms (bacteria, archaea, fungi, viruses). Students will also become familiar with the basics of microbial ecology, evolution, systematics and taxonomy of microorganisms.

**Predvideni študijski rezultati:**

Znanje in razumevanje

Znanje in razumevanje osnovnih mikrobioloških pojmov in zakonitosti, mikrobnih struktur in procesov.

Uporaba

Razlikovanje različnih tipov mikrobnih celic in gojenje mikroorganizmov v laboratoriju, poznavanje metod dela v mikrobiologiji, zmožnost razlage principov oz. zakonitosti na posameznih primerih in iskanje povezav s prakso.

Refleksija

Študent pridobi občutek za mikrobiološke dimenzije in posebnosti živega mikrobne sveta.

Prenosljive spretnosti

Teoretična in praktična podlaga potrebna za aseptično delo v mikrobiološkem laboratoriju, pri gojenju mikroorganizmov, uporaba domače in tuje literature ter drugih virov pri zbiranju in interpretiranju podatkov, poznavanje strokovnih izrazov, poročanje (ustno in pisno).

**Intended Learning Outcomes:**

Knowledge and Comprehension

Knowledge and understanding of basic microbiological terms, laws, microbial structures and processes.

Application

The ability to differentiate between various microbial cells and the knowledge of the microbial cultivation in the laboratory, proficiency in microbiological techniques/methods, the ability to explain principles or laws in individual cases and to apply this knowledge in real-life context. Acquisition of laboratory skills.

Analysis

To develop an understanding of the ubiquity, importance and peculiarity of microbes in the environment.

Skill-transference Ability

Theoretical and practical background needed for sterile technique, culture techniques, growth assessment, microscopy. Search and critical assessment of research literature and other sources; team working; collection and interpretation of the data; correct usage of the expert terminology; written and oral communication skills.

**Metode poučevanja in učenja:**

Predavanja in laboratorijske vaje. Študent s pridobljenim praktičnim in teoretičnim znanjem iz vaj, predavanj in ustreznih učbenikov ter po uspešno opravljenem izpitu razume osnovne mikrobiološke zakonitosti.

**Learning and Teaching Methods:**

Lectures, group seminar work and laboratory exercises. With the acquired theoretical and practical knowledge based on the lectures, laboratory exercises and appropriate textbooks after the exam was successfully passed, the student will be able to understand the basic microbiological principles.

Delež (v %) /

Weight (in %) **Assessment:**

**Načini ocenjevanja:**

Opravljenе vaje so pogoj za pristop k izpitu.

Successful performance of practical courses is the precondition for the theoretical exam.

Pisni izpit. Ocene: 6-10 (pozitivno), 1-5 (negativno).		Written exam. Marks: 6-10 (positive), 1-5 (negative).
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**Reference nosilca / Lecturer's references:**

- **GUNDE-CIMERMAN, Nina**, OREN Aharon., PLEMENITAŠ Ana (Editors): Adaptation to Life at High Salt Concentrations in Archaea, Bacteria, and Eukarya (Cellular Origin, Life in Extreme Habitats and Astrobiology) (Hardcover), 577 pages, Publisher: Springer; 1 edition (November 14, 2005) ISBN: 1402036329
- GOSTINČAR, Cene, GRUBE, Martin, DE HOOG, Sybren, ZALAR, Polona, **GUNDE-CIMERMAN, Nina**. Extremotolerance in fungi : evolution on the edge. FEMS microbiology, ecology, 2010, vol. 71, str. 2-11. [COBISS.SI-ID 2166607]
- LENASSI, Metka, GOSTINČAR, Cene, JACKMAN, Shaun, TURK, Martina, SADOWSKI, Ivan, NISLOW, Corey, **GUNDE-CIMERMAN, Nina**, PLEMENITAŠ, Ana, et al. Whole genome duplication and enrichment of metal cation transporters revealed by De Novo genome sequencing of extremely halotolerant black yeast *Hortaea werneckii*. PloS one, ISSN 1932-6203, Aug. 2013, vol. 8, iss. 8., [COBISS.SI-ID 30761177],

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

**Predmet:** MOLEKULARNA BIOLOGIJA  
**Course Title:** MOLECULAR BIOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	2.	4.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	4 <sup>th</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:**

BK119

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	20	10 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** izr. prof. dr. Marko Dolinar / Dr. Marko Dolinar, Associate Professor

**Jeziki / Languages:**

**Predavanja / Lectures:** slovenski / Slovenian

**Vaje / Tutorial:** slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

1. Mehanizem podvojevanja DNA
2. Mutacije in popraviljanje okvar na DNA
3. Homologna rekombinacija
4. Transkripcija in posttranskripcijski procesi
5. Genetski kod in tRNA
6. Biosinteza proteinov
7. Struktura kromosomov in organizacija genoma
8. Kontrola izražanja pri prokariontih in evkariontih
9. Usmerjanje proteinov in posttranslacijske modifikacije
10. Razgradnja proteinov
11. Dinamika proteinske strukture

**Content (Syllabus outline):**

1. Mechanism of DNA replication
2. Mutations and DNA damage repair
3. Homologous recombination
4. Transcription and posttranscriptional processes
5. Genetic code and tRNA
6. Protein biosynthesis
7. Chromosomal structure and genome organization
8. Regulation of expression in prokaryotes and eukaryotes
9. Protein targeting and posttranslational modifications
10. Protein breakdown.
11. Dynamics of protein structure

12. Primeri povezave med strukturo in delovanjem proteina  
13. Virusi

Laboratorijske vaje:

1. Plazmidi in transformacija bakterijskih celic
2. Laktozni operon in alfa komplementacija
3. Utišanje genov s protismerno RNA

12. Examples of structure – function relationship  
13. Viruses

Laboratory practicals:

1. Plasmids and transformation of bacterial cells
2. Lactose operon and alpha complementation.
3. Gene silencing with antisense RNA.

### Temeljna literatura in viri / Readings:

- B.E. Tropp: Principles of Molecular Biology. Jones & Bartlett Learning, 2014

pomožni vir:

- J.E. Krebs, E.S. Goldstein, S.T. Kilpatrick: Lewin's Essential Genes, 3rd edition, Jones & Bartlett Learning, 2013

### Cilji in kompetence:

Študenti bodo razumeli mehanizme prenosa genetske informacije in zorenja proteinov. Spoznali bodo raznolikost načinov delovanja molekul RNA in vedeli, kako je organiziran kromatin. S primeri bodo znali razložiti, kako sta povezani zgradba in funkcija proteinov.

### Objectives and Competences:

Students will understand the transmission mechanisms of genetic information and posttranslational processes. They will know the versatility of RNA molecules and the organisation of the chromatin. Based on examples, students will be able to demonstrate structure – function relationship in proteins.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Znanje:

Delovanje polimeraz in pomožnih proteinov pri ohranjanju in prenosu genetske informacije. Adapterska hipoteza in način povezovanja tRNA in aminokislin. Zgradba ribosomov in potek sinteze beljakovin. Zgradba genoma in načini uravnavanja izražanja genov. Lastnosti proteinov, ki določajo njihovo mesto v celici ali zunaj nje in mehanizmi usmerjanja proteinov. Mehanizmi znotrajcelične razgradnje beljakovin in njihova razgradnja v prebavilih. Zgradba virusov.

Razumevanje:

Različne vrste zapisa informacij v bioloških sistemih. Strukturna fleksibilnost nukleinskih kislin in pomen za uravnavanje prenosa genetske informacije. Mehanizmi zagotavljanja natančnosti prenosa zapisov z

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Knowledge:

Mechanisms of polymerases and accessory proteins in maintaining genetic information. Adapter hypothesis and mode of amino acid binding to tRNA. Ribosome structure and protein synthesis process. Genome organization and modes of regulating gene expression. Properties of proteins that determine their cellular localization and mechanisms of protein sorting. Mechanisms of intracellular protein degradation and protein digestion in the intestine. Viral structures.

Comprehension:

Various information formats in biological systems. Structural flexibility of nucleic acids and its role for regulation of genetic information transfer. Mechanisms determining a faithful flow of information from DNA to RNA

<p>DNA na RNA in proteine. Pomen zorenja proteinov za njihovo delovanje in usmerjanje v celici. Pomen razgrajevanja proteinov za delovanje celice in za pridobivanje aminokislin za biosintezne reakcije. Interakcije med nukleinskimi kislinami in proteini v celicah in virusih.</p>	<p>and proteins. Importance of protein maturation for their activity and cellular sorting. Importance of protein degradation for cell functions and gaining amino acids for biosynthetic reactions. Interactions between nucleic acids and proteins in cells and viruses.</p>
<p><u>Uporaba</u> Sposobnost razlikovanja stopenj kompleksnosti organizmov (prokarioti, evkarionti) na osnovi poznavanja biokemijskih procesov. Delo z bakterijami in virusi: varnostni in praktični vidiki.</p>	<p><u>Application</u> Differentiation between complexity levels of organisms (prokaryotes, eukaryotes) based on knowledge of biochemical processes. Practical considerations for work with bacteria and viruses.</p>
<p><u>Refleksija</u> Do katere mere so prokarioti lahko modelni organizmi za biokemijske procese? Molekule prenašajo informacije v zaporedjih dušikovih baz na podoben način kot zaporedja bitov v računalništvu. Zaporedja nukleotidov so digitaliziran zapis življenja. Za evolucijo je potrebno ohranjanje, pa tudi spreminjanje genetske informacije. Protein ni funkcionalen brez nativne tridimenzionalne zgradbe. Okužba z virusi ni samo stvar izpostavljenosti virusom, pač pa je odvisno od površinskih struktur virusnega delca in celic, ki so za okužbo dovzetne.</p>	<p><u>Analysis</u> In how far prokaryotes can serve as model organisms for biochemical processes? Molecules transfer information as sequences of nitrogen bases similarly to byte sequences in computers. Nucleotide sequences are digitalized life code. Evolution requires both maintaining and modifying genetic information. Proteins are not functional before they reach their native three dimensional structures. Viral infection not only deals with exposure, but also on surface structures of the viral particles and susceptible cells.</p>
<p><u>Prenosljive spretnosti</u> Pristopi k reševanju problemov v biokemiji (ob primerih klasičnih eksperimentov v molekularni biologiji). Interpretacija laboratorijskih testov, ki temeljijo na pretvorbi kromogenih substratov; kvantitativnost in kvalitativnost. Delo z DNA in bakterijami. Pripravljanje in predstavljanje strokovnih vsebin, napisanih v angleškem jeziku – uporaba terminološkega slovarja.</p>	<p><u>Skill-transference Ability</u> Approaches to solving problems in biochemistry (gained from classical experiments in molecular biology). Interpretation of laboratory tests based on conversion of chromogenic substrates. Quantitative vs. qualitative tests. Working with DNA and bacteria. Preparing and presenting professional content based on English sources – use of the terminology dictionary</p>

**Metode poučevanja in učenja:**

Predavanja, laboratorijske vaje, individualno in skupinsko delo pri pripravi seminarjev.

**Learning and Teaching Methods:**

Lectures, laboratory practical courses, individual and group work for preparing seminars.

**Načini ocenjevanja:**

Delež (v %) /

Weight (in %) **Assessment:**

Pisni izpit in seminarska naloga. Opravljene vaje so pogoj za pristop k izpitu.		Written examination, seminary presentation. Access to examination only with completed laboratory practicals.
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**Reference nosilca / Lecturer's references:**

- LAH, Jurij, DROBNAK, Igor, **DOLINAR, Marko**, VESNAVER, Gorazd. What drives the binding of minor groove-directed ligands to DNA hairpins?. Nucleic acids research, ISSN 0305-1048, 2008, vol. 36, no. 3, str. 897-904. [COBISS.SI-ID 29269765]

- VASILJEVA, Olga, **DOLINAR, Marko**, TURK, Vito, TURK, Boris. Recombinant human cathepsin H lacking the mini chain is an endopeptidase. Biochemistry, ISSN 0006-2960. [Print ed.], 2003, vol. 42, str. 13522-13528. [COBISS.SI-ID 17899303]

- **DOLINAR, Marko**, MEHLE, Andreja, MOZETIČ-FRANCKY, Bojana, SCHWEIGER, Ana, TURK, Vito. Endoproteolytic pattern observed during refolding of a human exopeptidase proenzyme, procathepsin H, produced in Escherichia coli. Food technology and biotechnology, ISSN 1330-9862, 2000, vol. 38, str. 5-9. [COBISS.SI-ID 14910247]



### UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** MOLEKULSKO KLONIRANJE  
**Course Title:** MOLECULAR CLONING

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	5.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	5 <sup>th</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:**

BK131

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	5	40 LV	/	/	75	5

**Nosilec predmeta / Lecturer:**

izr. prof. dr. Marko Dolinar /  
Dr. Marko Dolinar, Associate Professor

**Jeziki / Languages:**

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

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

1. Raziskovanje DNA in molekularna biotehnologija: zgodovina in prihodnost.
2. Laboratorijski organizmi v DNA-tehnologiji.
3. Encimi pri delu z DNA.
4. Elektroforezne metode.
5. Vektorske molekule. Reporterski geni.
6. Sinteza DNA *in vitro*. Sinteza cDNA. Priprava DNA-knjižnic. Transformiranje celic.
7. PCR in izvedene tehnike.
8. Hibridizacija, sode, načini označevanja DNA. Presejanje knjižnic.

**Content (Syllabus outline):**

1. Exploring DNA and molecular biotechnology – past and future.
2. Laboratory organisms in DNA technology.
3. DNA-modifying enzymes.
4. Electrophoretic methods.
5. Vectors and reporters.
6. DNA synthesis *in vitro*. cDNA synthesis. Preparation of DNA libraries. Cell transformation.
7. PCR and deduced techniques.
8. Hybridization, probes and approaches for DNA labelling. Screening of DNA libraries.
9. DNA sequencing.
10. Expression systems. *In vitro* transcription / translation.

9. Določanje nukleotidnega zaporedja DNA.
10. Ekspresijski sistemi.  
Transkripcija/translacija *in vitro*.
11. Izražanje v prokariontih: vektorji, fuzije, optimizacija proizvodnje. Usmerjena lokalizacija, topnost, stabilnost, renaturacija.
12. Izražanje v kvasovkah, insektnih in sesalskih celicah.
13. Laboratorijska varnost pri delu z GSO

**Praktični del:**

1. Načrtovanje začetnih oligonukleotidov, konstruiranje rekombinantnih molekul (računalniška vaja).
2. Preparativno rezanje plazmidne DNA z restriktazami.
3. Izolacija DNA iz gela in ocena koncentracije.
4. Priprava kompetentnih celic.
5. Ligacija fragmentov DNA in transformacija bakterij
6. Izolacija plazmidne DNA iz transformant v malem merilu.
7. Restriksijska analiza rekombinantnih vektorskih molekul.
8. Indukcija izražanja rekombinantne DNA.
9. Analiza topnosti rekombinantnega proteina. Lokalizacija rekombinantnega proteina in test biološke aktivnosti.

**Seminar:**

Ocena tveganja za delo z gensko spremenjenimi organizmi v zaprtem sistemu.

11. Expression in prokaryotes: vectors, fusions, optimization of production. Targeted localization, solubility, stability and renaturation.
12. Expression in yeast, insect and mammalian cells.
13. Laboratory safety issues in work with genetically modified organisms.

**Practical courses:**

1. Primer design and construction of recombinant molecules (computer work).
2. Preparative restriction enzyme cleavage of plasmid DNA.
3. DNA isolation from agarose gels and estimation of DNA concentration.
4. Preparation of competent cells.
5. DNA fragment ligation and bacterial transformation.
6. Small-scale plasmid DNA isolation from transformants.
7. Restriction analysis of recombinant vector molecules.
8. Induction of recombinant DNA expression.
9. Solubility assay, localization screening and biological activity test.

**Seminar:**

Risk assessment for work with GMOs in a contained system.

**Temeljna literatura in viri / Readings:**

- Twyman & Primrose: Principles of Gene Manipulation and Genomics. Oxford: Blackwell Publishing, 2006.

**Cilji in kompetence:**

Vsak študent mora biti po opravljenem kolokviju in izpitu sposoben ob ustreznem vodstvu sam izvesti osnovne analize DNA, pripraviti rekombinantno molekulo DNA in razumeti osnovne postopke dela pri pripravi rekombinantnih proteinov v različnih tipih

**Objectives and Competences:**

Under guidance, students will be able to perform basic DNA analyses and construct a recombinant DNA molecule. Students will understand fundamental procedures in recombinant protein preparation in different types of host organisms and will be aware of

gostiteljskih organizmov. Poznati bo moral tudi načela varnosti dela z gensko spremenjenimi organizmi.

safe laboratory work with genetically modified organisms.

**Predvideni študijski rezultati:**

**Intended Learning Outcomes:**

Znanje in razumevanje

Znanje: poznavanje encimov, ki jih uporabljamo pri delu z DNA in pri pripravi rekombinantnih proteinov, osnove metod za označevanje in analizo nukleinskih kislin, lastnosti vektorskih molekul in metode vnosa DNA v gostiteljsko celico. Zakonska urejenost dela z GSO.

Razumevanje: postopek PCR, postopek določanja nukleotidnega zaporedja, postopki priprave DNA-knjižnic, načini pridobivanja rekombinantnih proteinov.

Knowledge and Comprehension

Knowledge:

Knowing enzymes used for DNA modifications and preparation of recombinant proteins, basic methods for nucleic acids labelling and analysis, properties of vector molecules and methods for incorporation of foreign DNA into host cells.

Knowing legal framework for working with GMOs.

Comprehension:

PCR technique, DNA sequencing, preparation of DNA libraries, approaches to recombinant protein preparation.

Uporaba

Razlikovanje med vektorskimi molekulami, občutek za velikosti molekul DNA (bazni pari, masa) in količine (femtomolarno do mikromolarno območje). Izolacija vektorskih DNA iz celic. Rezanje DNA z restriktazami. Ligacija DNA. Transformiranje bakterijskih celic. Biosinteza rekombinantnih proteinov in analiza njegovih lastnosti.

Application

Differentiation between various types of vector molecules, feeling for sizes of biological macromolecules (base pairs vs. molecular mass) and quantities (femtomolar to micromolar range). Isolation of vector molecules from cells. DNA digestion with restriction enzymes. DNA ligation. Bacterial transformation. Biosynthesis of recombinant proteins and their analysis.

Refleksija

Povezovanje posameznih metod v celoten eksperiment – primer priprave rekombinantnega proteina. Povezovanje dela z DNA z analizo proteinov.

Analysis

Combining separate methods into an experiment – case experiments for preparation of a recombinant protein. Work with DNA continues at the protein level.

Prenosljive spretnosti

Laboratorijsko delo v skupini s kolegom. Pisanje poročil o laboratorijskem delu. Načela varnosti pri laboratorijskem delu z DNA in gensko spremenjenimi mikroorganizmi. Način priprave ocene tveganja.

Skill-transference Ability

Laboratory work in a group with a colleague student. Writing laboratory work reports. Principles of laboratory safety when working with DNA and GM microorganisms. Writing a risk assessment.

**Metode poučevanja in učenja:**

**Learning and Teaching Methods:**

Predavanja, laboratorijske vaje, individualno in skupinsko delo pri pripravi seminarjev. Spletna gradiva za določena poglavja.

Lectures, laboratory practical courses, individual and group work for preparing seminars. Web sources for some topics.

Delež (v %) /

Načini ocenjevanja:	Weight (in %)	Assessment:
Pisni izpit, seminarska naloga ter ustni kolokvij z vaj. Opravljene vaje so pogoj za pristop k izpitu.		Written examination, seminary presentation and oral practicals defence. Access to examination only with completed laboratory practicals.

**Reference nosilca / Lecturer's references:**

- ŠKRLJ, Nives, ERČULJ, Nina, **DOLINAR, Marko**. A versatile bacterial expression vector based on the synthetic biology plasmid pSB1. Protein expression and purification, ISSN 1046-5928, 2009, vol. 64, no. 2, str. 198-204, doi: 10.1016/j.pep.2008.10.019. [COBISS.SI-ID 30190085]
- VASILJEVA, Olga, **DOLINAR, Marko**, ROZMAN PUNGERČAR, Jerica, TURK, Vito, TURK, Boris. Recombinant human procathepsin S is capable of autocatalytic processing at neutral pH in the presence of glycosaminoglycans. FEBS letters, ISSN 0014-5793. [Print ed.], 2005, vol. 579, str. 1285-1290. [COBISS.SI-ID 18842407]
- PUNGERČIČ, Galina, DOLENC, Iztok, **DOLINAR, Marko**, BEVEC, Tadeja, KOKALJ-JENKO, Saša, KOLARIČ, Saša, TURK, Vito. Individual recombinant thyroglobulin type-1 domains are substrates for lysosomal cysteine proteinases. Biological chemistry, ISSN 1431-6730, 2002, vol. 383, str. 1809-1812. [COBISS.SI-ID 17215527]

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	ORGANSKA KEMIJA I
<b>Course Title:</b>	ORGANIC CHEMISTRY I

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	1.	2.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	2 <sup>nd</sup>

Vrsta predmeta / Course Type:

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

BK109

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
60	15	/	/	/	75	5

Nosilec predmeta / Lecturer:

prof. dr. Janez Košmrlj / Dr. Janez Košmrlj, Full Professor

Jeziki / Languages:

Predavanja / Lectures: slovenski / Slovenian

Vaje / Tutorial: /

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Osnove strukture organskih molekul (kovalentna vez, hibridizacija ogljikovega atoma, energija vezi, dolžina in valenčni koti); nomenklatura organskih spojin (nasičeni, nenasičeni in aromatski ogljikovodiki, alkil in aril halogenidi, alkoholi, fenoli, etri in amini, karbonilne spojine: aldehidi in ketoni, karboksilne kisline in njihovi derivati). Splošne lastnosti organskih spojin (elektronska delokalizacija, resonance, rezonačna energija, tautomerija, dipolni moment); kislost in bazičnost organskih spojin (vpliv topila, induktivni, rezonačni in sterični efekt ter vpliv hibridizacije); izomerija (konstitucijska izomerija in stereoisomerija, rotacija okrog C-C vezi v acikličnih spojinah, konformacije

Content (Syllabus outline):

Structure and bonding in organic molecules (ionic and covalent bonds, hybridization of the carbon atoms). Nomenclature of organic compounds (saturated, unsaturated and aromatic hydrocarbons, alkyl and aryl halides, alcohols, phenols, ethers and amines, carbonyl compounds: aldehydes, ketones, carboxylic acids and derivatives). Properties of organic compounds connected to the resonance (electron delocalization, resonance structures, resonance energy), tautomerism (keto-enol, nitro-acinitro, nitroso-oxime, imine-enamine and other tautomerisms), and dipole moment. Organic acids and bases: the influence of the solvent, inductive, resonance and steric effect, the role

cikloalkanov, geometrijska izomerija, optična izomerija, relativna in absolutna konfiguracija, racemati). Reakcijski mehanizmi (vrste organskih reakcij, načini cepitve vezi, elektrofilni in nukleofilni reagenti, ogljikovi intermediati, prehodno stanje in aktivacijski kompleksi, kinetični in termodinamski produkti, kataliza, pozitivni katalizatorji in inhibitorji. Nukleofilne substitucije in eliminacije na nasičenih ogljikih (substitucije SN1 in SN2, stereokemija substitucij, substitucijam konkurenčne reakcije, reakcije alkil halogenidov in alkoholov, eliminacije E1 in E2, sin in anti eliminacije); adicije na alkene in alkine (elektrofilne adicije, cikloadicije, radikalske adicije); aromatske substitucije (aromatičnost, mehanizmi elektrofilnih substitucij, tipični primeri, vrste nukleofilnih aromatskih substitucij).

of hybridization. Isomers in organic chemistry: rotamers, conformers, cis and trans isomerism, optical isomerism (enantiomers, diastereoisomers, optical activity, relative and absolute configuration, racemates). Types of organic reactions (radical and ionic cleavage, electrophilic and nucleophilic reagents, carbon intermediates, activation complex, free energy of activation, reaction rate, catalysis and catalysts). Nucleophilic substitutions on sp<sup>3</sup> carbons (SN1, SN2 and their stereochemistry, competition reactions, applications in organic synthesis). Elimination reactions (E1 and E2 reactions, examples of sin and anti-eliminations). Additions involving alkenes and alkynes. Electrophilic and nucleophilic aromatic substitutions.

#### Temeljna literatura in viri / Readings:

- Organic chemistry with Biological Applications, John McMurry, 2nd edition, Brooks/Cole, 2011, pp 1-360.

#### Cilji in kompetence:

Študent na primerih enostavnih modelnih spojin spozna osnovne principe in zakonitosti, po katerih potekajo kemijske pretvorbe organskih spojin ter povezavo med reaktivnostjo in lastnostmi spojine s strukturo molekule. Pridobljeno znanje študentu omogoča prepoznavanje reaktivnosti in lastnosti določenih kompleksnejših molekul.

#### Objectives and Competences:

Knowledge of the basic principles required to understand fundamental reactions of organic compounds. Understanding the connection between the structure and the properties of organic molecules. The students will be able to follow more advanced organic courses. Ability to use the IUPAC as well as the trivial nomenclature on various types of organic compounds. Ability to discuss general properties of organic substrates in connection with resonance, tautomerism, dipole moment etc. Interpretation of three-dimensional structures of various molecules. Ability to plan simple transformations of aliphatic and aromatic substrates employing nucleophilic substitutions and eliminations as well as electrophilic additions and aromatic substitutions.

#### Predvideni študijski rezultati:

Znanje in razumevanje

#### Intended Learning Outcomes:

Knowledge and Comprehension

Študent spozna nekatere osnovne zakonitosti, ki veljajo v organski kemiji. Poleg znanj o reaktivnosti in lastnostih obravnavanih organskih spojin je sposoben načrtovati možnosti za njihovo interkonverzijo.	Understanding the fundamentals of organic chemistry. Knowledge on structural features of organic compounds, structure-reactivity relationship, and typical organic transformations.
<u>Uporaba</u> Študent se seznani s posameznimi vrstami organskih spojin, z njihovo strukturo, reaktivnostjo in z možnostmi njihove interkonverzije. Skupaj s predmetom Organska kemija 2 dobi nekatere osnove za razumevanje biokemijskih procesov. Predmet pripravlja študenta za eksperimentalno delo v organskem laboratoriju.	<u>Application</u> Student acquires knowledge about the types of organic compounds, their structure, reactivity and possible interconversions. In combination with the Organic Chemistry II course, the student acquires some basics to understand biochemical processes. Student gets prepared for experimental work in an organic chemistry laboratory.
<u>Refleksija</u> Študent pridobi občutek za določene transformacije organskih spojin, ki jih je mogoče izvesti v laboratoriju.	<u>Analysis</u> Student learns basics for some transformation of organic compounds that can be conducted in laboratory.
<u>Prenosljive spretnosti</u> Izkušnje pri reševanju problemov, delo v skupinah, zbiranje in interpretacija rezultatov ter njihovo kritično vrednotenje.	<u>Skill-transference Ability</u> Experiences in solving problems, team work, collection and interpretation of results and their critical evaluation.

**Metode poučevanja in učenja:**

Predavanja, seminarji.

**Learning and Teaching Methods:**

Lectures, seminars.

**Načini ocenjevanja:**Pisni in ustni izpit.  
Ocene: 6-10 (pozitivno), 1-5 (negativno).

Delež (v %) /

Weight (in %) /

**Assessment:**Written and oral exm.  
Grades: 6-10 (positive), 1-5 (negative).**Reference nosilca / Lecturer's references:**

- A. Demšar, J. Košmrlj, S. Petriček: Variable-temperature nuclear magnetic resonance spectroscopy allows direct observation of carboxylate shift in zinc carboxylate complexes. J. Am. Chem. Soc. 2002, 124, 3951–3958.
- D. Urankar, J. Košmrlj: Concise and Diversity-Oriented Synthesis of Ligand Arm-Functionalized Azoamides. J. Comb. Chem. 2008, 10, 981–985.
- Z. Časar, M. Steinbücher, J. Košmrlj: Lactone Pathway to Statins Utilizing the Wittig Reaction. The Synthesis of Rosuvastatin. J. Org. Chem. 2010, 75, 6681–6684.
- B. Pinter, D. Urankar, A. Pevec, F. De Proft, J. Košmrlj: Platinum mediated dinitrogen liberation from 2-picolylazide through a putative Pt=N double bond containing intermediate. Inorg. Chem. 2013, 4528–4533.

- A. Bolje, **J. Košmrlj**: A Selective Approach to Pyridine Appended 1,2,3-Triazolium Salts. *Org. Lett.* 2013, 15, 5084–5087.

- D. Cappoen, V. Majce, C. Uythethofken, D. Urankar, V. Mathys, M. Kočevar, L. Verschaeve, S. Polanc, K. Huygen, **J. Košmrlj**, *Eur. J. Med. Chem.* 2014, 74, 85–94.

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EFKKT



## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	ORGANSKA KEMIJA II
<b>Course Title:</b>	ORGANIC CHEMISTRY II

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	2.	3.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	3 <sup>rd</sup>

Vrsta predmeta / Course Type:

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

BK112

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 LV	/	/	75	5

Nosilec predmeta / Lecturer:

prof. dr. Janez Košmrlj / Dr. Janez Košmrlj, Full Professor

Jeziki / Languages:

Predavanja / Lectures: slovenski / Slovenian

Vaje / Tutorial: slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Karbonilne spojine (vrste transformacij karbonilnih spojin, adicija vode, alkoholov, karboanionov in dušikovih nukleofilov na aldehide in ketone, aldolna kondenzacija in sorodne reakcije, adicije na kumulirane sisteme, pretvorbe karboksilnih kislin in njihovih derivatov). Heterociklične spojine (sintezni principi, reakcije nekaterih heterociklov, porfirinska barvila, protoporfirin IX, hem, klorofil, derivati korina, žolčna barvila, piridin, NAD, piridoksin, piridoksal, piridoksamin, pirimidini in purini, nukleozidi in nukleotidi). Ogljikovi hidrati (struktura monosaharidov, mutarotacija, reakcije monosaharidov, disaharidi, načini tvorbe

Content (Syllabus outline):

Carbonyl compounds (typical transformations of aldehydes and ketones: addition of water, alcohols, hydride ion, cyanide ion, carbanions, and nitrogen nucleophiles; condensations; transformations of carboxylic acids and their derivatives).  
Heteroaromatic compounds (general synthetic approaches; typical reactions of electron-rich heterocycles: pyrroles, furans, thiophenes; porphyrins: protoporphyrin IX, hem, haemoglobin, chlorophylls; vitamin B12; indole and derivatives; pyridines: properties, synthesis, reactions, nicotinic acid, NAD, vitamin B6; pyrimidines: synthesis and reactions,

glikozidne vezi, maltoza, celobioza, laktoza, saharoza, homopolisaharidi, škrob, glikogen, celuloza, hitin); maščobe (sestava in lastnosti, trigliceridi in njihova hidroliza, fosfolipidi; terpeni in steroidi (izoprenska enota v terpenih, neciklični in ciklični monoterpeni, osnovne karakteristike steroidov), amino kisline (struktura in lastnosti amino kislin, izoelektrična točka, značilne reakcije amino kislin).

Vaje iz organske kemije: varnost pri delu v laboratoriju in ukrepi v primeru nesreče, laboratorijska oprema, osnove protonske in IR spektroskopije, sinteza, izolacija in čiščenje spojin.

hydroxypyrimidines; purines, nucleosides and nucleotides.

Carbohydrates (classification, names and the structures of carbohydrates, Fischer projections, conformations of cyclic forms, anomeric sugars, mutarotation, reactions of monosaccharides: oxidations and reductions, formation of glycosides, ethers and esters, important disaccharides: maltose and isomaltose, cellobiose, lactose, sucrose, polysaccharides: amylose, amilopectin, glycogen, cellulose, chitin). Fats: fatty acids, triglycerides, phospholipids, glycolipids. Terpenes and steroids.  $\alpha$ -Amino acids: structure and properties, isoelectric point, typical reactions of  $\alpha$ -amino acids.

**Experimental work:** safety in the lab, an introduction to the IR and NMR spectroscopy, lab equipment, experiments involving the synthesis, isolation, purification and identification of simple organic compounds.

#### Temeljna literatura in viri / Readings:

- Organic chemistry with Biological Applications, John McMurry, 2nd edition, Brooks/Cole, 2011, pp 444-1040.

#### Cilji in kompetence:

Študent nadgradi znanje iz Organske kemije 1 o enostavnih modelnih spojinah in zakonitostih, po katerih potekajo kemijske pretvorbe organskih spojin. Pridobljeno znanje študentu omogoča prepoznavanje reaktivnosti in lastnosti kompleksnejših molekul in razumevanje že opisanih procesov v živih organizmih na molekularnem nivoju.

#### Objectives and Competences:

Upgrading the knowledge from Organic Chemistry I course on simple model compounds and principles of organic transformations. Student gets prepared to recognize reactivity and properties of more complex molecules and processes on leaving organisms at the molecular level.

#### Predvideni študijski rezultati:

##### Znanje in razumevanje

Študent spozna osnovne zakonitosti, ki veljajo v organski kemiji. Poleg znanj o reaktivnosti in lastnostih mnogih organskih spojin je sposoben načrtovati nekatere možnosti za njihovo interkonverzijo. Spozna tudi pomembne naravne spojine, ki jih srečuje pri nadaljnjem študiju.

#### Intended Learning Outcomes:

##### Knowledge and Comprehension

Student acquires basic principles of organic chemistry, knowledge about the reactivity and properties of organic compounds. Student learns about the most important natural occurring compounds that are the subject in continuation of the study.

<p><b>Uporaba</b> Študent se seznani s posameznimi vrstami organskih spojin, z njihovo strukturo, reaktivnostjo in z možnostmi njihove interkonverzije. Dobi nekatere osnove za razumevanje biokemijskih procesov. Predmet usposablja študenta za samostojno eksperimentalno delo.</p>	<p><b>Application</b> Student learns about different classes of organic compounds, their structure, reactivity and interconversion. Student learns basic principles to understand biochemical processes. Student gets trained for an independent laboratory experimental work.</p>
<p><b>Refleksija</b> Študent pridobi občutek za različne transformacije organskih spojin, ki jih je mogoče izvesti v laboratoriju ter za primerjavo le-teh s procesi v naravi.</p>	<p><b>Analysis</b> Student acquires feeling for different transformations that can be performed in laboratory and for their comparison with the processes in nature.</p>
<p><b>Prenosljive spretnosti</b> Izkušnje pri reševanju problemov, delo v skupinah, zbiranje in interpretacija rezultatov ter njihovo kritično vrednotenje.</p>	<p><b>Skill-transference Ability</b> Experiences in solving problems, team work, collection and interpretation of results and their critical evaluation.</p>

**Metode poučevanja in učenja:**

Predavanja, seminarji, laboratorijske vaje.

**Learning and Teaching Methods:**

Lectures, seminars, practical courses.

Delež (v %) /

**Načini ocenjevanja:**Weight (in %) **Assessment:**

<p>Pisni in ustni izpit. Ocene: 6-10 (pozitivno), 1-5 (negativno).</p>		<p>Written and oral exm. Grades: 6-10 (positive), 1-5 (negative).</p>
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**Reference nosilca / Lecturer's references:**

- A. Demšar, J. Košmrlj, S. Petriček: Variable-temperature nuclear magnetic resonance spectroscopy allows direct observation of carboxylate shift in zinc carboxylate complexes. J. Am. Chem. Soc. 2002, 124, 3951–3958.
- D. Urankar, J. Košmrlj: Concise and Diversity-Oriented Synthesis of Ligand Arm-Functionalized Azoamides. J. Comb. Chem. 2008, 10, 981–985.
- Z. Časar, M. Steinbücher, J. Košmrlj: Lactone Pathway to Statins Utilizing the Wittig Reaction. The Synthesis of Rosuvastatin. J. Org. Chem. 2010, 75, 6681–6684.
- B. Pinter, D. Urankar, A. Pevec, F. De Proft, J. Košmrlj: Platinum mediated dinitrogen liberation from 2-picolylazide through a putative Pt=N double bond containing intermediate. Inorg. Chem. 2013, 4528–4533.
- Bolje, J. Košmrlj: A Selective Approach to Pyridine Appended 1,2,3-Triazolium Salts. Org. Lett. 2013, 15, 5084–5087.
- D. Cappoen, V. Majce, C. Uythethofken, D. Urankar, V. Mathys, M. Kočevar, L. Verschaeve, S. Polanc, K. Huygen, J. Košmrlj, Eur. J. Med. Chem. 2014, 74, 85–94.

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	OSNOVE BIOKEMIJSKEGA INŽENIRSTVA
<b>Course Title:</b>	FUNDAMENTALS OF BIOCHEMICAL ENGINEERING

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	5.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	5 <sup>th</sup>

**Vrsta predmeta / Course Type:** izbirni strokovni / Elective Professional

**Univerzitetna koda predmeta / University Course Code:** BKSI1

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** izr. prof. dr. Polona Žnidaršič Plazl /  
Dr. Polona Žnidaršič Plazl, Associate Professor

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

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

*Uvod:* biotehnologija - interakcija disciplin.  
*Osnove kemijsko procesnega računanja:* Stacionarne in nestacionarne snovne in energijske bilance.  
*Osnove kemijske reakcijske kinetike:* določanje kinetične enačbe, diferencialna in integralna metoda. Idealna mešalni in cevni reaktor. Šaržno in kontinuirno obratujoči reaktorji. Homogene reakcije. Heterogene reakcije.  
*Osnove bioreaktorskega inženirstva:* transportni procesi v bioreaktorjih: tok tekočin ter mešanje in zračenje. Reologija bioprocenih brozg. Prenos toplote in snovi: toplotni in snovni tok, toplotna in snovna prehodnost in prestopnost, potencialna razlika. Vrste

**Content (Syllabus outline):**

Introduction: Biotechnology- interaction of disciplines. Fundamentals of chemical  
  
Engineering calculations: mass and energy balances. Fundamentals of chemical reaction  
  
Kinetics: estimation of reaction kinetics equation: differential and integral method. Mixed flow and plug flow reactors. Batch and continuous operation of reactors. Homogenous and heterogeneous reactions.  
  
Fundamentals of bioreactor engineering: heat and mass transfer in bioreactors. Rheology of fermentation broths. Basic types of bioreactors.

bioreaktorjev. Izbira in načrtovanje bioreaktorja. Merjenje in kontrola procesnih parametrov v bioreaktorju. Načini kontrole bioprosesov: šaržno, kontinuirno in polšaržno. Osnove prenosa postopka v industrijsko proizvodnjo.  
*Pripravljalni procesi:* izbira in priprava gojišča in vcepka. Sterilizacija zraka, gojišča in opreme.  
*Izolacijski procesi:* ločevanje in obdelava biomase ter izolacija produktov. Ravnanje z odpadki in zaščita okolja.  
*Biotehnoški postopki:* pregled izvedb tipičnih biotehnoških postopkov proizvodnje biomase, primarnih in sekundarnih metabolitov ter biotransformacij.  
Vsa poglavja so obogatena s številnimi praktičnimi računskimi primeri. Posamezne skupine študentov pripravijo seminarje iz izbrane tematike.  
Laboratorijske vaje: Mešanje. Prenos kisika. Gojenje v mikrobov v bioreaktorju. Ultrafiltracija.  
Seminar: izbrani primeri osnovnih operacij, bioprosesov oziroma biotehnoških postopkov.

Introduction to bioreactor design. Measurement and control of bioprocess parameters. Transfer of bioprocess from laboratory to industrial scale. Upstream processes: inoculum and substrate preparation, sterilization.  
Downstream processes: biomass separation and product isolation. Waste management and environment protection.  
Bioprocess technology: description of selected bioprocess technologies.

#### Temeljna literatura in viri / Readings:

- Doran, P.M. Bioprocess Engineering Principles, 2nd Ed., Elsevier, Amsterdam [etc.], 2013, 919 p. (30 %)
- Raspor, P. (ur.) Biotehnologija. Bia, d.o.o., Ljubljana. 1996. 815 p. (20 %)
- Žnidaršič Plazl, P., Pavko, A. Praktikum iz biokemijskega inženirstva. Fakulteta za kemijo in kemijsko tehnologijo, Ljubljana. 2005. 89 p. (90 %)

#### Cilji in kompetence:

Cilj predmeta je spoznanje in razumevanje osnovnih inženirskih principov in vloge kemijskega inženirstva oziroma tehnike v biotehnologiji, ki je po definiciji interdisciplinarna veda in se ukvarja z nastajanjem produkta od laboratorija do proizvodnje za trg.  
Študent si pri predmetu pridobi naslednje specifične kompetence:  
-sposobnost razumevanja in povezovanja inženirskih znanj z znanji mikrobiologije, in biokemije,

#### Objectives and Competences:

Understanding the basic principles of chemical engineering; Knowing the role of chemical engineering in the field of biotechnology, knowing how to integrate chemical engineering, microbiological and biochemical principles to obtain the biotechnological product on commercial scale.  
Competences: Ability to define the basic steps in biotechnological process from raw material to a biotechnological product. Knowledge of basic principles of transfer from laboratory to industrial scale. Ability to define and analyse the

- spoznavanje tehnološkega postopka od laboratorijskih raziskav do industrijskega postopka,  
- uporaba inženirskih znanj v industrijskih procesih,  
- spoznavanje različnosti tehnoloških procesov z ozirom na uporabljeni mikroorganizem,  
- sposobnost pridobivati potrebne podatke za izračune v biokemijskem inženirstvu,  
- sposobnost analizirati dejavnike, ki so pomembni za načrtovanje, delovanje, obnašanje in spremljanje bioprosesov,  
- osvajanje nekaterih izbranih laboratorijskih tehnik za analizo in vodenje bioprosesa v laboratorijskem merilu.

parameters which are important for the process design and control.

### **Predvideni študijski rezultati:**

#### Znanje in razumevanje

Študent se pri predmetu seznanja z osnovnimi zakonitostmi in principi kemijskega inženirstva in vlogo te vede v biotehnologiji. Nauči se tehničnega razmišljanja in integralnega pristopa pri aplikaciji naravoslovnih in tehničnih znanj pri analizi, načrtovanju in vodenju biotehnoloških procesov.

#### Uporaba

Pridobljeno znanje bo študent uporabil pri analizi posameznih faz biotehnoloških postopkov oziroma pri prenosu postopkov v večje merilo ter pri analizi in vodenju biotehnoloških proizvodnih procesov od surovine do produkta v vseh merilih.

#### Refleksija

Študent pridobi občutek za tehnični način razmišljanja in predstavo o sestavljanju posameznih faz postopka v celoto.

#### Prenosljive spretnosti

Izkušnje pri reševanju biotehnoloških problemov. Zbiranje podatkov, računanje in načrtovanje ter kritično vrednotenje rezultatov. Uporaba domače in tuje literature. Podajanje poročil o opravljenem delu.

### **Intended Learning Outcomes:**

#### Knowledge and Comprehension

Understanding basic principles of chemical engineering and the role of engineering in biotechnology. Knowing how to integrate chemical engineering, microbiological and biochemical principles in development, operation, performance and monitoring of biotechnological processes.

#### Application

Student will develop the ability to participate in the development, control and analysis of biotechnological processes.

#### Analysis

Student will interpret and analyse the knowledge on selected biocatalytic processes.

#### Skill-transference Ability

Experiences with solving biotechnological problems. Experimental data collection, analysis and critical evaluation of results. The use of scientific literature, writing and presentation of reports.

### **Metode poučevanja in učenja:**

- Predavanja,  
- laboratorijske vaje,  
- seminarji.

### **Learning and Teaching Methods:**

Lectures, seminars, practical training.

<b>Načini ocenjevanja:</b>	<b>Delež (v %) / Weight (in %)</b>	<b>Assessment:</b>
Kolokvij iz laboratorijskih vaj 40 %	40 %	Laboratory practical exam
Seminar 20 %	20 %	Seminar
Pisni in ustni izpit 40 %	40 %	Written and oral exam
Ocene: 6-10 (pozitivno), 1-5 (negativno).		Grades: 6-10 (positive), 1-5 (negative)

**Reference nosilca / Lecturer's references:**

- NOVAK, Uroš, POHAR, Andrej, PLAZL, Igor, **ŽNIDARŠIČ PLAZL, Polona**. Ionic liquid-based aqueous two-phase extraction within a microchannel system. *Separation and Purification Technology*, 2012, 97, 172-178
- **ŽNIDARŠIČ PLAZL, Polona**, PLAZL, Igor. Microbioreactors. In: MOO-YOUNG, Murray (Ed.). *Comprehensive Biotechnology*, 2<sup>nd</sup> Edition. Amsterdam [etc.]: Elsevier, 2011, 289-301.
- POHAR, Andrej, **ŽNIDARŠIČ PLAZL, Polona**, PLAZL, Igor. Integrated system of a microbioreactor and a miniaturized continuous separator for enzyme catalyzed reactions. *Chem. Eng. J.*, 2012, vol. 189/190, no. 1, 376-382.

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	OSNOVE FARMAKOLOGIJE
<b>Course Title:</b>	FUNDAMENTALS OF PHARMACOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	6.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	6 <sup>th</sup>

**Vrsta predmeta / Course Type:** izbirni strokovni / Elective Professional

**Univerzitetna koda predmeta / University Course Code:** BKSI2

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
10	15	12 LV	/	38	75	5

**Nosilec predmeta / Lecturer:** doc. dr. Katarina Černe / Dr. Katarina Černe, Assistant 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:**

Opredelevanje farmakologije in njenih področij.

1. Osnovni principi delovanja zdravil (tarče in mehanizmi delovanja).
2. Osnove farmakokinetike – kako zdravila pridejo v organizem, kako prehajajo v različne predelke organizma in na kakšen način se jih organizem znebi.
3. Kako pride do neželenih učinkov zdravil.
4. Osnove toksikologije.
5. Pregled izbranih farmakodinamskih skupin zdravil.

**Content (Syllabus outline):**

Definition of pharmacology and its fields:

1. Basic principles of drug action (targets and mechanisms of action)..
2. Basics of pharmacokinetics - how the drug comes into the body, how to pass through the different compartments of the organism and the main routes of excretion.
3. How comes to adverse drug reactions.
4. Basics of toxicology.

Overview of selected pharmacodynamic drug groups.

**Temeljna literatura in viri / Readings:**

- Rang HP, Dale MM, Ritter JM, Flower RJ, Henderson G: Rang and Dale's Pharmacology,, Churchill Livingstone Elsevier. Zadnja izdaja.



- Černe K, Ferjan I, Kržan M, Lipnik-Štangelj M, Osredkar D, Rajtar-Osredkar S, Stanovnik L. Izbrana poglavja iz farmakologije. Navodila za vaje s protokoli. Elektronska oblika dostopna na spletni strani Inštituta za farmakologijo in eksperimentalno toksikologijo. Zadnja verzija.

### Cilji in kompetence:

Cilji: Študent spozna, kako zdravila delujejo na organizem in kako organizem vpliva na zdravila; na kakšen način zdravila spremenijo potek bolezenskih procesov in kako lahko povzročijo neželene učinke. Spoznal bo, kako se preskušajo potencialna nova zdravila. Seznanil se bo tudi z glavnimi skupinami zdravil.

Kompetence: Sposobnost pokazati znanje in povezovanje bistvenih dejstev in načel pri razvoju in delovanju zdravil. Sposobnost razumevanja farmakokinetike zdravila in njenega pomena na učinek zdravila. Zmožnost razmišljanja in povezovanja interdisciplinarnih znanj. Sposobnost povezovanja temeljnega znanja različnih področij, kemije, biokemije ter elementov fiziologije.

### Objectives and Competences:

Objectives: Students learn about how drugs act on the body and how the body affects the drug; how medicines alter the course of disease processes and how they can cause adverse effects. They will learn how to test potential new drugs. Students will become acquainted with major categories of drugs.

Competencies: Ability to demonstrate knowledge and integration of the essential facts and principles in the development and mechanisms of actions of medicines. The ability to understand the pharmacokinetics and its relevance to the effect of the drug. The ability of thinking and integration of interdisciplinary knowledge. Ability to connect basic knowledge of different areas of chemistry, biochemistry and elements of physiology.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Študent osvoji osnove delovanja zdravil: mehanizme delovanja, učinke in farmakokinetične lastnosti predstavnikov posameznih farmakodinamičnih skupin zdravil. Pozna indikacijska področja in kontraindikacije za jemanje posameznih zdravil. Predvideti zna možnost nastanka neželenih učinkov zdravil ter pozna ukrepe pri zastrupitvah z zdravili.

#### Uporaba

Študij tega predmeta je podlaga za to, da bo študent razumel dejavnike, ki vplivajo na učinke zdravil in mu bo pomagalo pri povezavi s praktičnimi primeri uporabe zdravil ter pri raziskovanju učinkov zdravila. Razumel bo principe raziskav, ki jih bo uporabljal na različnih strokovnih področjih v povezavi z zdravili /ksenobiotiki Pridobljeno znanje mu bo pomagalo pri interpretaciji in evalvaciji dobljenih rezultatov.

#### Refleksija

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Students acquire the basics of drug action: mechanism of action, effects and pharmacokinetic properties of representatives of individual pharmacodynamic drug groups. He knows the areas of indication and contraindications for taking certain medicines. Can foresee the possibility of the occurrence of adverse drug reactions and knows measures in poisoning with drugs.

#### Application

Study of this object is the basis for that student will understand the factors that influence the effects of medicines and will help him in connection with practical examples of the use of drugs and study the effects of the medicine. Understand the principles of research, which will be used in various professional fields in conjunction with drugs / xenobiotics acquired knowledge, will help him in the interpretation and evaluation of the results obtained.

#### Analysis

<p>Študent: pridobi občutek za povezovanje teorije in izkušenj v praksi pri procesu nastajanja zdravil ali pri preučevanju mehanizmov delovanja in učinkov zdravil/ksenobiotikov. Pridobi tudi občutek za kritično vrednotenje med teoretičnimi principi in praktičnim eksperimentalnim delom. Pridobi tudi osnovo za boljše razumevanje vpliva režima doziranja zdravil pri posamezni medikamentozni terapiji.</p>	<p>Students will acquire a feel for the integration of theory and experience in practice in the process of the emergence of medication or when examining mechanisms of action and effects of drugs / xenobiotics. Get a feel for the critical evaluation of the theoretical principles and practical experimental work. Obtain a basis for better understanding the impact of dosage regimen of medicines in individual drug therapy.</p>
<p><b>Prenosljive spretnosti</b> Izkušnje pri reševanju problemov. Zbiranje in interpretiranje rezultatov ter njihovo kritično vrednotenje. Uporaba domače in tuje literature. Podajanje poročil o opravljenem delu. Izkušnje s predstavitvijo svojega dela in z uporabo pripomočkov pri tem.</p>	<p><b>Skill-transference Ability</b> Experience in problem solving. Collection and interpretation of results and their critical evaluation. The use of domestic and foreign literature. Expression of reports on the work done. Experience with the presentation of their work and the use of the devices in this.</p>

**Metode poučevanja in učenja:**

Predavanja, vaje, seminarji, problemsko naravnani študij.

**Learning and Teaching Methods:**

Lectures, seminars, practical training, problem-based study.

**Načini ocenjevanja:**

Pisni in ustni izpit.  
Ocene od 6-10 (pozitivno) oz. 1-5 (negativno).

Delež (v %) /  
Weight (in %)

**Assessment:**

Written and oral examination.  
Grades 6-10 (positive) and. 1-5 (negative).

**Reference nosilca / Lecturer's references:**

- JAKIMOVSKA, Marina, ČERNE, Katarina, VERDENIK, Ivan, KOBAL, Borut. Circulating serum SVCAM-1 concentration in advanced ovarian cancer patients: correlation with concentration in ascites. *Radiology and oncology*, ISSN 1318-2099, 2013, vol. , no. , str. 9-15, ilustr., doi: 10.2478/raon-2013-0066. [COBISS.SI-ID 30924505]

- ČERNE, Katarina, ERMAN, Andreja, VERANIČ, Peter. Analysis of cytotoxicity of melittin on adherent culture of human endothelial cells reveals advantage of fluorescence microscopy over flow cytometry and haemocytometer assay. *Protoplasma*, 2013, vol. , iss. , str., ilustr., doi: 10.1007/s

- ČERNE, Katarina, KOBAL, Borut. Implications of microvesicle and cell surface protein shedding for biomarker studies, cancerogenesis, and therapeutic target discovery in ovarian cancer. V: IGLIČ, Aleš (ur.). *Advances in planar lipid bilayers and liposomes*. Vol. 16. Oxford [etc.]: Elsevier: Academic Press, 2012, str. 239-274, ilustr., graf. prikazi, doi: 10.1016/B978-0-12-396534-9.00008-8. [COBISS.SI-ID 30079961] 00709-013-0489-8.

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

**Predmet:** OSNOVE GENETIKE  
**Course Title:** FUNDAMENTALS OF GENETICS

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	5.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	5 <sup>th</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK134

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Simon Horvat / Dr. Simon Horvat, Full Professor

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

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

**PREDAVANJA**

1. Vloga genetike v sodobni biologiji in predstavitev genetskih konceptov
2. Osnovna mendelska genetika: monogenske, spolno vezane lastnosti, analiza križanj, rodovnikov
3. Razširjena mendelska genetika: dihibridno križanje, osnovna statistična orodja, heterozis
4. Genetska rekombinacija
5. Vezano dedovanje in kartiranje
6. Interakcije med aleli (dominanca) in med lokusi (epistaza)
7. Struktura evkariontskih genov in ravni uravnavanja njihovega izražanja
8. Mobilni genetski elementi
9. Razvoj in uporaba genetskih označevalcev

**Content (Syllabus outline):**

**LECTURES**

1. The role of genetics in modern life sciences and genetic concepts.
2. Basic Mendelian genetics: monogenic and sex-linked traits, analyses of crosses and pedigrees.
3. Extended Mendelian genetics: dihybrid cross, basic statistical tools for genetic analyses, heterosis.
4. Genetic recombination
5. Genetic linkage and mapping.
6. Interactions between alleles (dominance) and loci (epistasis).
7. Eukaryotic gene structure and basics of gene expression regulation.
8. Mobile genetic elements.

10. Osnove genomike
11. Citogenetika in kromosomske aberacije
12. Populacijska genetika
13. Genetika kvantitativnih lastnosti
14. Evolucijska genetika
15. Konzervacijska genetika in ohranjanje genskih virov

#### SEMINARSKE VAJE

1. Molekulska osnova genetske informacije, viri fenotipske variabilnosti
2. Vrste, načini dedovanja I.
3. Vrste, načini dedovanja II.
4. Vrste, načini dedovanja III.
5. Genetske interakcije
6. Analiza vezave
7. Kartiranje genov
8. Osnovni populacijski parametri
9. Selekcija (naravna, umetna)
10. Heritabiliteta
11. Kvantitativne lastnosti
12. Heterozis
13. Filogenetska analiza
14. Genetska analiza majhnih populacij

#### LABORATORIJSKE VAJE

1. Izolacija DNA iz celic in tkiv ter analiza kvalitete
2. Določanje genetske variabilnosti z označevalci (npr. RFLP-PCR, SNP, CNV).
3. Citogenetika (sestavljanje, analiza kariotipa)
4. Analiza genomov z orodjem ENSEMBL I. (npr. anotacija genomov, struktura lokusa, transkriptov; primerjalna genomika)

Analiza genomov z orodjem ENSEMBL II.  
(variabilnost, regulatorni elementi)

9. Development and application of genetic
10. Fundamentals of genomics.
11. Cytogenetics and chromosomal aberrations.
12. Population genetics.
13. Quantitative trait genetics.
14. Evolutionary genetics.
15. Conservation genetics and preservation of genetic resources.

#### CABINET TUTORIAL

1. Molecular basis of genetic information, sources of phenotype variability
2. Modes of inheritance I.
3. Modes of inheritance II.
4. Modes of inheritance III.
5. Genetic interactions
6. Linkage analysis
7. Gene mapping
8. Calculating basic population parameters
9. Selection (natural, artificial)
10. Heritability
11. Quantitative traits
12. Heterosis
13. Phylogenetic analysis
14. Genetic analysis of small populations

#### LABORATORY PRACTICAL

1. Isolation of DNA from cells and tissues and quality assessment
2. Examining genetic variability using markers (e.g., RFLP-PCR, SNP, CNV)
3. Cytogenetics (constructing and analysing of the karyotype)
4. Genome analyses using tools of ENSEMBL I. (e.g., genome annotations, locus structure, comparative genomics)

Genome analyses using tools of ENSEMBL II.  
(e.g., genome variation, regulatory features)

#### **Temeljna literatura in viri / Readings:**

- GRIFFITH, AJF, WESSLER, SR, CARROLL, SB: Introduction to genetic analysis, W.H. Freeman & Co, New York, 2012, 10th Edition 800 pp
- DEBELJAK, N, HORVAT, S., JUVAN, P., KUNEJ, T., PETROVIČ, U., REŽEN, T.. Funkcijska genomika : praktikum. 1. izd. Ljubljana: Medicinska fakulteta, 2014. 58 str.

#### **Cilji in kompetence:**

#### **Objectives and Competences:**

Študenti bodo razumeli, kako se kvalitativne in kvantitativne lastnosti prenašajo med generacijami, ob tem pa bodo znali analizirati različna križanja oziroma rodovnike in razumeti koncepte umetne selekcije različnih učinkov genov (dominantnost, recesivnost, nad-dominanca, aditivnost), interakcije med aleli in geni, ter mehanizem genetske rekombinacije.

Obvladali bodo osnovna statistična orodja v genetiki in pristope h genskemu kartiranju. Hkrati bodo znali na primerih razložiti uporabnost genskih markerjev in njihove lastnosti. Razumeli bodo, kakšne so možnosti analize genoma na ravni celice in organizma ter kako genetsko opišemo populacije. Vedeli bodo, zakaj je pomembno ohranjanje genskih virov in kako je to mogoče doseči. Študentje bodo kompetentni pri izbiri optimalnega genetskega modela za določeno znanstveno vprašanje.

Understanding how qualitative and quantitative traits are transmitted through generations, getting to know how experimental genetic crosses and pedigrees are analysed; and knowing the basic concepts of artificial selection, gene actions, gene interactions, mechanisms of meiotic recombination, and current genomics approaches.

Students will become competent in applying basic statistical methods in evaluating genetic problems and understand the main characteristics of genetic and biochemical markers and their suitability for various applications. They should develop a genome-wide understanding of underlying biochemical processes at a cell, tissue, organismal or population level. Students should be able to identify and select the most appropriate genetic model for a particular scientific question under study.

#### **Predvideni študijski rezultati:**

##### Znanje in razumevanje

Študentje bodo pridobili znanje različnih genetskih konceptov in razumevanja elementov determinacije fenotipa, načinov dedovanja, kvalitativne in kvantitativne genetike in se naučili analizirati genetska križanja in rodovnike.

Pridobili bodo kompetence za samostojno uporabo sodobnih bioinformacijskih orodij za analizo dednih dejavnikov v bioloških sistemih. Osvojili bodo "genetski" način razmišljanja pri obravnavanju fenotipa in dednih bolezni ter možnosti uporabe pri svojih projektih iz ožjega področja biokemije.

##### Uporaba

Uporabnost statističnih metod in modelov v biologiji. Računanje alelnih frekvenc in drugih genetskih lastnosti populacije. Analiza poskusnih križanj ali obstoječih rodovnikov za posamezne dedno prenosljive lastnosti. Integriranje klasične mendelske genetike z molekularnimi mehanizmi.

##### Refleksija

#### **Intended Learning Outcomes:**

##### Knowledge and Comprehension

Students should be able to acquire knowledge of a wide spectrum of genetic concepts in determination of phenotype, modes of inheritance of qualitative and quantitative traits, and learn how to analyse genetic crosses and pedigrees.

Competences gained cover a comprehensive understanding of genetic concepts and development of genetic approach to thinking about the biochemical and biological questions, phenotype and inherited diseases.

##### Application

Ability to use state of the art statistical tools will enable students to analyse genetic mapping problems, use of genetic markers and how to characterise populations with genetic means. Students should be able to integrate classical genetic knowledge with modern biochemistry and molecular biology.

##### Analysis

<p>Tudi biološki procesi (dedovanje) so podvrženi matematičnim zakonitostim. Populacije imajo svoje skupne genetske lastnosti. Dedne bolezni se dedujejo predvidljivo. Za ohranjanje genetskih lastnosti ni dovolj ohranjanje biotopa. Genetske lastnosti dinamične populacije so odvisne tudi od njene velikosti. Naravna in umetna selekcija imata enako genetsko osnovo a različne cilje. Razvijanje "genetskega" načina razmišljanja pri obravnavanju fenotipa ter kritično vrednotenje genetskih konceptov.</p>	<p>Students should be able to reflect how inheritance is linked to biochemical and biological processes and mathematical/statistical concepts – what constitutes common genetic architecture of a population and why can we predict inheritance patterns of next generations. How natural and artificial selection have common genetic basis but different aims. Ability to reflect common grounds of biochemistry and genetics.</p>
<p><b>Prenosljive spretnosti</b> Statistična analiza populacij in dedovanja. Predstavitve strokovnih vsebin na osnovi angleškega izvirnika; uporaba terminološkega slovarja. Razumevanje etičnih vidikov povezanih s sodobno genetiko je lahko koristno pri evalvaciji širših bioetičnih problemov v bioznanostih.</p>	<p><b>Skill-transference Ability</b> Use of genetic and statistical analyses in problem solving. Use of foreign contemporary literature and genetic terminology to enhance understanding in other fields of life sciences. Students will also gain insight into ethical, legal and social issues surrounding modern genetics.</p>

**Metode poučevanja in učenja:**

Predavanja, laboratorijske in seminarske vaje; vmesna kratka preverjanja znanja (kvizi); individualno reševanje problemov doma

**Learning and Teaching Methods:**

Lectures, laboratory and seminar practicum; short quizzes; take-home individual problem solving exercises.

<b>Načini ocenjevanja:</b>	Delež (v %) / Weight (in %)	<b>Assessment:</b>
Pisni izpit		Written exam

**Reference nosilca / Lecturer's references:**

- KEBER, Rok, AČIMOVIČ, Jure, MAJDIČ, Gregor, MOTALN, Helena, ROZMAN, Damjana, **HORVAT, Simon**. Male germ cell-specific knockout of cholesterologenic Cytochrome P450 lanosterol 14[alpha]-demethylase (Cyp51). *J LIPID RES*, Jun. 2013, vol. 54, iss. 6, str. 1653-1661

- LAPLANTE, Mathieu, **HORVAT, Simon**, FESTUCCIA, William T., BIRSOY, Kivanc, PREVORŠEK, Zala, EFEYAN, Alejo, SABATINI, David M. DEPTOR cell-autonomously promotes adipogenesis, and its expression is associated with obesity. *CELL METABOLISM*, 2012, vol. 16, no. 2, str. 202-212.

- SIMONČIČ, Matjaž, REŽEN, Tadeja, JUVAN, Peter, ROZMAN, Damjana, FAZARINC, Gregor, FIEVET, Catherine, STAELS, Bart, **HORVAT, Simon**. Obesity resistant mechanisms in the Lean polygenic mouse model as indicated by liver transcriptome and expression of selected genes in skeletal muscle. *BMC Genomics*, 2011, vol. 12, no. 96,

- KEBER, Rok, MOTALN, Helena, WAGNER, Kay D., DEBELJAK, Nataša, RASSOULZADEGAN, Minoo, AČIMOVIČ, Jure, ROZMAN, Damjana, **HORVAT, Simon**. Mouse knockout of the cholesterologenic cytochrome P450 lanosterol 14[alpha]-Demethylase (CYP51) resembles Antley-Bixler syndrome, *J BIOL CHEM*, Aug. 2011, vol. 286, no. 33, str. 29086-29097,

- AVBELJ, Monika, **HORVAT, Simon**, JERALA, Roman. The role of intermediary domain of MyD88 in cell activation and therapeutic inhibition of TLRs. *J. IMMUNOL* , 2011, vol. 187, no. 5, str. 2394-2404.
- PREVORŠEK, Zala, GORJANC, Gregor, PAIGEN, Beverly, **HORVAT, Simon**. Congenic and bioinformatics analyses resolved a major-effect Fob3b QTL on mouse Chr 15 into two closely linked loci. *Mammalian genome*, 2010, vol. 21, no. 3/4, str. 172-185.

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**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	PODJETNIŠTVO
<b>Course Title:</b>	ENTREPRENEURSHIP

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	2.	3.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	3 <sup>rd</sup>

**Vrsta predmeta / Course Type:** izbirni splošni / Elective General

**Univerzitetna koda predmeta / University Course Code:** SI102

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	/	45 SV	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Mateja Drnovšek / Dr. Mateja Drnovšek, 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:** Študenti bodo v okviru predmeta spoznali:  
- pomen podjetništva v gospodarstvu in temeljne pojme podjetništva  
- prepoznavanje poslovnih priložnosti  
- dinamična podjetja in razvoj novih izdelkov in storitev v obdobju globalizacije  
- pet korakov razvoja novih izdelkov in storitev – opazovanje, brainstorming, hitro prototipiranje, izboljšanje prototipov in implementacija rešitve.  
- dizajnerski način razmišljanja – tehnični, poslovni, človeški vidik  
- kreativnost in inovativnost v poslovnem in privatnem življenju  
- tehnike spodbujanja kreativnosti

**Content (Syllabus outline):** Students will learn:  
– Entrepreneurship and its role in the socio-economic development  
– Developing entrepreneurial opportunities  
– Dynamic companies and development of new products in a globalized world  
– Five steps of product development process: observation, brainstorming, rapid prototyping, testing and refinement and implementation  
– Design thinking – desirability, feasibility, viability of new solutions  
– Creativity and innovativeness in personal and business life  
– Techniques of developing creativity



- praktična aplikacija metode razvoja novih izdelkov in dizajnerskega procesa
- okolje podjetja in njegova analiza
- različne oblike družb z oceno njihovih prednosti in slabosti
- osnove računovodstva in financiranja
- poslovno načrtovanje, vsebino in način izdelave poslovnega načrta
- politiko spodbujanja podjetništva države
- pomen in vsebino marketinške/prodajne funkcije v podjetju
- metode raziskovanja trga, porabnikov, konkurence
- temeljna znanja iz projektnega menedžmenta
- poslovno komunikacijo
- primere uspešnih slovenskih izdelkov, podjetij, podjetnikov

- Practical application of new product development methodologies and design thinking
- Business environment and it's analysis
- Different form of enterprise and their differences
- Basics of accounting and financing
- Business planning, contents and the development of a business plan
- Governmental policies on supporting entrepreneurship
- Role definition of marketing and sales
- Methods of customer, competition and market analysis
- Basic project management skills
- Business communication
- Examples of successful Slovenian products, companies, entrepreneurs

#### **Temeljna literatura in viri / Readings:**

- Vahčič, A., Prodan, I., in ostali: D.SCHOOL RAZVOJ NOVIH PRODUKTOV IN STORITEV - Od interdisciplinarnosti in dizajnerskega način razmišljanja do uspeha na trgu, 2008
- Kelley, T.: The Ten Faces of Innovation: IDEO's Strategies for Defeating the Devil's Advocate and Driving Creativity Throughout Your Organization
- Kelley, T. et al: The Art of Innovation: Lessons in Crativity from IDEO, America's Leading Design Firm
- dodatna aktualna gradiva, objavljena na spletni strani predmeta

#### **Dopolnilna literatura:**

- Antončič, B., Hisrich, R., Petrin, T., Vahčič, A., Podjetništvo, Založba GV, Ljubljana, 2002, 485 str.

#### **Cilji in kompetence:**

**Cilj** predmeta je študentom razviti sposobnost timskega dela, prevzemanja odgovornosti in samoiniciativnega delovanja pri reševanju človeških, tehničnih in ekonomskih problemov povezanih z razvojem novih produktov in storitev. Študentje z uporabo dizajnerskega pristopa in hitrega prototipiranja izdelajo delujoč prototip rešitve problema. Poleg tega predmet razvija sposobnost dizajnerskega in holističnega razmišljanja kot sodobne tehnike za reševanje problemov. Študentje osvojijo tudi zmožnosti za presojo poslovanja v podjetjih, sposobnosti za presojo poslovnih priložnosti in pridobijo kompetence za samostojno vodenje.

#### **Objectives and Competences:**

The aim of the course is to develop the ability of teamwork, responsibility, taking the initiative, and the ability to solve any societal, technical or business problem associated with developing new products and services. Students will be using Design Thinking and rapid prototyping to produce a working prototype of a solution to a given problem. In addition, the subject develops design thinking and holistic thinking as modern techniques for problem solving. Students acquire the ability to assess the operation of enterprises, the ability to assess business opportunities and gain skills for managing a small business.

Študentje si pri predmetu pridobijo naslednje **specifične kompetence:**

- prepoznavanje in izkoriščanje podjetniške priložnosti
- metode raziskav trga, kupcev, konkurence
- kreativno in inovativno reševanje problemov
- uporaba sodobnih multimedijskih in telekomunikacijskih orodij
- funkcionalno poslovno pismenost in osnove poslovnih predstavitev
- usposobljenost za vodenje projektov, prenos znanja v prakso, analizo poslovanja podjetij

Students obtain the following specific competencies:

- Identification and exploitation of business opportunities
- Methods of market research (including customers and competition)
- Creative and innovative problem solving
- The use of modern media and telecommunication tools
- Functional business literacy and basics of business presentations
- Ability to manage projects, transfer of knowledge into practice, analysis of businesses

### **Predvideni študijski rezultati:**

#### Znanje in razumevanje

Študent bo spoznal in razumel:

- pojme s področja podjetništva in gospodarstva, organizacije dela, vodenja projektov, marketinga
- osnovne zakonitosti kreativnega razvoja novih izdelkov in storitev ter podjetniške dejavnosti s poudarkom na primerih iz prakse kakor tudi iz študentovih življenjskih potreb ter izkušenj

#### Uporaba

Predmet je usmerjen v praktično uporabo najnaprednejših metod razvoja novih izdelkov in storitev. Skozi dizajnerski način razmišljanja in s pomočjo d.school metodologije študent reši konkreten poslovni ali življenjski problem in osvoji znanje, ki ga lahko replicira v profesionalnem in osebnem življenju. Prepoznavanje podjetniških priložnosti, analiza podatkov in informacij za sprejemanje poslovnih odločitev, izdelava prototipov, antropološke in etnografske metode spremljanja potrošnikov, izpeljava rešitve problema. Dokumentacija procesa z multimedijskimi metodami, samostojna priprava finančnih in poslovnih analiz (trženjskih, prodajnih ipd).

#### Refleksija

Študent bo interpretiral ter pred kolegi analiziral lastno razumevanje vsebine aktualnih člankov in razpoznavanja trendov. V skupinskem delu študentje analizirajo delo

### **Intended Learning Outcomes:**

#### Knowledge and Comprehension

The student will recognise and understand:

- Concepts in the field of entrepreneurship and economy as a whole, management, project management, marketing
- The basic principles of creative development of new products and services, and entrepreneurial activities with an emphasis on case studies as well as from the student's needs and life experiences

#### Application

The course is focused on the practical application of advanced methods of developing new products and services. Through design thinking methodology students solve a specific business or societal problem and acquire knowledge that can be replicated in professional and personal life.

Identifying business opportunities, analysis of data and information for business decision-making, prototyping, anthropological and ethnographic methods of customer analysis, implementing solutions to a specific problem. The documentation of the process with multimedia, independent preparation of financial and business analyses (marketing, sales, etc.).

#### Analysis

The student will interpret and in front of colleagues analyse her understanding of articles on current topics and show recognition of trends. In group work, students analyse their

svoje in ostalih skupin in podajajo konstruktivno kritiko.	own work and work of other groups and give constructive feedback.
<p><b>Prenosljive spretnosti</b> Pri predmetu bo študent pridobil sposobnosti razumevanja podjetništva, razpoznavanja poslovnih priložnosti, analize trgov, potrošnikov, konkurence. Uporaba replikativne metodologije reševanja problemov in udejanjanja poslovnih priložnosti. Poslovna komunikacija. Pridobljene spretnosti bodo študentje znali uporabljati v osebnem in profesionalnem življenju, v delu v gospodarstvu ali javnem sektorju. Sposobnost `gradnje` boljših modelov namesto izbiranja med obstoječimi modeli.</p>	<p><b>Skill-transference Ability</b> In this course the student will acquire the ability to understand entrepreneurship, identify business opportunities, analyse markets, consumers, competition. Use of a replicative methodology of problem solving and realizing business opportunities. Business communication. Students will be able to use the acquired skills in their personal and professional life, either in business or in the public sector. The ability to develop better models instead of selecting between existing models.</p>

**Metode poučevanja in učenja:**

Predavanja s pomočjo različnih AV sredstev. Študentom podamo uvod v obravnavano snov, jih napotimo na obravnavo člankov v medijih, na spletnih straneh, na obravnavo primerov iz vsakdanje prakse – tudi s pomočjo strokovnjakov iz prakse. Delo na konkretnem projektu, aktualnem problemu. Predstavitve sprotne dela, poročilo in komentarji s strani mentorjev in študentov. Uporaba multimedijske tehnologije za spremljanje napredka, Internet, video Aktivno mentorstvo s strani pedagogov, asistentov, praktikov - podjetnikov Terensko delo – analiza trga, potrošnikov, testiranje prototipov, uporaba rešitve problema, praktične vaje d.school metodologije

**Learning and Teaching Methods:**

Lectures using audio-visual technology. We give students an introduction to specific topics, assign them to read articles in the media, on websites. Students will deal with cases from everyday practice - with the help of experts from practice. Work on a specific project in form of a real business or societal problem. Ongoing work will be regularly presented and comments will be given by tutors and students. The use of multimedia (Internet, video, etc.) for monitoring progress. Active mentoring will be available by teachers, assistants, practitioners – entrepreneurs. Fieldwork - market analysis, prototype testing, implementing the solution, practical exercises of the design thinking methodology

Delež (v %) /

Weight (in %) **Assessment:**

<b>Načini ocenjevanja:</b>	Delež (v %) / Weight (in %)	<b>Assessment:</b>
Redna poročila o napredku	<b>20</b>	Regular progress reports
Končno poročilo in predstavitev o rešitvi problema	<b>40</b>	Final report and presentation on the solution of the problem
Domače naloge, sodelovanje na srečanjih	<b>20</b>	Homeworks and active participation in sessions
Izpit pisni in/ali ustni.	<b>20</b>	Written and / or oral exam. Grades 6-10.
Ocene: 6-10 pozitivno		

**Reference nosilca / Lecturer's references:**

- Ahlin, Branka, **Drnovšek, Mateja**, Hisrich, Robert D. (2014). Entrepreneurs creativity and firm innovation : the moderating role of entrepreneurial self-efficacy. Small business economics,
- Slavec, A., **Drnovšek, M** (2012). A perspective on scale development in entrepreneurship research. Economic and Business Review, 14(1), pp. 39-62
- Ahlin, B., **Drnovšek, M.**, Hisrich, R.D. (2012). Exploring moderating effects of proactivity on the relationship between market information and innovation performance. Economic and Business Review, 14(2), pp. 121-146.
- **Drnovšek, M.**, Örtqvist, D., Wincent, J. (2010). The effectiveness of coping strategies used by entrepreneurs and their impact on personal well-being and venture performance. Zb. rad. Ekon. fak. Rij., 28(2), pp. 193-220.
- Prodan, I., **Drnovšek, M.** (2010). Conceptualizing academic- entrepreneurial intentions: an empirical test. Technovation, 30 (5/6), pp. 332-347
- **Drnovšek, M.**, Wincent, J., Cardon, M. (2010). Entrepreneurial self-efficacy and business start-up: developing a multi-dimensional definition. International Journal of Entrepreneurial Behavior and Research, 14 (4), pp. 329-348.
- Cardon, M., Wincent, J., Singh, J. **Drnovšek, M.** (2009). The nature and experience of entrepreneurial passion. Academy of Management Review, 34 (3), pp. 511-532.

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** PRAKTIČNO USPOSABLJANJE  
**Course Title:** PRACTICAL TRAINING

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	2. ali 3.	/
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup> or 3 <sup>rd</sup>	/

**Vrsta predmeta / Course Type:**

izbirni strokovni / Elective Professional

**Univerzitetna koda predmeta / University Course Code:**

PRUSP

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
/	/	/	/	150	/	5

**Nosilec predmeta / Lecturer:** doc. dr. Bogdan Štefane / Dr. Bogdan Štefane, Assistant Professor

**Jeziki / Languages:**

**Predavanja / Lectures:** /

**Vaje / Tutorial:** /

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

11. Pri praksi se študenti seznanijo z zahtevnostjo in kompleksnostjo vodenja industrijskih procesov. Spoznajo, da je za uspešno in varno delo v industriji osnovni pogoj natančno poznavanje vseh faz procesa in podrobna kemijska analiza in druga karakterizacija surovin, intermediatov, procesnih tokov in končnih produktov, kot tudi celovita analiza njegovega delovanja. Uspešnost procesa je pogojena z mnogo dejavniki in za njegovo varno obratovanje je potrebno tako optimalno delovanje posameznih procesnih operacij kot tudi usklajeno delovanje sistema kot celote.

**Content (Syllabus outline):**

Through practical work students learn about the complexity of running a chemical process, the importance of thorough understanding of all phases of a process, detailed chemical analysis of raw materials, intermediates, process flows, and final products, and comprehensive analysis of production. Since a successful operation depends on numerous factors, it is necessary to provide optimal performance of process operations and the system as a whole. The program of practical training is adapted to a particular workplace or a job. Students can carry out practice in the following fields:  
- introduction to a job of a biochemist,

<ol style="list-style-type: none"><li>12. Vsebina prakse se prilagaja konkretnemu mestu kjer se opravlja. Področja na katerih študent lahko opravlja prakso so:</li><li>13. uvajanje v delo na poklicnem področju,</li><li>14. spoznavanje s tehnološkim procesom in industrijsko proizvodnjo,</li><li>15. sodelovanje pri raziskovalno razvojnih nalogah in planiranju ter načrtovanju izdelkov,</li><li>16. nadzor proizvodnega procesa,</li><li>17. vhodna in izhodna kontrola kvalitete surovin in produktov,</li><li>18. instrumentalna analitika v raziskovalnem in kontrolnem laboratoriju,</li><li>19. aktivnosti v zvezi z varovanjem okolja in zagotavljanjem varnosti,</li><li>20. vzdrževanje aparatov, merilnih in regulacijskih sistemov.</li></ol>	<ul style="list-style-type: none"><li>- learning about a technological process or industrial production,</li><li>- R&amp;D projects and product planning,</li><li>- production process control,</li><li>- input and output quality control of raw materials and products,</li><li>- instrumental analyses in a research or control laboratory,</li><li>- environmental protection, safety at work,</li><li>- maintenance of instruments, measuring and regulation systems.</li></ul>
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#### Temeljna literatura in viri / Readings:

Nabor literature bo študent dobil na mestu opravljanja prakse oziroma jo lahko dobi tudi v knjižnici UL FKKT.  
Since the practical training is individually orientated the literature will be provided on the site.

#### Cilji in kompetence:

Namen prakse je omogočiti študentom preverjanje posredovanih teoretičnih znanj v okolju v katerem bodo delovali po zaključku študija ter jih nadgradili z znanji, ki so značilna za industrijsko tehnološko okolje in jih ni možno dobiti na šoli. Praksa poteka v povezavi študent – mentor v podjetju ali inštituciji – mentor na fakulteti.  
Praktično usposabljanje uvajanja študente v praktično delo in s tem spoznavanje strokovne narave dela ter aktualnih problematik v laboratoriju, industrijski proizvodnji in drugod.

#### Objectives and Competences:

The purpose is to verify theoretical knowledge in practice, and to gain experience by working in an industrial environment. Practical training will run under the mentorship of a company and university mentor.  
Competences:  
Acquisition of practical skills, training for independent work in genuine professional environment (laboratory, industry, etc.)

#### Predvideni študijski rezultati:

Znanje in razumevanje  
Študent se pri opravljanju praktičnega dela usposobi za povezovanje teoretičnih in praktičnih znanj, ki jih je pridobil pri različnih

#### Intended Learning Outcomes:

Knowledge and Comprehension  
Experience and knowledge of real situations in industrial environment. Application and practice of gained theoretical knowledge in solving

<p>predmetih med študijem z dejanskimi pogoji v praksi, tj. analiznih laboratorijih in laboratorijih za kontrolo kvalitete, industrijskih obratih. Študent spozna način reševanja posameznega problema, se seznanja s tehnološko-tehničnimi parametri, se nauči strokovne komunikacije z drugimi člani tima.</p>	<p>practical tasks. Gaining importance of safety measures in industrial environment. Becoming familiar with organization strategies and administration protocols in real working environment.</p>
<p><u>Uporaba</u> Praktično usposabljanje razvija pri študentu: sposobnost prenosa teoretičnih znanj na reševanje konkretnih problemov, predstavi sodoben pristop k reševanju inženirskih problemov, razvija sposobnost za vključevanje v skupinsko delo, sposobnost komuniciranja s sodelavci in strokovnjaki drugih disciplin, kar mu omogoča sodelovanje pri multidisciplinarnih projektih in mu razvija profesionalno etično in okoljsko odgovornost.</p>	<p><u>Application</u> Student can use and apply his practical knowledge and abilities during his further education and professional development.</p>
<p><u>Refleksija</u> Študent je sposoben kritično analizirati in primerjati različne pristope pri reševanju problemov tako na laboratorijskem kot tudi industrijskem nivoju.</p>	<p><u>Analysis</u> Student is capable critically compare and evaluate different approaches for problem solving in laboratory as well as in industrial on-line environment.</p>
<p><u>Prenosljive spretnosti</u> Usposabljanje v konkretnem delovnem okolju mu razvija sposobnost za analitično naravoslovno tehnično vrednotenje dogajanj v praksi.</p>	<p><u>Skill-transference Ability</u> Mastered practical abilities can student use in further professional activities. He is capable of transferring his theoretical knowledge to new working environments. Student develops analytical approach to solve individual problems.</p>

**Metode poučevanja in učenja:**

Praksa poteka v izbranem podjetju oziroma drugi inštituciji s katerim je vnaprej podpisana tripartitna pogodba, ki določa pogoje usposabljanja. V podjetju vodi delo študenta, ki mora imeti najmanj 7. stopnjo izobrazbe kemijske ali sorodne smeri.

**Learning and Teaching Methods:**

Practical training is taking place in selected corporations or related working environments and is organised individually. For each student is provided industrial tutor. Tutor responsibility and obligation are to guide the student during the practical training.

Deež (v %) /

Weight (in %) **Assessment:**

**Načini ocenjevanja:**

<p>Študent odda dnevnik in sumarno poročilo o praksi. Potrdilo o opravljenem praktičnem usposabljanju z oceno delovnega mentorja v podjetju in fakultetnega mentorja je osnova za oblikovanje ocene.</p>		<p>Keeping a practical training diary is required. After completion of the practical training students is required to write a critical assessment of his observations and gained skills. Only a "pass" and "fail" grade is given.</p>
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Ocenjevalna lestvica: opravljeno – neopravljeno.		
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**Reference nosilca / Lecturer's references:**

- **ŠTEFANE, Bogdan.** Selective addition of organolithium reagents to BF<sub>3</sub>-chelates of [beta]-ketoesters. *Organic letters*, ISSN 1523-7060, 2010, vol. 12, no. 13, str. 2900-2903, doi: [10.1021/ol100620j](https://doi.org/10.1021/ol100620j). [COBISS.SI-ID [34162181](https://www.cobiss.si/id/34162181)]
- WANG, Jingxin, **ŠTEFANE, Bogdan**, JABER, Deana, SMITH, Jacqueline A. I., VICKERY, Christopher, DIOP, Mouhamed, SINTIM, Herman O. Remote C-H functionalization : using the N-O moiety as a atom-economical tether to obtain 1,5- and the rare 1,7-C-H insertions. *Angewandte Chemie*, ISSN 1433-7851. [Print ed.], 2010, vol. 49, no. 23, str. 3964-3968, doi: [10.1002/anie.201000160](https://doi.org/10.1002/anie.201000160). [COBISS.SI-ID [34061573](https://www.cobiss.si/id/34061573)]
- NAKAYAMA, Shizuka, KELSEY, Ilana, WANG, Jingxin, ROELOFS, Kevin, **ŠTEFANE, Bogdan**, LUO, Yiling, LEE, Vincent T., SINTIM, Herman O. Thiazole orange-induced c-di-GMP quadruplex formation facilitates a simple fluorescent detection of this ubiquitous biofilm regulating molecule. *Journal of the American Chemical Society*, ISSN 0002-7863, 2011, vol. 133, no. 13, str. 4856-4864, doi: [10.1021/ja1091062](https://doi.org/10.1021/ja1091062). [COBISS.SI-ID [34845957](https://www.cobiss.si/id/34845957)]



**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

**Predmet:** RASTLINSKA BIOKEMIJA  
**Course Title:** PLANT BIOCHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	5.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	5 <sup>th</sup>

**Vrsta predmeta / Course Type:**

izbirni strokovni / Elective Professional

**Univerzitetna koda predmeta / University Course Code:**

BKSI3

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 LV	/	/	75	5

**Nosilec predmeta /  
Lecturer:**

izr. prof. dr. Kristina Gruden / Dr. Kristina Gruden, Associate Professor

**Jeziki / Languages:****Predavanja / Lectures:** slovenski / Slovenian**Vaje / Tutorial:** slovenski / Slovenian**Pogoji za vključitev v delo oz. za opravljanje  
študijskih obveznosti:**Študent oz. kandidat mora imeti predmet  
opredeljen kot študijsko obveznost.**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

Uvod (Rastlinski sistem, morfologija rastlin, rast. celica).  
Posebnosti rastlinskega metabolizma:  
Glioksilatni cikel, glukoneogeneza. Na cianid  
rezistentna dihalna veriga. Fotosinteza  
Ogljikovi hidrati. Monosaharidi, sladkorni  
alkoholi, kisline, polisaharidi (heteroglikani,  
homoglikani): škrob, komponente in zgradba  
celične stene. Prehranski vidiki rastlinskih OH:  
vlaknine (pektini, inulin, celuloza), rezistentni  
škrob. Zdravilne rastline s sluzmi. Tehnološko  
pomembni OH iz rastlin (agar, alginska kislina,  
celuloza)  
Lipidi, derivati maščobnih kislin (trigliceridi,  
fosfolipidi, voski, suberin), kemizem, fiziologija,

**Content (Syllabus outline):**

Introduction (Plant systematics, plant  
morphology, plant cell).  
Special features of plant metabolism: Glioksilatn  
cycle, gluconeogenesis. cyanide resistant  
respiratory chain. Photosynthesis  
Carbon hydrates. Monosaccharides, sugar  
alcohols, acids, polysaccharides (heteroglikans,  
homoglikans): starch, components and  
structure of cell wall. Nutritional aspects of  
vegetable carbon hydrates: fibers (pectin,  
inulin, cellulose), resistant starch.  
Lipids, fatty acid derivatives (triglycerides,  
phospholipids, waxes, suberin), physiology,  
metabolism, biochemistry, essential fatty acid,  
nutritional sources of lipids, types of lipids in

metabolizem, biokemija, esencialne maščobne kisline, prehranski viri lipidov, vrste lipidov v rastlinah. Vpliv lipidov (z nasičenimi, enkrat nenasičenimi, večkrat nenasičenimi, omega-3, omega-6) na zdravje

Fenoli: fenilpropanoidi, lignani, lignin, flavonoidi: biosintezne poti (šikimatna pot), glavne skupine, biološka aktivnost tanini, poliketidi (antrakinoni, benzodiantroni), Spojine z žveplom: česen, hren

Terpeni: eterična olja, steroidi, saponini; biosintezne poti (mevalonatna in Rohmerjeva biosintezna pot), glavne skupine, biološka aktivnost

Spojine z dušikom, alkaloidi: biosintezne poti, glavne skupine, biološka aktivnost.

Prehrabeni vidiki rastlin: metabolizem dušika, aminokislin in proteinov, ostale komponente prehrane bodo predstavljene v zadnjem sklopu

Rastlinski hormoni in tkivne kulture: metabolizem rastlinskih hormonov, ki je ena od bistvenih drugačnosti rastlin glede na živali. Seznanili se bodo s tehnologijo rastlinskih tkivnih kultur, katere bistvo je poznavanje hormonalnega metabolizma rastlin in primeri uporabe v rastlinskih tkivnih kultur biotehnologiji.

Interakcije med organizmi in odgovor rastline na stres: Rastline kot sesilni organizmi imajo razvite specifične mehanizme obrambe pred napadalci. Seznanili se bomo s simbiotskimi reakcijami, patogenimi interakcijami, inkompatibilnimi interakcijami in s pojavom alelopatije, vsa prepoznavanja na molekularno biokemijskem nivoju.

Transgene rastline in njihova uporaba: Seznanili se bomo s tehnologijo priprave transgenih rastlin, možnimi načini uporabe tehnologije in diskutirali o prednostih in slabostih uporabe ter kako ocenimo varnost transgenih rastlin.

plants. Influence of lipids (with saturated, mono unsaturated, poly unsaturated, omega-3, omega-6) on health.

Phenols: phenylpropanoids, lignans, lignin, flavonoids: biosynthetic pathway (shikimatna pathway), main groups, biological activity tanins, poliketids (antracins, benzodiantrons), Compounds with sulphur: garlic, horseradish Terpenes: essential oils, steroids, saponins; biosynthetic pathway (mevalonate and Rohmer's biosynthetic pathway), main groups, biological activity

Compounds with nitrogen, alkaloids: biosynthetic pathway, main groups, biological activity.

Nutritional value of plants: metabolism of nitrogen, amino acids and proteins, the other nutritional aspects will be presented in last part of the course.

Plant hormones and plant tissue cultures:

Students will get acquainted with the metabolism of plant hormones, one of substantially different aspects of plant biochemistry compared to animal one. The technique of plant tissue cultures, which is closely connected with the knowledge of the metabolism of hormones, and different aspect of its application in biotechnology will be discussed.

Interactions and defense response: Plants have developed specific mechanisms for communication with other organisms and environment. Symbiotic, pathological and incompatible interactions will be discussed from biochemical point of view as well as some examples of allelopathy.

Transgenic plants: Technology of plant transformation and regeneration, example of transgenic plants approved for use on the market and the future use of the technology, pros and cons of technology, risk assessment of transgenic plant.

### Temeljna literatura in viri / Readings:

- J. Bruneton: Pharmacognosy, phytochemistry, medicinal plants, Lavoisier publishing 1999.

Dodatna literatura:

- T.W.Goodwin, E.Mercer: Introduction to plant biochemistry, 2nd ed. Pergamon Press, Oxford, 1988
- Jones,Ougham, Thomas, Waaland: The molecular life of plants, 2013
- Chrispeels, Sadava: Plants, Genes and Crop Biotechnology 2003

**Cilji in kompetence:**

Predmet razširja znanje splošne biokemije na procese izgradnje in metabolizna snovi, ki so specifične za rastline ter pojasnjuje vlogo teh snovi pri odzivu rastline na stresne dejavnike; nakazuje pa tudi možnosti uporabe tega znanja v farmaciji in moderni biotehnologiji. Sposobnost uporabe znanj, zlasti sposobnost reševanja problemov; ter sposobnost analize gradiva in oblikovanje koncepta.

**Objectives and Competences:**

The course extends the previous knowledge of biochemistry to plant specific metabolic processes. Explains the role of plant secondary metabolites in interactions with other organisms. The applicability of this knowledge in pharmacy and biotechnology is presented. The competencies of the students completing this course successfully would include understanding of basic concepts n plant biochemistry, application of knowledge in case studies, ability to study related literature and form basic conclusions.

**Predvideni študijski rezultati:**

Znanje in razumevanje  
Poznavanje biosinteze rastlinskih metabolitov in njihove biološke funkcije, ter uporabnosti v farmaciji in biotehnologiji.

Uporaba  
Reševanje praktičnih nalog.

Refleksija  
Zahteva se razumevanje teorije in izkušenj v praksi, kritično ovrednotenje skladnosti med teoretičnimi načeli in praktičnim ravnanjem.

Prenosljive spretnosti  
Prepoznavanje funkcionalnih skupin v formulah spojin. Samostojna uporaba literature in interneta za reševanje strokovnih nalog.

**Intended Learning Outcomes:**

Knowledge and Comprehension  
Understanding of plant metabolism with applications in pharmacy and biotechnology

Application  
Solving practical problems

Analysis  
Understanding of theory and praxis is required, together with critical thinking when solving practical problems

Skill-transference Ability  
Ability to recognise functional groups in plant specific compounds. Independent problem oriented literature and web search

**Metode poučevanja in učenja:**

predavanja, vaje, vodene individualne naloge, sodelovalno učenje / poučevanje.

**Learning and Teaching Methods:**

Deež (v %) /

**Načini ocenjevanja:**

Weight (in %) **Assessment:**

Pisni izpit Ocene: pozitivno 6-10; negativno 1-5.		Written assessment Grades: positive 6-10,negative 1-5
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**Reference nosilca / Lecturer's references:**

TAVČAR BENKOVIĆ, Eva, ŽIGON, Dušan, FRIEDRICH, Miha, PLAVEC, Janez, **KREFT, Samo**. Isolation, analysis and structures of phototoxic fagopyrins from buckwheat. Food chemistry, vol. 143, 2014, str. 432-439

TAVČAR BENKOVIĆ, Eva, GROHAR, Tina, ŽIGON, Dušan, ŠVAJGER, Urban, JANEŠ, Damjan, **KREFT, Samo**, ŠTRUKELJ, Borut. Chemical composition of the silver fir (*Abies alba*) bark extract Abigenol and its antioxidant activity. Industrial crops and products, vol. 52, 2014, str. 23-28,

KOČEVAR GLAVAČ, Nina, **KREFT, Samo**. Excretion profile of glycyrrhizin metabolite in human urine. Food chemistry, 2012, vol. 131, str. 305-308.

BAEBLER, Špela, KREČIČ STRES, Hana, ROTTER, Ana, KOGOVSŠEK, Polona, CANKAR, Katarina, KOK, Esther, **GRUDEN, Kristina**, KOVAČ, Maja, ŽEL, Jana, POMPE NOVAK, Maruša, RAVNIKAR, Maja. PVY[*supra*]NTN elicits a diverse gene expression response in different potato genotypes in the first 12 h after inoculation. Molecular plant pathology, ISSN 1464-6722, 2009, vol. 10, no. 2, str. 263-275.

BAEBLER, Špela, STARE, Katja, KOVAČ, Maja, BLEJEC, Andrej, PREZELJ, Nina, STARE, Tjaša, KOGOVSŠEK, Polona, POMPE NOVAK, Maruša, ROSAHL, S., RAVNIKAR, Maja, **GRUDEN, Kristina**. Dynamics of responses in compatible potato - potato virus Y interaction are modulated by salicylic acid. PloS one, ISSN 1932-6203, 2011, vol. 6, issue 12, str. 1-12

MILJKOVIĆ, Dragana, STARE, Tjaša, MOZETIČ, Igor, PODPEČAN, Vid, PETEK, Marko, WITEK, Kamil, DERMASTIA, Marina, LAVRAČ, Nada, **GRUDEN, Kristina**. Signalling network construction for modelling plant defence response. PloS one, ISSN 1932-6203, 2012, vol. 7, no. 12, str. e51822-1e51822-18.

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	SPEKTROSKOPSKE METODE V BIOKEMIJI
<b>Course Title:</b>	SPECTROSCOPIC METHODS IN BIOCHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	5.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	5 <sup>th</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:**

BK130

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	10	35 SV	/	/	75	5

**Nosilec predmeta / Lecturer:**

prof. dr. Andrej Petrič / Dr. Andrej Petrič, Full Professor

**Jeziki / Languages:****Predavanja / Lectures:** slovenski / Slovenian**Vaje / Tutorial:** slovenski / Slovenian**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

Splošen uvod v spektroskopijo: elektromagnetno valovanje in interakcija z materijo, energetska stanja, prehodi med njimi, resonančni pogoj, absorpcija in emisija energije.

Masna spektrometrija: princip delovanja masnega spektrometra, izotopska sestava, fragmentacije, ionizacijske metode, MS visoke ločljivosti, masni spektri spojin z velikimi molekulskimi masami.

UV/Vis spektroskopija: vibracijski in elektronski nivoji molekule, prehodi med njimi, UV/Vis spektroskopija, polarimetrija, kirooptične metode (optična rotacijska disperzija (ORD) in cirkularni dihronizem (CD)), fluorescenca

**Content (Syllabus outline):**

General introduction to spectroscopy: Physical background of spectroscopic methods (electromagnetic radiation, interaction of light with matter, energy levels and transitions between them, absorption and emission of energy).

Mass spectrometry (principles of measuring molecular mass, ionization techniques, ion mass analysis, low- and high-resolution MS, mass spectra of molecules with high molecular weight).

UV/Vis spectroscopy: vibration and electron levels, transitions, UV/Vis spectroscopy, polarimetry, optical rotary dispersion (ORD) and circular dichroism (CD), fluorescence (emission,

(emisijski, ekscitacijski spekter, korekcija spektra, Stokesov premik, absolutni in relativni kvantni izkoristek).

Vibracijska in rotacijska spektroskopija: Ramanska, IR in mikrovalovna spektroskopija, uporaba.

Nuklearna magnetna resonanca (NMR): Osnove NMR eksperimenta, kemijski premik, multipliciteta in sklopitvena konstanta, integral, primerjava zveznega in pulznega načina snemanja NMR spektrov, osnove modernih 1D in 2D NMR tehnik.

Elektronska paramagnetna resonanca (EPR): Principi EPR, hiperfina struktura, primeri uporabe EPR.

Metode strukturnega in funkcionalnega slikanja: MRI (Magnetic Resonance Imaging), slikanje strukture organov in tkiv, principi delovanja, pozitronska emisijska tomografija (PET), principi metode, uporaba PET v raziskavah biokemijskih procesov v živih organizmih, konfokalna mikroskopija, principi, uporaba.

Vaje: Urjenje v uporabi spektrometrov in interpretaciji spektrov za določanje struktur modelnih molekul in pri vsakodnevnem delu v (biokemijskem) laboratoriju.

excitation spectrum, correction for PMT response, Stokes shift, absolute and relative quantum yield.

Vibration and rotation spectroscopy: Raman, IR and microwave spectroscopy, application in biochemistry.

Nuclear magnetic resonance (NMR): basics of NMR experiments, chemical shift, homonuclear and heteronuclear coupling, integration, continuous wave versus pulse experiments, basics of modern 1D and 2D NMR methods.

Electron paramagnetic resonance (EPR): principles of EPR experiments, hyperfine splitting, application.

Methods of structural and functional imaging: Magnetic Resonance Imaging (MRI), imaging of tissues and organs, principles and application, positron emission tomography (PET), principles and application, confocal optical fluorescence microscopy, principles and application.

Practical spectroscopy: sample preparation, basic instrumental procedures, one-dimensional experiments ( $^1\text{H}$ ,  $^{13}\text{C}$ , X), two-dimensional experiments (COSY, TOCSY, HMQC, HMBC).

### Temeljna literatura in viri / Readings:

- M. Hesse, H. Meier, B. Zeeh, Spectroscopic Methods in Organic Chemistry, Thieme, 2008; 453 str.

### Dodatna literatura / Additional reading:

- G.M. Lampman, D. L. Pavia, G. S. Kriz, J. R. Vyvyan, Spectroscopy, Brooks/Cole 2010 Int. Ed.; 656 str.

- A. Petrič, Spektroskopske metode v biokemiji (interno študijsko gradivo), UL FKKT, Ljubljana, 2012 (167 str.).

### Cilji in kompetence:

**Cilji:** Namen predmeta je posredovati študentu osnove in ga izuriti v uporabi spektroskopskih metod s posebnim poudarkom na uporabi v biokemiji.

Absolvent predmeta je sposoben načrtovati uporabo in izbiro ter interpretirati rezultate

### Objectives and Competences:

**Objectives:** To teach students theory and practice of spectroscopic methods with the emphasis on the application in biochemistry. After the course, the student is capable of designing and selection of appropriate

spektroskopskih metod pri reševanju strokovnih problemov na področju biokemije.  
**Kompetence:** Sposobnost načrtovanja, izvedbe in interpretacije spektroskopskih eksperimentov za uporabo v biokemiji.

experiments in solving spectroscopic problems in the field of biochemistry.  
**Competences:** Ability to design, perform, and interpret spectroscopic experiments for biochemical applications.

**Predvideni študijski rezultati:**

<u>Znanje in razumevanje</u> Razumevanje osnovnih principov spektroskopskih in spektrometričnih tehnik, prenosa energije elektromagnetnega valovanja na materijo in izkoriščanja tega efekta za določanje strukture molekul.
<u>Uporaba</u> Uporaba naučenih principov oziroma zakonitosti za analizo oziroma določanje strukture molekul s pomočjo spektroskopskih in spektrometričnih tehnik.
<u>Refleksija</u> Zavedanje, da sicer podatki, pridobljeni s spektroskopskimi ali spektrometričnimi metodami, vsebujejo informacije o strukturi molekul, da pa je potrebno te podatke kritično uporabiti. Rezultat spektroskopske analize mora ustrezati vsem pridobljenim spektroskopskim lastnostim hkrati.
<u>Prenosljive spretnosti</u> Pri predmetu se študenti z reševanjem znanih in neznanih problemov izurijo v uporabi spektroskopskih in spektrometričnih tehnik, analitičnega mišljenja in uporabe literaturnih virov.

**Intended Learning Outcomes:**

<u>Knowledge and Comprehension</u> Understanding the basic principles of spectroscopic methods, interaction of matter and electromagnetic waves, and utilization of this interaction in molecular structure elucidation.
<u>Application</u> Student will be able to apply the acquired knowledge in solving analytical problems.
<u>Analysis</u> Being aware that data, acquired by spectroscopic methods contain information on molecular structure but they must be critically evaluated. All measured spectroscopic characteristics must uniformly support the proposed solution of the problem.
<u>Skill-transference Ability</u> Using known and unknown examples the student is trained in utilization of spectroscopic methods, analytical thinking and using literature sources.

**Metode poučevanja in učenja:**

Predavanja, seminarske in laboratorijske vaje.

**Learning and Teaching Methods:**

Lectures and problem solving seminars.

**Načini ocenjevanja:**

Pisni izpit  
Ocene: 6-10 (pozitivno), 1-5 (negativno).

Delež (v %) /

Weight (in %)

**Assessment:**

Written exam  
Grades: 6-10 (positive), 1-5 (negative)

**Reference nosilca / Lecturer's references:**

- **PETRIČ, Andrej.** C-13 and H-1 NMR assignments for (1R)-3 beta-phenyl-8-methyl-azabicyclo[3.2.1]octane-2 beta-carboxylic acid methyl ester. Magn. reson. chem., 1996, vol. 34, 393-394.

- SHOGHI-JADID, Kooresh, SMALL, Gary W., AGDEPPA, Eric D., KEPE, Vladimir, ERCOLI, Linda M., SIDDARTH, Prabha, READ, Stephen, SATYAMURTHY, Nagichettiar, **PETRIČ, Andrej**, CHENG-HUANG, Sung, BARRIO, Jorge R. Localization of neurofibrillary tangles and beta-amyloid plaques in the brains of living patients with Alzheimer disease. *Am. j. geriatr. psychiatry*, 2002, vol. 10, str. 24-35.

- **PETRIČ, Andrej**, JOHNSON, Scott A., PHAM, Hung V., LI, Ying, ČEH, Simon, GOLOBIČ, Amalija, AGDEPPA, Eric D., TIMBOL, Gerald, LIU, Jie, KEUM, Gyochang, SATYAMURTHY, Nagichettiar, KEPE, Vladimir, HOUK, Kendall N., BARRIO, Jorge R. Dicyanovinyl naphthalenes for neuroimaging of amyloids and relationships of electronic structures and geometries to binding affinities. *Proc. Natl. Acad. Sci. U. S. A.*, 2012, vol. 109, no. 41, str. 16492-16497.

UL  
EFKKT



## UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** SPLOŠNA BIOLOGIJA  
**Course Title:** GENERAL BIOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	1.	1.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	1 <sup>st</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:**

BK105

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	10	20 LV	/	/	75	5

**Nosilec predmeta / Lecturer:**

prof. dr. Jasna Štrus / Dr. Jasna Štrus, Full Professor

**Jeziki / Languages:**

**Predavanja / Lectures:** slovenski / Slovenian

**Vaje / Tutorial:** slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

**Uvod v biologijo:** osnovne značilnosti živih organizmov. Zgradba pro- in evkariontske celice. (rastline, glive, živali). Celična ultrastruktura in funkcija.  
**Tkiva in organi večceličarjev:** interakcije celic in nastanek tkiv. Rastlinska in živalska tkiva. Zgradba in delovanje organov modelnih organizmov.  
**Osnovni mehanizmi razmnoževanja, razvoja in rasti:** razmnoževanje rastlin in živali; meristemi- organizacija rasti rastlin; osnovni genetski koncepti povezani s spolnostjo.  
**Organizmi in okolje:** interakcije mikroorganizmov, rastlin in živali med seboj in z okoljem ter antropogeni vplivi na okolje.

**Content (Syllabus outline):**

**Introduction to biology:** Main characteristics of living organisms. Structure of prokaryotic and eukaryotic cell (animal, plant and fungi) Cell ultrastructure and function.  
**Tissues and organs of multicellular organisms:** Cell interactions and formation of tissues. Types of animal and plant tissues. Structure and function of organs in model organisms.  
**Basic mechanisms of organism reproduction, growth and development:** Reproduction in plants and animals; Organisation of plant growth – meristems; basic genetic concepts related to sexuality.

**Organism and environment:** Interactions of microorganisms, plants and animals with environment and anthropogenic influences.

### Temeljna literatura in viri / Readings:

- ŠTRUS J. (2002). Splošna zoologija. Učbenik splošne zoologije za študente biologije. ŠOU, Ljubljana. 1. ponatis 2002
- MINKOFF E.C. (2004). Biology Today. An issues approach. Third Edition. Garland Science Publishing. ISBN: 0815341571 (gradiva za seminarje)
- Dermastia M. (2007). Pogled v rastline. NIB. ISBN 978-961-90363-7-2
- Campbell, N.A, J.B. Reece, E.J. Simon (2007). Essential biology with physiology (2nd Edition). Pearson International Edition, San Francisco, CA 94111, ISBN 0-321-48649-8
- Nature Principles of Biology Interactive Textbook: <http://www.nature.com/principles> (gradiva za seminarje)

### Cilji in kompetence:

Cilj predmeta je poznavanje osnovnih zakonitosti življenja, načel in pojmov v biologiji. Študent spozna osnovne značilnosti živih sistemov, zgradbo in delovanje celic, tkiv, organov in povezovanje v organizem.

Spozna enotnost in raznolikost živega sveta, interakcije med organizmi in njihovo povezanost z neživim svetom. Študent pridobi osnovne spretnosti za delo z organizmi in se seznanja z osnovnimi metodami dela v biologiji. Spoznava strokovno terminologijo in je zmožen iskati in uporabljati ustrezne vire za pridobivanje in poglobljanje biološkega znanja. Na osnovi poznavanja zgradbe je študent zmožen primerjati in razložiti delovanje različnih organizmov.

### Objectives and Competences:

Students will get basic knowledge on structure and dynamics of animal and plant cells, tissues and organs. Students get practical skills in light microscopy and methods of samples preparation. They will understand the importance of cell biology and histology in research and applications in diagnostics and industry, understand the importance of cell and tissue cultures in research and applications. They will be able to use and combine different informational sources.

Students will understand basic concepts and principles in biology. They become familiar with structure of main organic systems in animals and plants and can interpret their function. They get insight into inheritance, reproductive and developmental processes of animals and plants and master basic concepts in ecology. The students get basic on animal reproduction and development and are able to link different levels of biological organization.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Razumevanje osnovnih bioloških procesov, ki vzdržujejo življenje. Poznavanje zgradbe in delovanja celic enoceličnih organizmov ter celic, tkiv in organov večceličnih organizmov.

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Basic knowledge on animal cell and tissue structure and understanding of basic biological concepts and principles of life. Understanding interactions between organisms and their

<p>Poznavanje osnovne zgradbe in delovanja človeškega organizma. Razumevanje interakcij med organizmi in okoljem ter poznavanje vplivov na okolje. Razumevanje pomena raznolikosti živih bitij za ohranjanje naravnega okolja.</p>	<p>environment. The significance of maintenance of biological diversity and nature conservation.</p>
<p><u>Uporaba</u> Razlikovanje različnih tipov celic in tkiv. Vzdrževanje celic in tkiv v kulturi. Zmožnost uporabe metod za ločevanje, analizo in identifikacijo celic in tkiv. Poznavanje biologije osnovnih skupin rastlin in živali in njihove povezanosti. Poznavanje zgradbe in delovanja človeškega organizma, ki je osnova za razumevanje bolezenskih procesov. Zmožnost uporabe strokovne terminologije.</p>	<p><u>Application</u> Preparation of animal and plant cell and tissue samples for microscopy. Differentiation between different animal cell and tissue types. Knowledge of biology of different organisms and their interactions. Identification of basic animal types and their reproductive and developmental stages. Biology of different animal groups and their role in different environments. Learning and usage of biological terminology.</p>
<p><u>Refleksija</u> Na osnovi pridobljenih znanj o zgradbi in delovanju modelnih organizmov bo študent zmožen primerjati različne tipe organizmov in interpretirati njihove značilnosti ter medsebojno povezanost. Študent bo razumel osnovne genetske mehanizme in pomen spolnega razmnoževanja za raznolikost živih bitij. Spoznal bo občutljivost okolja za antropogene vplive in znal predvideti škodljive posledice.</p>	<p><u>Analysis</u> Understanding and comparing life at cellular and tissue levels; interpretation of cell structure of different organic systems in lower and higher animals and plants. Basic reproductive mechanisms and significance of sexuality for biodiversity. Understanding the sensitivity of the environment for anthropogenic influences and prediction of possible harmful effects.</p>
<p><u>Prenosljive spretnosti</u> Študent bo obvladal osnovne tehnike priprave bioloških preparatov za opazovanje zgradbe z različnimi tipi mikroskopov. Znal bo določiti osnovne tipe rastlinskih in živalskih organizmov. Poznal bo osnovno anatomijo človeka.</p>	<p><u>Skill-transference Ability</u> Preparation of animal tissues for microscopy, observations by light microscopy, imaging and documenting histological samples, interpretation of cell ultrastructure, histology and organ structure in animals and plants; preparation of reports and proper use of literature and biological terminology.</p>

**Metode poučevanja in učenja:**

Predavanja, laboratorijske vaje, seminarji kot skupinsko in problemsko zasnovano delo. Študent pridobi praktične izkušnje pri laboratorijskem delu in jih dopolni s teoretičnim znanjem pri predavanjih in skupinsko predstavitvijo seminarjev iz aktualnih bioloških tem povezanih s

**Learning and Teaching Methods:**

Lectures, practical courses, seminars as team work and project based learning. Prevailing experience during practical work is upgraded by theoretical basis from lectures and presentation of seminars based on up-to date topics in biology. Upgrading knowledge in

teoretičnimi znanji pri predmetu. Znanje nadgrajuje s samostojnim študijem in z uporabo ustreznih študijskih in informacijskih virov.

biology through individual student work using different study and information sources.

Delež (v %) /

**Načini ocenjevanja:**

Weight (in %)

**Assessment:**

Opravljene vaje so pogoj za pristop k izpitu.		Practical work is prerequisite for written exam.
Kolokvij iz laboratorijskih vaj 10 %	<b>10 %</b>	Colloquium from practical work
Seminarska naloga 30 %	<b>30 %</b>	Seminar
Pisni izpit 60 %	<b>60 %</b>	Written exam
Ocene: pozitivno 6-10; negativno 1-5.		Grades: passed:6-10, failed 1-5

**Reference nosilca / Lecturer's references:**

- **ŠTRUS, Jasna**, KLEPAL, Waltraud, REPINA, Janja, TUŠEK-ŽNIDARIČ, Magda, MILATOVIČ, Maša, PIPAN TKALEC, Živa. Ultrastructure of the digestive system and the fate of midgut during embryonic development in *Porcellio scaber* (Crustacea: Isopoda). *Arthropod structure & development*, ISSN 1467-8039, 2008, vol. 37, no. 4, str. 287-298. <http://dx.doi.org/10.1016/j.asd.2007.11.004>, doi: doi: 10.1016/j.asd.2007.11.004. [COBISS.SI-ID 1853775]
- MILATOVIČ, Maša, KOSTANJŠEK, Rok, **ŠTRUS, Jasna**. Ontogenetic development of *Porcellio scaber* : staging based on microscopic anatomy. *J. crustac. biol.*, 2010, vol. 30, no. 2, str. 225-234. [COBISS.SI-ID 2163535]
- KOSTANJŠEK, Rok, MILATOVIČ, Maša, **ŠTRUS, Jasna**. Endogenous origin of endo- $\beta$ -1,4-glucanase in common woodlouse *Porcellio scaber* (Crustacea, Isopoda). *Journal of comparative physiology. B, Biochemical, systemic, and environmental physiology. B*, ISSN 0174-1578, 2010, vol. 180, no. 8, str. 1143-1153. <http://dx.doi.org/10.1007/s00360-010-0485-7>, doi: 10.1007/s00360-010-0485-7. [COBISS.SI-ID 2242127]
- VITTORI, Miloš, KOSTANJŠEK, Rok, ŽNIDARŠIČ, Nada, ŽAGAR, Kristina, ČEH, Miran, **ŠTRUS, Jasna**. Calcium bodies of *Titanethes albus* (Crustacea: Isopoda) : molt-related structural dynamics and calcified matrix-associated bacteria. *Journal of structural biology*, ISSN 1047-8477, 2012, vol. 180, issue 1, str. 216-225. [COBISS.SI-ID 2622031]
- VITTORI, Miloš, ROZMAN, Alenka, GRDADOLNIK, Jože, NOVAK, Urban, **ŠTRUS, Jasna**. Mineral deposition in bacteria-filled and bacteria-free calcium bodies in the crustacean *Hyloniscus riparius* (Isopoda: Oniscidea). *PloS one*, ISSN 1932-6203, 2013, vol. 8, no. 3, str. 1-14, e58968. <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0058968>, doi: 10.1371/journal.pone.0058968. [COBISS.SI-ID 2756943]

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	SPLOŠNA KEMIJA
<b>Course Title:</b>	GENERAL CHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	1.	1.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	1 <sup>st</sup>

Vrsta predmeta / Course Type:

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

BK103

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	30	/	/	/	75	5

Nosilec predmeta / Lecturer:

prof. dr. Anton Meden / Dr. Anton Meden, Full Professor

Jeziki / Languages:

Predavanja / Lectures: slovenski / Slovenian

Vaje / Tutorial: slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

**Uvod:** utrjevanje in nadgradnja srednješolskega znanja – osnovne kemijske zakonitosti in njihova uporaba.

**Zgradba atomov:** osnovni delci atoma, izotopi; model atoma vodika (kvalitativno): orbitale (kvantna števila, oblika, meje, orientiranost v prostoru); večielektronski atomi, izgradnja elektronske ovojnice ( Hundovo pravilo, Paulijev princip); periodni sistem: lastnosti elementov v periodnem sistemu (radiji atomov in ionov, ionizacijske energije, elektronska afiniteta).

**Kemijska vez:** ionska vez; kovalentna vez (nepolarna, polarna vez, dipolni moment, teorija valenčne vezi: principi teorije,

Content (Syllabus outline):

**Introduction:** consolidation and upgrade of the secondary school knowledge – basic chemical principles and application thereof.

**Structure of atoms:** atomic particles, isotopes; model of hydrogen atom (qualitative level): orbitals (quantum numbers, shapes, boundaries, orientation in space); multi-electron atoms, building of the electron shell (Hund rule, Pauli principle); Periodic Table, atomic properties (atomic radii, ionization energies, electron affinity).

**Chemical bonding:** ionic bond, covalent bond (non-polar, polar, dipolar momentum, valence bond theory: principles, resonance, hybridization, molecular geometry; molecular

resonanca, hibridizacija, geometrija molekul; teorija molekularnih orbital: principi teorije, delokalizirane MO); elektronegativnost; strukture anorganskih molekul (strukturne formule in nomenklatura anorganskih spojin)

**Agregatna stanja snovi in medmolekulske vezi:** plini, tekočine, trdne snovi; interakcije med molekulami (Van der Waalove in vodikove vezi, vpliv teh vezi na lastnosti snovi). Struktura amorfnih in kristaliničnih trdnih snovi: ionski, kovalentni, kovinski in molekularni kristali, polprevodniki, tekoči kristali.

**Disperzni sistemi:** prave in koloidne raztopine ter njihove lastnosti.

**Kemijske reakcije:** kemijske reakcije in kemijske enačbe; energijske spremembe pri kemijskih reakcijah (standardne tvorbenne in standardne reakcijske entalpije, Hessov zakon); ravnotežje kemijskih reakcij, Le Chatelierovo načelo; vplivi na hitrost kemijske reakcije, kataliza; ionske reakcije (ionska ravnotežja, topnost, topnostni produkt); protolitske reakcije (Brønstedova teorija kislin in baz, pH, indikatorji, titracija, vpliv ionov na protolitska ravnotežja); redoks reakcije (oksidacijsko število in urejanje redoks reakcij, galvanski členi, elektroliza).

**Koordinacijske spojine:** stereokemijske značilnosti koordinacijskih spojin (izomerija); kemijska vez v koordinacijskih spojinah; vpliv elektronske konfiguracije na magnetne in optične lastnosti koordinacijskih ionov (kvalitativno).

orbital theory: principles, delocalized MO); electronegativity, structures of inorganic compounds (structural formulas and nomenclature of inorganic compounds).

**States of matter and intermolecular bonds:** gases, liquids, solids, intermolecular interactions (Van der Waals and hydrogen bonds, influence of these bonds on properties of matter). Structure of amorphous and crystalline compounds: ionic, covalent and molecular crystals, semiconductors, liquid crystals.

**Disperse systems:** true and colloidal solutions and their properties.

**Chemical reactions:** chemical reactions and chemical equations: energy changes at chemical reactions (standard enthalpies of formation and standard reaction enthalpies, Hess law); chemical equilibrium, Le Chatelier's principle; the influences on the rate of the chemical reactions, catalysis; ionic reactions (ionic equilibria, solubility, solubility product); protolytic reactions (Brønsted theory of acids and bases, pH, indicators, titration. Influence of ions on protolytic equilibria). Redox reactions (oxidation number and balancing of redox reactions, galvanic cells, electrolysis).

**Basics of coordination chemistry:** stereochemical properties of coordination compounds, chemical bond in coordination compounds, the influence of the electronic structure on the magnetic and optical properties of coordination ions (qualitative basis).

### Temeljna literatura in viri / Readings:

#### Osnovni učbenik:

- F. Lazarini, J. Brenčič, Splošna in anorganska kemija, Založba FKKT, Ljubljana 2004, str. 1-261.

#### Dodatna literatura:

- R.H. Petrucci, W.S. Harwood, F.G. Herring, General Chemistry, Principles and modern applications, osma izdaja, Prentice Hall New Jersey, 2002, 1150 str. (30%)

- A. Burrows, J. Holman, A. Parsons, G. Pilling, G. Price, Chemistry<sup>3</sup>: Introducing inorganic, organic and physical chemistry (Second Edition), Oxford University Press, Oxford, 2013 (1440 pages). Izbrana poglavja (20 %).

**Cilji in kompetence:**

**Cilji:** Poglobiti in nadgraditi znanje splošne in anorganske kemije, pridobljeno na srednji šoli, ki je potrebno za nadaljnji študij. Poudarek je na poznavanju in pravilnim razumevanjem osnovnih kemijskih zakonitosti ter poznavanju zgradbe snovi in njenega vpliva na kemijske lastnosti snovi.

**Kompetence:** Študent pozna in razume osnovne kemijske zakonitosti, principe in teorije ter jih zna uporabiti pri reševanju preprostih problemov (kvalitativno ali kvantitativno). Je sposoben poiskati in ovrednotiti določene podatke o snoveh in jih zna povezati z njihovimi lastnostmi.

**Objectives and Competences:**

**Objectives:** Deepening and upgrading the knowledge of general and inorganic chemistry, acquired in the secondary school, which is necessary for further study. Emphasis is given to knowledge and correct understanding basic chemical principles and knowledge on the constitution of matter and its influence on chemical properties of matter.

**Competences:** student knows and understands basic chemical principles and theories and knows how to use them for solving simple problems (qualitative or quantitative). He is able to find and evaluate given data about substances and is able to relate them to the properties of the substances.

**Predvideni študijski rezultati:**

Znanje in razumevanje

Študent pozna in razume osnovne kemijske zakonitosti ter jih zna povezati z zgradbo in lastnostmi snovi in kemijskimi reakcijami.

Uporaba

Znanje in razumevanje osnovnih kemijskih zakonitosti so temelji predmetom pri nadaljnjem študiju.

Refleksija

Študent je sposoben oceniti pomen osnovnih kemijskih zakonitosti in teoretskega znanja za razlago eksperimentalnih dejstev in lastnosti snovi.

Prenosljive spretnosti

Študent zna poiskati podatke iz strokovne literature, podatke iz virov medmrežja pa zna kritično oceniti; zna uporabljati strokovni jezik (pisno in ustno).

**Intended Learning Outcomes:**

Knowledge and Comprehension

Student knows and understands basic chemical principles and is able to relate them to the structure and properties of matter and chemical reactions.

Application

Knowledge and understanding of basic chemical principles are the basis of subjects for further study.

Analysis

Student is able to assess the meaning of basic chemical principles and theoretical knowledge for an explanation of experimental facts and properties of compounds.

Skill-transference Ability

Student is able to find data from professional literature and is able to critically evaluate the data from the internet; he is able to use the professional language (written and spoken).

**Metode poučevanja in učenja:**

Eksperimentalna predavanja z uporabo IKT; seminarji: sodelovalno učenje/ poučevanje ter problemsko delo; sprotne preverjanje znanja s testi.

**Learning and Teaching Methods:**

Experimental lectures using the ICT; seminars: cooperative learning/teaching and problem work; regular knowledge assessment using tests.

**Načini ocenjevanja:**

Delež (v %) /

Weight (in %) **Assessment:**

<p>2 testa za sprotno preverjanje znanja in pisni izpit. Če študent na vsakem od obeh testov najmanj 51 % točk je lahko oproščen opravljanja izpita.</p> <p>Ocenjevalna lestvica v skladu z enotno lestvico na Univerzi v Ljubljani: 6 – 10 opravil izpit, 1 – 5 ni opravil izpita.</p>	<p>2 test for during the semester and written exam. If the student collects at least 51 % of points at each of the tests, he can be excused from the exam.</p> <p>Grades according to the standard levels of the University of Ljubljana: 6-10 passed, 1-5 insufficient.</p>
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**Reference nosilca / Lecturer's references:**

- ZUPANIČ, Franc, MARKOLI, Boštjan, NAGLIČ, Iztok, WEINGÄRTNER, Tobias, **MEDEN, Anton**, BONČINA, Tonica. Phases in the Al-corner of the Al-Mn-Be system. *Microscopy and microanalysis*, ISSN 1431-9276. [Print ed.], FirstView Article, online: 18 June 2013, doi: [10.1017/S1431927613001852](https://doi.org/10.1017/S1431927613001852). [COBISS.SI-ID [16956694](#)]
- IPAVEC, Andrej, GABROVŠEK, Roman, VUK, Tomaž, KAUČIČ, Venčeslav, MAČEK, Jadran, **MEDEN, Anton**. Carboaluminate phases formation during the hydration of calcite-containing Portland cement. *Journal of the American Ceramic Society*, ISSN 0002-7820, 2011, vol. 94, no. 3, str. 1238-1242, doi: [10.1111/j.1551-2916.2010.04201.x](https://doi.org/10.1111/j.1551-2916.2010.04201.x). [COBISS.SI-ID [34764037](#)]
- MALI, Gregor, **MEDEN, Anton**, DOMINKO, Robert. [sup] 6 Li MAS NMR spectroscopy and first-principles calculations as a combined tool for the investigation of Li [sub] 2 MnSiO [sub] 4 polymorphs. *Chemical communications*, ISSN 1359-7345, 2010, issue 19, str.3306-8, doi: [10.1039/c003065a](https://doi.org/10.1039/c003065a). [COBISS.SI-ID [4386074](#)]
- KÜZMA, Mirjana, DOMINKO, Robert, HANŽEL, Darko, KODRE, Alojz, ARČON, Iztok, **MEDEN, Anton**, GABERŠČEK, Miran. Detailed in situ investigation of the electrochemical processes in Li[sub]2FeTiO[sub]4 cathodes. *Journal of the Electrochemical Society*, ISSN 0013-4651, 2009, vol. 156, no. 10, str. A809-A816. [COBISS.SI-ID [4219162](#)]
- MOLČANOV, Krešimir, KOJIĆ-PRODIĆ, Biserka, **MEDEN, Anton**. [pi]-Stacking of quinoid rings in crystals of alkali diaqua hydrogen chloranilates. *CrystEngComm*, ISSN 1466-8033, 2009, vol. 11, iss. 7, str. 1407-1415, doi: [10.1039/b821011j](https://doi.org/10.1039/b821011j). [COBISS.SI-ID [516331545](#)]



## UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** ŠPORTNA VZGOJA  
**Course Title:** PHYSICAL EDUCATION

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	1.	1.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	1 <sup>st</sup>

**Vrsta predmeta / Course Type:** izbirni splošni / Elective General

**Univerzitetna koda predmeta / University Course Code:** ŠPVZG

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
10	/	65 SV	/	/	75	5

**Nosilec predmeta / Lecturer:** mag. Matej Jamnik, pred. šp. vzg. / Matej Jamnik, MSc., Lecturer

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

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

Predmet ŠV vključuje naslednje vsebine:

- uvod in opredelitev predmeta (vsebina in organizacija),
- pomen in vloga predmeta ŠV kot vrednota kakovosti življenja v času študija in med opravljanjem poklica,
- učinki športne aktivnosti na celovito telesno, duševno in socialno zdravje študentov,
- športna aktivnost kot preventivna, korektivna in promocijska dejavnost za ohranjanje zdravja,
- športni način življenja kot vodilo zdravega načina življenja,
- izvajanje predmeta poteka tako, da študentje lahko izbirajo med štirimi moduli,

**Content (Syllabus outline):**

Subject includes the following contents:

- Introduction and definition of the object (content and organization).
- The importance and role of object as a value the quality of life during the study and the practice of his profession.
- The effects of sports on the overall physical, mental and social health of students,
- Sports activity as a preventive, corrective and promotional activity to maintain,
- Sport lifestyle as a guide to a healthy lifestyle.
- Implementation of an object takes place so that students can choose from among four modules, namely: basic programs, health-special programs, competitive programs and

in sicer: osnovni programi, zdravstveni ter specialni programi, tekmovalni programi in programi za usposabljanje za strokovno delo v športu.

*Prvi modul: Osnovni programi*

Osnovni programi obravnavajo teoretične in praktične vsebine športnih panog. Vsebine osnovnih programov športa so športne panoge, ki se izvajajo v različnih oblikah in na več stopnjah zahtevnosti. Obsegajo programe učenja, izpopolnjevanja in športno-rekreativnega treninga v izbranih športnih panogah, ki se izvajajo kontinuirano preko celega semestra ali v zgoščenih oblikah.

*Drugi modul: Zdravstveni ter specialni programi*

Zdravstveni in specialni programi obsegajo teoretične in praktične vsebine, ki omogočajo ohranjanje zdravja, korekcijo negativnih učinkov študija in dela ter navajajo na zdrav način življenja.

*Tretji modul: Tekmovalni programi*

Tekmovalni programi obsegajo vsa fakultetna, univerzitetna in meduniverzitetna tekmovanja v izbranih športnih panogah in so sestavni del dejavnega sožitja študentov, učiteljev in drugih pripadnikov univerze z namenom sodelovanja znotraj fakultet in univerz.

*Četrti modul: Programi za usposabljanje za strokovno delo v športu*

Programi za usposabljanje za strokovno delo v športu obsegajo teoretične in praktične vsebine, ki omogočajo opravljanje strokovnega dela v športu.

training programs for professional work in sports.

The first module: Basic programs

Basic programs address the theoretical and practical knowledge of sport disciplines that are necessary for the basic needs for sport recreation. Components of the basic programs of sports are sports disciplines, to be implemented in various forms with the aim of acquiring the basics of sports training. The contents are carried out continuously over the two semesters completed by concentrated forms.

The second module: Health-special programs

Health and special programs include theoretical and practical content, enabling the influence preservation of health, the correction of the adverse effects of study and work, and indicate on a healthy lifestyle.

The third module: Competitive programs

Competitive programs include the entire faculty, the university, inter-university and international competitions (the European and global academic competition, and universiade) in selected sport disciplines are an integral part of the active co-existence of students, teachers and other members of the university to cooperate within the faculties and universities.

The fourth module: Training programs for professional work in sport

Training programs for professional work in sports include theoretical and practical content to pursue professional work in sports.

**Temeljna literatura in viri / Readings:**

• Splošna literatura za tiste segmente, ki so skupne vsem programom (vedenja o vplivu športne aktivnosti na zdrav način življenja in vzdrževanja psihofizičnega ravnovesja ter ohranjanja delovnih sposobnosti) /

General bibliography for those segments that are common to all programs:

Obvezna literatura / Mandatory readings:

- Društvo za zdravje srca in ožilja Slovenije (2000). Lepota gibanja tudi za zdravje (izbrana poglavja). Ljubljana: Društvo za zdravje srca in ožilja Slovenije, 336 str.

- Društvo za zdravje srca in ožilja Slovenije (1997). Prehrana - vir zdravja (izbrana poglavja). Ljubljana: Društvo za zdravje srca in ožilja Slovenije, 315 str.
- Rotovnik-Kozjek, N. (2004). Gibanje je življenje (izbrana poglavja). Ljubljana: Domus, 238 str.

Priporočljiva literatura / Recommended readings:

- Berčič, H. et al. (2001). Šport v obdobju zrelosti. Ljubljana: Fakulteta za šport UL, Inštitut za šport, 210 str.
- CINDI Slovenija (2002). Krepimo zdravje z gibanjem in zdravo prehrano (mednarodna konferenca - Radenci). Ljubljana: CINDI Slovenija, 177 str.
- Francis, P. R. (1996). Real exercise for real people : Finding your optimum level of physical activity for a life time of healthy living. Rocklin: Prima Pub, 178 str.
- Inštitut za varovanje zdravja Republike Slovenije (2000). Gibanje za zdravje (svetovni dan zdravja). Ljubljana: Inštitut za varovanje zdravja Republike Slovenije, 85 str.
- Pokorn, D. (1988). Gorivo za zmagovalce - prehrana športnika in rekreativca. Ljubljana: Inštitut za varovanje zdravja Republike Slovenije, 153 str.
- Russell, R. V. (1982). Planning programs in recreation. St. Louis, Toronto, London: The C. V. Mosby Company, 352 str.
- Sharkey, B., J. (1997). Fitness and health (4th ed.). Champaign, Windsor, Leeds, Lower Mitcham, Auckland: Human Kinetics, 417 str.
- Ušaj, A. (1997). Kratek pregled osnov športnega treniranja. Ljubljana: Fakulteta za šport UL, Inštitut za šport, 299 str.

Specifična literatura glede na izbrane programe po posameznih športnih panogah oziroma druge programe /

The specific literature in relation to the selected programs for individual sport disciplines or other programs.

**Cilji in kompetence:**

**Cilji:** Cilj predmeta so skozi organizirano in načrtno vodeno športno vadbo pri študentih vplivati na oblikovanje pozitivnih stališč do športa, ozaveščati o vrednotah športa, navajati na zdrav način življenja ter aktivno in ustvarjalno izrabo prostega časa, usmerjati v organizirane oblike športa na univerzi in širšem okolju, preventivno vplivati na posledice pomanjkanja gibanja, razvijati psihofizične sposobnosti in izpopolniti znanje v posameznih izbranih športnih panogah.

**Ideja predmeta:** Predmet ŠV je organiziran v obliki modulov. Vsem študentom Fakultete za upravo je dana možnost izbire modulov, ki so glede na specifične najbližji njihovim študijskim programom.

**Značilnosti predmeta:**

- racionalno vgrajevanje športa v način življenja,

**Objectives and Competences:**

**Objectives:** The aim of this course is through an organized and systematic sports training for students to influence the formation of positive attitudes to sport, to raise awareness about the values of sport, accustomed to a healthy lifestyle and active and creative use of free time, guided in organized sports at the university and the wider environment preventive effect on the consequences of the lack of movement, develop physical and mental abilities and improve skills in selected individual sports.

**The idea of the object:** Object PE is organized in the form of modules. All students of the Faculty of Chemistry and Chemical Technology is given the choice of modules, which, according to the specifics of the nearby their study program.

**Features of the object:**

<ul style="list-style-type: none"> <li>• oblikovanje razumskega in čustvenega odnosa do telesnega napora,</li> <li>• poznavanje teorije aktivnega počitka,</li> <li>• poznavanje opredelitev zdravega življenjskega sloga,</li> <li>• obvladanje metod za regeneracijo telesa,</li> <li>• poznavanje učinkov športne rekreacije na celovito zdravje,</li> <li>• poznavanje zdravega prehranjevanja in regulacije telesne teže,</li> <li>• poznavanje medicinskih vidikov športa,</li> <li>• poznavanje posebnosti najpogostejših patologij gibalnega in srčno-žilnega sistema,</li> <li>• osvajanje priljubljene športne panoge,</li> <li>• znanje demonstracije izbranih gibalnih in športnih prvin,</li> </ul> <p>poznavanje didaktike izbranih športov in gibalnih vsebin.</p>	<ul style="list-style-type: none"> <li>• Rational incorporation of sport into a way of life.</li> <li>• The creation of rational and emotional attitudes towards physical effort,</li> <li>• Knowledge of the theory of active rest.</li> <li>• Knowledge of the definition of a healthy lifestyle.</li> <li>• Mastery of methods for the regeneration of the body.</li> <li>• Knowledge of the effects of sports recreation on a comprehensive health.</li> <li>• Knowledge of healthy eating and weight control.</li> <li>• Knowledge of the medical aspects of sport.</li> <li>• Knowledge of the specificities of the most common pathologies of the musculoskeletal and cardiovascular systems.</li> <li>• Conquering favourite sport.</li> <li>• Knowledge demonstrations of selected physical and sports elements.</li> <li>• Knowledge of didactics of selected sports and exercise content.</li> </ul>
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**Predvideni študijski rezultati:**

<p><u>Znanje in razumevanje</u> osvajanje vsebin športa kot temeljev, ki omogočajo kvaliteto življenja.</p>
<p><u>Uporaba</u> uporaba pridobljenega znanja za kompenzacijo vsakodnevnih stresov med študijem.</p>
<p><u>Refleksija</u> Uporaba pridobljenega znanja za kompenzacijo vsakodnevnih stresov v poklicu in družini.</p>
<p><u>Prenosljive spretnosti</u> Gibalne spretnosti in psihofizična vzdržljivost.</p>

**Intended Learning Outcomes:**

<p><u>Knowledge and Comprehension</u> Conquering content sport as a foundation to enable the quality of life.</p>
<p><u>Application</u> Use the knowledge acquired to compensate for the daily stress during the study.</p>
<p><u>Analysis</u> Use the knowledge acquired to compensate for the daily stress in the profession and family.</p>
<p><u>Skill-transference Ability</u></p>

**Metode poučevanja in učenja:**

<p>Predavanje, vadba, skupinske in individualne konzultacije.</p>
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**Learning and Teaching Methods:**

<p>Lectures, tutorial - practical training, group and individual consultation.</p>
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Delež (v %) /

**Načini ocenjevanja:**

Weight (in %)

**Assessment:**

<p><b>Metoda ocenjevanja:</b> pisni izpit iz vedenj o vplivu športne aktivnosti na zdrav način življenja in vzdrževanja psihofizičnega ravnovesja ter</p>		<p><b>Method of assessment:</b> Examination of behaviours on the impact of sports on healthy lifestyles and maintenance of psychophysical balance and the</p>
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ohranjanja delovnih sposobnosti, 75% aktivna prisotnost na vajah v izbranem vadbenem programu. <b>Ocenjevalna lestvica:</b> 6-10 (pozitivno), 1-5 (negativno).		maintenance of work ability, 75% active participation in the exercises in the practical training program selected. <b>Assessment scale:</b> 6-10 (positive), 1-5 (negative).
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**Reference nosilca / Lecturer's references:**

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## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	STRUKTURA ATOMOV IN MOLEKUL
<b>Course Title:</b>	STRUCTURE OF ATOMS AND MOLECULES

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	2.	4.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	4 <sup>th</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK118

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	30	/	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Barbara Hribar Lee / Dr. Barbara Hribar Lee, 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:**

**Uvod v kvantno mehaniko.** Fotoefekt, Sevanje črnega telesa, Zgodovina modelov atoma. Valovna enačba svetlobe in valovanje delcev. Dvojnost narave. Heisenbergov princip nedoločljivosti. Pojem diferencialne enačbe, vektorska algebra, funkcije več spremenljivk. Opisna razlaga Schrödingerjeve enačbe in zveza med njenimi rešitvami ter verjetnostjo. Uvedba pojma operatorja.

**Modelni sistemi.** Kvantni delec v neskončni potencialni jami. Siplanje delcev in tunelski efekt. Togi rotator in kvantni harmonski oscilator. Prehodi med kvantnimi stanji. Opisno o metodah približnega računanja.

**Atomi.** Vodikov in vodiku podoben atom (lastne funkcije, energije kot lastne vrednosti,

**Content (Syllabus outline):**

Introduction to quantum mechanics (models of atom, quantum phenomena, Heisenberg principle, wave – particle duality, Schrödinger equation, quantum operators, commutation, expectation values).

Model systems (free particle, particle in a box, tunnelling effect, rotators, oscillators, transition moments). Approximate calculations (variation methods, perturbation theory).

Atoms (hydrogen and helium atom, orbital and spin angular momentum, atoms in magnetic fields, Pauli principle, electronic configuration, periodic systems).

Molecular orbital method, valence bond theory. H<sub>2</sub> + H<sub>2</sub> systems.

kvantna števila). Orbitalna in spinska vrtilna količina. Paulijev princip in Paulijeve sile. Nameščanje elektronov na energijske nivoje, Hundova pravila. Ionizacijski potenciali, elektronske afinitete, efektivni radiji. Elektronska konfiguracija atomov in periodni sistem.

**Metoda valenčnih vezi (VB)** in metoda molekularskih orbital (MO). Metoda valenčnih vezi, sistem  $H_2$  z metodo valenčnih vezi. Metoda molekularskih orbital, obravnavanje sistemov  $H_2^+$  in  $H_2$ . Povezava med obema pristopoma.

**Dvo- in večatomne molekule.** Slike in označevanje molekularskih orbital. Neto valenčnost. Hibridne orbitale (vpeljava in grafična predstavitev). Princip maksimalnega prekrivanja. Elektronegativnost (definicija, lestvice). Ionski karakter vezi. Večatomne molekule: elektronski problem (poenostavljen opis nastavitve problema in načinov reševanja, zgradba računalniških programov in praktični prikaz reševanja konkretnega primera s pomočjo računalnika). Hückelova metoda. Vodikova vez, kvantna in molekularska mehanika v biokemiji

Two- and multiple electron systems. The description of the molecular orbitals, hybrid orbitals, electronegativity, ionic character of the molecular bond. Electronic problem, Hückel method.

Hydrogen bond, quantum and molecular mechanics in biochemistry.

#### Temeljna literatura in viri / Readings:

- J. Koller, Struktura atomov in molekul (bolonjski program), FKKT, Ljubljana 2010, 209 str., (100 %)
- P.W. Atkins, Physical Chemistry (šesta izdaja), Oxford University Press, Oxford 1998, 998 str., (15%)

#### Dopolnilna literatura:

- F.L. Pilar, Elementary Quantum Chemistry, McGraw-Hill, 1990, 599 str.
- J. Koller, Struktura atomov in molekul – zbirka nalog z rešitvami, FKKT, Ljubljana 2002, 121 str.
- M. Karplus in R.N. Porter, Atoms and Molecules, Benjamin, New York 1970, 620 str.

#### Cilji in kompetence:

Predmet je del področja kvantna kemija, ki je uporaba metod kvantne fizike v kemiji in biokemiji.

Cilj predmeta je, da se študent seznani z osnovnimi principi kvantne mehanike in uporabo le-teh ter novim načinom gledanja na svet mikrokozmosa.

#### Objectives and Competences:

**Learning outcomes:** Understanding the basic principles of quantum mechanics and the use of these principles in learning the new perspectives of looking at the micro cosmos.

**Competences:** Ability to interpret the atomic structure and the structure of simple molecules. Directing students to independent theoretical work.

Specifične kompetence: osnovno znanje za samostojno teoretično delo na področju strukturne biokemije, strukture proteinov, membran itd.

**Predvideni študijski rezultati:**

Znanje in razumevanje

Študent se pri predmetu nauči osnov kvantne mehanike, navadi se na abstraktno razmišljanje (marsikateri pojav nima klasične razlage), spozna teoretično ozadje biokemijskih principov, nauči se vrednotiti rezultate teoretičnih računov. Spozna povezavo med klasično in kvantno fiziko in vzroke strukture biološko pomembnih molekul ter kje je potrebno uporabiti kvantno in kje je dovolj klasična fizika.

Uporaba

Poznavanje principov, ki jih posreduje ta predmet, je nujna osnova za vse teoretične študije v biokemiji. Študent se spozna z enačbami, s katerimi lahko obravnava atome, molekule in molekulske sisteme, rezultati katerih pa so fizikalno-kemijske količine, ki jih lahko izmerimo.

Refleksija

Študent si pridobi občutek, da se obnašanja zelo majhnih (kvantnih) delcev ne da vedno predstavljati s pojmi iz vsakodnevnega življenja in se navadi abstraktnega gledanja. Nauči se tudi, kje je dovoljeno obravnavanje sistemov s klasično fiziko.

Prenosljive spretnosti

Pri predmetu se študenti naučijo prepoznavati problem, ga rešiti s pomočjo katerega od komercialnih računalniških programov in na koncu interpretirati rezultate. Poseben poudarek je na kritičnem ovrednotenju dobljenih rezultatov. Naučijo se uporabe domače in tuje literature ter podajanja zaključenega dela v pisni obliki.

**Intended Learning Outcomes:**

Knowledge and Comprehension

The student learns the basics of quantum mechanics and abstract thinking, gets to know the theoretical basis for the biochemistry principles and learns to assess the theoretical results. The student discovers the correlation between classical and quantum physics, and the reasons for the structure of the biologically important molecules.

Application

The knowledge of the principles of this subject is the basics for all the theoretical studies in the biochemistry. The student gets familiar with the equations that describe the properties of atoms and molecules, resulting in the physical chemistry properties of the systems.

Analysis

The students learn the abstract thinking process, realizing that the quantum systems do not have an analogy in the everyday life. The students get to know where the quantum mechanics needs to be used in the place of classical physics.

Skill-transference Ability

The students learn to recognize the problem, to formulate it in the mathematical language, and to interpret the results. Special attention is paid to critical assessment of the obtained results. They learn how to use the literature and to present a written report.

**Metode poučevanja in učenja:**

Predavanja  
Seminar (računske naloge iz predelane snovi)

**Learning and Teaching Methods:**

- Lectures  
- Seminars (Problem solving)

Delež (v %) /

**Načini ocenjevanja:**

Weight (in %) **Assessment:**



Pisni (nadomestita ga lahko dva pozitivno ocenjena kolokvija) in ustni izpit.		Written (can be substituted with two positively graded partial tests) and oral exam.
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**Reference nosilca / Lecturer's references:**

- **HRIBAR, Barbara**, DILL, Ken A., VLACHY, Vojko. Receptacle model of salting-in by tetramethylammonium ions. J. phys. chem., B Condens. mater. surf. interfaces biophys., 2010, vol. 114, no. 46, str. 15085-15091
- LUKŠIČ, Miha, URBIČ, Tomaž, **HRIBAR, Barbara**, DILL, Ken A. Simple model of hydrophobic hydration. J. phys. chem., B Condens. mater. surf. interfaces biophys., 2012, vol. 116, no. 21, str. 6177-6186
- JARDAT, Marie, **HRIBAR, Barbara**, DAHIREL, Vincent, VLACHY, Vojko. Self-diffusion and activity coefficients of ions in charged disordered media. J. chem. phys., 2012, vol. 137, no. 11, art. no. 114507 (9 str.)

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**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	STRUKTURA PROTEINOV
<b>Course Title:</b>	PROTEIN STRUCTURE

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	6.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	6 <sup>th</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK135

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	30	15 SV	/	/	75	5

**Nosilec predmeta / Lecturer:** doc. dr. Marko Novinec / Dr. Marko Novinec, Assistant Professor

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

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**  
 Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**  
 The course has to be assigned to the student.

**Vsebina:**  
 Osnovni gradniki in motivi strukture proteinov. Klasifikacija proteinskih struktur. Razredi proteinskih struktur s primeri (alfa, beta, alfa/beta proteini). Zvijanje in konformacijska fleksibilnost proteinov. Primeri povezave med strukturo in funkcijo proteinov: DNK-vezavni proteini, proteini v prenosu signalov, membranski proteini, fibrilarni proteini, proteini imuskega odziva. Strukturna podlaga encimske katalize. Metode za identifikacijo in analizo proteinov. Masna spektroskopija. Osnove proteomike in biologije sistemov. Metode za določanje tridimenzionalne strukture proteinov. Napovedovanje strukture proteinov. Proteinska bioinformatika. Evolucija proteinov. Proteinski inženiring.

**Content (Syllabus outline):**  
 Basic building blocks and motifs of protein structure. Classification of protein structures. Structural classes with examples (alpha, beta, alpha/beta proteins). Folding and conformational flexibility of proteins. Examples of structure-function relationships in proteins: DNA-binding proteins, proteins in signal transduction, membrane proteins, fibrillar proteins, proteins of the immune system. Structural basis of enzyme catalysis. Methods for the identification and analysis of proteins. Mass spectroscopy. Basics of proteomics and system biology. Methods for the determination of three-dimensional structures of proteins. Protein structure prediction. Protein

bioinformatics, Protein evolution. Protein engineering.

**Temeljna literatura in viri / Readings:**

- Arthur M. Lesk: Introduction to Protein Science: Architecture, Function, and Genomics. 2nd ed. 2010. 430 str. (40%)
- Branden & Tooze: Introduction to Protein Structure. 2nd ed. 1999. 393 str. (40%)

**Cilji in kompetence:**

Cilji: študenti spoznajo strukturno raznolikost proteinov in njihovo klasifikacijo, metode za analizo proteinov ter strukturno podlago interakcij proteinov z drugimi molekulami.

Kompetence: študenti se naučijo povezovati strukturo proteinov z njihovo biološko funkcijo.

**Objectives and Competences:**

Objectives: students learn about with the structural diversity of proteins and their classification, methods used in protein analysis and the structural basis of protein interactions.

Competences: students learn to link the structure of proteins with their biological function.

**Predvideni študijski rezultati:**

Znanje in razumevanje

Študenti pri predmetu pridobijo znanje o strukturi proteinov in njihovih interakcijah z drugimi molekulami, seznanijo se z najpogostejšimi raziskovalnimi metodami analize struktur proteinov in spoznajo pomembnost povezave med strukturo in funkcijo proteinov v bioloških sistemih.

Uporaba

Razumevanje strukture proteinov in njene povezave s njihovo funkcijo je ključnega pomena za razumevanje delovanja bioloških sistemov na molekularnem nivoju.

Refleksija

Študentje pridobijo način razmišljanja o funkciji proteinov z vidika njihove strukture.

Prenosljive spretnosti

Izkušnje pri reševanju problemov. Timsko delo (pri seminarskih in laboratorijskih vajah). Zbiranje in interpretiranje rezultatov ter njihovo kritično vrednotenje. Uporaba domače in tuje literature. Podajanje poročil o opravljenem delu.

**Intended Learning Outcomes:**

Knowledge and Comprehension

Students gain knowledge of protein structure and the interactions of protein with other molecules, they become familiar with the most common research methods for protein structure analysis and learn the importance of the relationship between protein structure and function in biological systems.

Application

Understanding protein structure and its connection to protein function is critical for the understanding of biological systems at the molecular level.

Analysis

Students gain the ability to evaluate protein function from the structural perspective.

Skill-transference Ability

Problem-solving experience. Team work (seminar work and laboratory course). Collection, interpretation and critical assessment of results. Use of domestic and foreign literature. Writing laboratory reports.

**Metode poučevanja in učenja:**

Predavanja, seminarji.  
Seminarske in laboratorijske vaje.

**Learning and Teaching Methods:**

Lectures, seminars  
Seminar and laboratory tutorial.

Deež (v %) /

Načini ocenjevanja:	Weight (in %)	Assessment:
Opravljene vaje so pogoj za pristop k izpitu.  Seminarska naloga Pisni izpit		Completed laboratory tutorial is a prerequisite for admission to the examination. Seminar work Written examination

**Reference nosilca / Lecturer's references:**

- **NOVINEC, Marko**, KORENČ, Matevž, CAFLISCH, Amedeo, RANGANATHAN, Rama, LENARČIČ, Brigita, BAICI, Antonio. A novel allosteric mechanism in the cysteine peptidase cathepsin K discovered by computational methods. Nature communications, ISSN 2041-1723, feb. 2014, vol. 5, art. no. 3287
- **NOVINEC, Marko**, KOVAČIČ, Lidija, LENARČIČ, Brigita, BAICI, Antonio. Conformational flexibility and allosteric regulation of cathepsin K. Biochemical journal, ISSN 0264-6021, 2010, vol. 429, no. 2, p. 379-389
- **NOVINEC, Marko**, GRASS, Robert N., STARK, Wendelin J., TURK, Vito, BAICI, Antonio, LENARČIČ, Brigita. Interaction between human cathepsins K, L, and S, Mechanism of elastinolysis and inhibition by macromolecular inhibitors. The Journal of biological chemistry, ISSN 0021-9258, 2007, vol. 282, no. 11, str. 7893-78902

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** TEHNIŠKA ANGLEŠČINA  
**Course Title:** TECHNICAL ENGLISH

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	2.	3.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	3 <sup>rd</sup>

**Vrsta predmeta / Course Type:**

splošni izbirni

**Univerzitetna koda predmeta / University Course Code:**

SI103

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
15	30	30 SV	/	/	75	5

**Nosilec predmeta / Lecturer:**

Doc. dr. Primož Jurko / Primož Jurko, Assistant Professor, PhD

**Jeziki / Languages:**

**Predavanja / Lectures:** angleški / English

**Vaje / Tutorial:** angleški / English

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

**Prerequisites:**

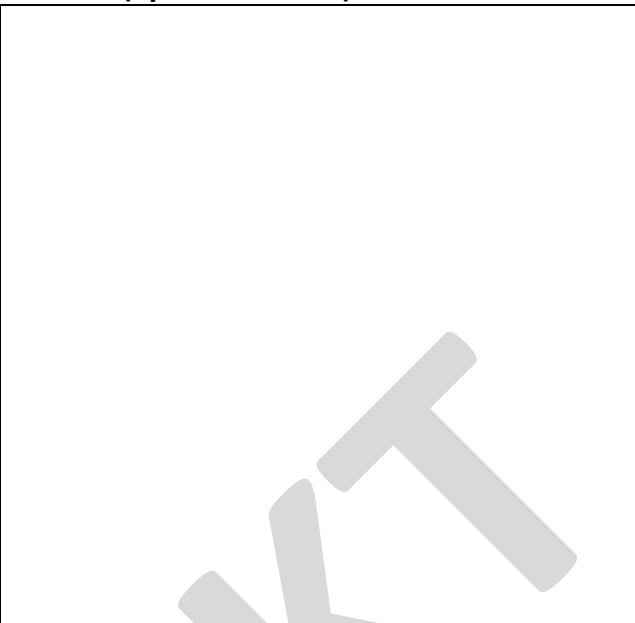
- a) za vključitev v delo: dobro srednješolsko znanje angleščine (raven B2) Evropskega jezikovnega okvirja ter vpis v prvi letnik  
b) za pristop k pisnemu izpitu: uspešno opravljena seminarska naloga (Sn) in govorna vaja (Gv)  
c) za pristop k ustnemu izpitu: pozitivno ocenjen pisni (Pi) del izpita

**Vsebina:**

Učne vsebine zajemajo naslednje tematske sklope (vsak se v semestru obravnava po dva tedna):

- 1 Zrak in ozračje
- 2 Materiali, polimeri, življenjski cikli
- 3 Prehranska veriga, zdrave in škodljive kemične snovi
- 4 Periodni sistem elementov, kemijski simboli, atomska zgradba idr.
- 5 Kemijske spojine iz naravnega okolja idr.
- 6 Kemijska industrija; kisline, baze in soli
- 7 Organska kemija, kemijska analiza, kemijske reakcije, zelena kemija

**Content (Syllabus outline):**



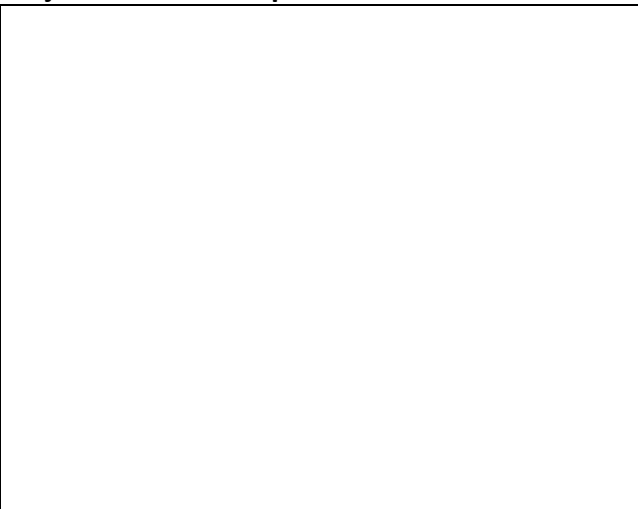
**Temeljna literatura in viri / Readings:**

- Hunt, A. in Grayson, A. 2006. *Twenty First Century Science: GCSE Chemistry Textbook*. University of York Science Education Group & the Nuffield Curriculum Centre. Oxford: Oxford University Press.
- The Staff of The Princeton Review. 2005. *Cracking the GRE Chemistry Subject Test*. 3. izd. New York: Random House, Inc. (Izbrana poglavja za univerzitetne študijske programe)
- Vukadinovič, N. 2003. *Describing Chemical Experiments*. Ljubljana: NTF – Kemijsko izobraževanje in informatika. Dostopno na: <http://www.kii.ntf.uni-lj.si/anglescina/doc/Descr%20Chem%20Exp%202003.pdf/>.
- Vukadinovič, N. 2002. *English for Chemists*. Ljubljana: Naravoslovnotehniška fakulteta, Oddelek za kemijsko izobraževanje in informatiko. [1 CD-rom].
- Dopolnilni spletni viri.

**Cilji in kompetence:**

- Usvajanje modernega angleškega strokovnega jezika, ki se uporablja v kemiji, biokemiji, kemijskem inženirstvu in kemijski tehnologiji (ESP & EAP in Chemistry)
- Bogatitev angleškega besednega zaklada s specifičnim strokovnim izrazjem med nadgrajevanjem jezikovnega znanja
- Urjenje v jezikovnih spretnostih bralnega, slušnega in vizualnega razumevanja, govornega sporazumevanja in ter ustnega in pisnega sporočanja
- Izražanje mnenj in zagovarjanje stališč v strokovni diskusiji

**Objectives and Competences:**



- Opisovanje laboratorijskih poskusov in pripomočkov v angleščini
- Interpretiranje numeričnih podatkov (kemijskih formul, enačb in grafov)
- Uporabljanje spletnih referenčnih virov in literature, npr. slovarjev, leksikonov in enciklopedij, pri prevajanju izvirnega angleškega strokovnega besedila in sestavljanju angleško-slovenskega glosarja
- Povzemanje besedil iz strokovnih in znanstvenih revij ter spletnih virov za pripravo poročil in ustnih predstavitev
- Pisanje izvlečkov, povzetkov in strokovnih člankov v angleščini
- Razvijanje učnih strategij za vseživljenjsko učenje

**Predvideni študijski rezultati:**

Znanje in razumevanje

- Bralno, slušno in vizualno razumevanje vsebin s področja stroke
- Pisno sporočanje ter govorno sporazumevanje in sporočanje v angleščini o vsebinah stroke
- Strokovna terminologija
- Uporaba referenčnih virov

Uporaba

Študentje bodo znanje lahko uporabljali pri študiju (npr. branje študijske literature v angleščini) ter pozneje v poklicu. Naučili se bodo spremljati dogajanje in novosti na področjih kemije, biokemije, kemijskega inženirstva in kemijske tehnologije po angleških virih in literaturi. Ob koncu študija se bodo lažje vključili v trajnostni razvoj omenjenih področij.

Refleksija

Znanje angleškega jezika je temeljna spretnost in služi za splošno komunikacijo v modernem globalnem svetu.

Prenosljive spretnosti

Prenosljive spretnosti so: urjenje sposobnosti razumevanja, sporočanja in sporazumevanja,

**Intended Learning Outcomes:**

Knowledge and Comprehension

Application

Analysis

Skill-transference Ability

sodelovanja v diskusijah; iskanje specifičnih informacij po različnih virih in sposobnost njihovega umeščanja v širši okvir; strategije učenja za razvoj samostojnih udeležencev v procesu vseživljenjskega učenja.

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**Metode poučevanja in učenja:**

Predavanja, vaje in seminarji z uporabo računalnika; samostojno ter sodelovalno delo v parih in skupinah. Frontalna metoda se uporablja pri predstavitev in pojasnjevanju temeljnih vsebin.

**Learning and Teaching Methods:**

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Delež (v %) /

Weight (in %)

**Assessment:**

**Načini ocenjevanja:**

*I. metode ocenjevanja:*  
a) seminarska naloga (Sn) s prevodom in glosarjem, oddana v času predavanj in vaj pred ustno predstavitev  
b) govorna vaja (Gv) med študijskim letom, tj. ustna predstavitev s pomočjo opornih točk in ključnih besed ter slikovnega ponazoritvenega gradiva na PowerPointovih prosojnicah  
c) pisni izpit (Pi), ki ga imajo študentje možnost opraviti tudi med študijskim letom z dvema pozitivno opravljenima kolokvijema  
d) sprotno sodelovanje  
*II. struktura končne ocene:*  
Pisni izpit (Pi): 75 % ocene  
Preverjanje med letom (Sn + Gv): 20 % ocene  
Sodelovanje (aktivna udeležba pri predavanjih in vajah): 5 % ocene  
*III. ocenjevalna lestvica:*  
a) končna ocena: 1–5 negativno, 6–10 pozitivno  
b)

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**Reference nosilca / Lecturer's references:**

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## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	TEMELJI BIOKEMIJE
<b>Course Title:</b>	FUNDAMENTALS OF BIOCHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	1.	2.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	2 <sup>nd</sup>

Vrsta predmeta / Course Type:

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

BK110

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	30	/	/	/	75	5

Nosilec predmeta / Lecturer:

prof. dr. Brigita Lenarčič / Dr. Brigita Lenarčič, Full Professor

Jeziki / Languages:

Predavanja / Lectures: slovenski / Slovenian

Vaje / Tutorial: /

Pogoji za vključitev v delo oz. za opravljanje  
študijskih obveznosti:Študent oz. kandidat mora imeti predmet  
opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Molekule in življenje.  
Aminokislina, peptidi in proteini.  
3D zgradba proteinov in njihova biološka vloga.  
Encimi: reakcije, kinetika, inhibicija, koencimi.  
Ogljikovi hidrati: zgradba in biološka vloga.  
Lipidi, biološke membrane, transport.  
DNA in RNA: zgradba in vloga.  
Ohranjanje in prenos biološke informacije.  
Rekombinantna DNA in biotehnologija.  
Osnove celičnega metabolizma in bioenergetike.  
Glikoliza in glukoneogeneza.  
Nastanek NADH, NADPH.  
Verige za prenos elektronov in nastanek ATP.

Content (Syllabus outline):

Molecules and life.  
Amino acids, peptides and proteins.  
3D structures of proteins and biological function.  
Enzymes: reactions, kinetics, inhibition, coenzymes.  
Carbohydrates: structure and biological function.  
Lipids, biological membrane, cellular transport.  
DNA and RNA: structure and function.  
Storage and transfer of biological information.  
Recombinant DNA and biotechnology.  
Basic concepts of cellular metabolism and bioenergetics.  
Glycolysis and gluconeogenesis.

Katabolizem maščobnih kislin in dušikovih spojin.

NADH, NADPH formation.  
Electron-transport chain and ATP formation.  
Catabolism of fatty acids and nitrogenous compounds.

**Temeljna literatura in viri / Readings:**

- Temelji biokemije, Boyer (Študentska založba, 2005) strani 630 (50%)

**Cilji in kompetence:**

Namen predmeta je, da študentje pridobijo biokemijske osnove (zgradba in vloga bioloških makromolekul in njihova regulacija, celični metabolizem). Po opravljenih obveznostih bo študent sposoben razumeti razlago osnovnih biokemijskih in fizioloških procesov.

**Objectives and Competences:**

The objective of the course is to provide students with the basic biochemical knowledge (structure and function of biological macromolecules and their regulation, cellular metabolism). After completing the course, students will be able to understand the basic biochemical and physiological processes.

**Predvideni študijski rezultati:**

Znanje in razumevanje

Znanje: poznavanje zgradbe in biološke vloge makromolekul. Energetske molekule in njihove pretvorbe.

Razumevanje: delovanje encimov in inhibitorjev, princip ohranjanja in prenosa genetske informacije, metabolizem.

Uporaba

Predmet daje znanja, ki so nujno potrebna za nadaljevanje študija.

Refleksija

Študent bo razmišljal o povezavi med strukturo makromolekul in njihovo biološko vlogo.

Prenosljive spretnosti

Samostojno in skupinsko delo za pripravo seminarjev, sposobnost uporabe literature in drugih virov, ustno in pisno in poročanje.

**Intended Learning Outcomes:**

Knowledge and Comprehension

Knowledge of the structure and biological function of macromolecules. High energy molecules and their interconversion.

Function of enzymes and their inhibitors, principles of the storage and transfer of biological information, metabolism

Application

The course provides knowledge essential for a successful continuation of the study programme.

Analysis

Students will reflect on the connection between structure and biological function of macromolecules.

Skill-transference Ability

Individual and group work in preparing seminars, the ability to use literature and other sources, oral and written reporting.

**Metode poučevanja in učenja:**

Predavanja, individualni in skupinski seminarji.

**Learning and Teaching Methods:**

Lectures and individual seminars.

**Načini ocenjevanja:**

Delež (v %) /

Weight (in %) **Assessment:**

Seminarska naloga Pisni izpit Ocene: 6-10 (pozitivno), 1-5 (negativno).		Seminar work Written exam Grades: 6-10 (positive), 1-5 (negative)
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**Reference nosilca / Lecturer's references:**

- KLEMENČIČ, Marina, NOVINEC, Marko, MAIER, Silke, HARTMANN, Ursula, **LENARČIČ, Brigita**. The heparin-binding activity of secreted modular calcium-binding protein 1 (SMOC-1) modulates its cell adhesion properties. PloS one, 2013, vol. 8, no. 2, art.no. e56839 (doi: 10.1371/journal.pone.0056839).
- NOVINEC, Marko, PAVŠIČ, Miha, **LENARČIČ, Brigita**. A simple and efficient protocol for the production of recombinant cathepsin V and other cysteine cathepsins in soluble form in Escherichia coli. Protein expression and purification, 2012, vol. 82, no. 1, str. 1-5.
- PAVŠIČ, Miha, **LENARČIČ, Brigita**. Expression, crystallization and preliminary x-ray characterization of the human epithelial cell-adhesion molecule ectodomain. Acta crystallographica. Section F, Structural biology and crystallization communications, 2011, vol. F67, no. 11, str. 1363-1366.

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	TEMELJI FIZIOLOGIJE
<b>Course Title:</b>	FUNDAMENTALS OF PHYSIOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UN Biokemija, 1. stopnja	/	2.	4.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	2 <sup>nd</sup>	4 <sup>th</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** BK121

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Robert Zorec / Dr. Robert Zorec, 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:**

Pri predmetu Temeljna fiziologija študent spozna 1) temelje fizioloških procesov metazojskih evkariontov s poudarkom predstavitve integrativnih mehanizmov. Pridobljeno znanje mu omogoča razumevanje temeljnih življenjskih procesov na ravni molekularnih funkcionalnih modulov v celici, na ravni delovanja posamezne celice, na ravni tkiv, organov in na sistemski ravni. 2) Spozna tudi načela in nekatere tehnologije meritev fizioloških količin, ki prispevajo k homeostazi v organizmu.

Predavanja obravnavajo teme od molekulske in celične ravni, do ravni organov in sistemov. Študenti spoznajo mehanizme homeostaze,

**Content (Syllabus outline):**

At the course Fundamental Physiology the student will learn: 1) basic principles of the physiological processes of the metazoan eukaryotic organism, with the emphasis on the integrative mechanisms. The acquired knowledge will enable students to understand the processes in live matter on the level of the molecular modules in the cell, on the level of the tissue, organs, and on the systemic level. 2) The student will also learn the principles of experimentation and measurement of physiological parameters. The lectures will cover a broad spectrum of topics from molecular and cellular level, to organs and the systemic level. Students will learn mechanisms of homeostasis, historical

zgodovinski vidik fiziologije, temelje transportnih mehanizmov na ravni celice in sistema, nato pa sistematično še mehanizme, ki prispevajo k homeostazi fizioloških količin z obravnavanjem živčnega in endokrinega sistema, mišičja, srca in obtočil, pljuč in pljučnih obtočil, ledvic in uravnavanja telesnih tekočin, acido-baznega ravnotežja, gastrointestinalnega trakta, uravnavanja telesne temperature, procesov staranja na molekularni, celični in sistemski ravni

Na vajah se študenti seznanijo z meritvami nekaterih fizioloških količin in pojavov (transmembranska napetost, akcijski potencial, krvni tlak, kontrakcija mišic, ....) hkrati spoznajo nekatere metode pri fiziološkem raziskovalnem delu. Pri vajah uporabljamo metode, ki so alternativa delu s poskusnimi živalmi (delo na rastlinskih celicah, samostojno delo z računalniško simulacijo poskusov na živalih, posnetki poskusov, preproste neinvazivne metode na človeku).

aspect of physiology, transport mechanisms, nervous and endocrine system, muscles, heart and vasculature, kidney, gastrointestinal tract, control of the body temperature, aging on the molecular, cellular and systemic level.

The practical training will be focused on measurements of selected physiological parameters and processes (e.g.: transmembrane potential, action potential, blood pressure, muscle contraction). Students will learn selected methods in physiology research. The practical training will be performed using approaches, which are the alternative to the experimental animals, i.e. the use of plant cells, work in silico, video demonstrations, non-invasive measurements on human.

#### **Temeljna literatura in viri / Readings:**

- R. Rhoades in R. Pflanzer. Human Physiology, fourth edition, Saunders College Publishing, Harcourt College Publishers, 2003. (30%) ISBN-10: 0534462510
- Optional in Slovenian language: »Temelji fiziologije – Navodila za vaje, 2. popravljena in dopolnjena izd. 2012« authors, Marko Kreft, Helena Chowdhury in Robert Zorec. ISBN 978-961-91257-7-9

#### **Cilji in kompetence:**

Cilji predmeta so naučiti študente temeljev procesov v metazojskih evkariontskih organizmih, ki prispevajo k homeostazi. Kompetence študenta bodo poznavanje načel in nekaterih tehnologij meritev fizioloških količin, ki prispevajo k homeostazi v organizmu.

#### **Objectives and Competences:**

Students will learn the principles and selected methodologies in physiology. Competences will include principles of measurement in physiology, and understanding of homeostasis.

#### **Predvideni študijski rezultati:**

##### Znanje in razumevanje

Pri predmetu Temelji fiziologije študent spozna temelje fizioloških procesov metazojskih evkariontov. Spozna tudi načela in nekatere tehnologije meritev fizioloških količin. Pridobljeno znanje mu omogoča razumevanje temeljnih življenjskih procesov

#### **Intended Learning Outcomes:**

##### Knowledge and Comprehension

The outcome of the course will be acquired knowledge of the fundamental processes in the metazoan eukaryotic organism, which are essential in homeostasis in the level of molecular functional modules in the cell, the

na ravni molekularnih funkcionalnih modulov v celici, na ravni delovanja posamezne celice, na ravni tkiv, organov in na sistemski ravni.	level of cellular processes and processes in tissue, organ and organism.
<u>Uporaba</u> Študij predmeta Temelji fiziologije je nujna podlaga za razumevanje procesov v organizmih, ti pa so ključni za bioinženirstvo in mnoga druga strokovna področja biomedicine in biotehnologije.	<u>Application</u> The course is essential background for understanding processes in living organisms, which are critical in bioengineering, biomedicine and biotechnology.
<u>Refleksija</u> Študent pridobi vpogled v procese v bioloških organizmih in pridobi razumevanje homeostaze.	<u>Analysis</u> Student will learn principles of physiology in all living organisms and will understand homeostasis.
<u>Prenosljive spretnosti</u> Študent spozna temelje eksperimentalnega dela v fiziologiji in bioloških znanostih, spozna različne fiziološke količine, ki jih lahko merimo, analiziramo in interpretiramo rezultate.	<u>Skill-transference Ability</u> Student will learn basics of experimental work in physiology, biosciences. They will learn measurements of biological variables, analysis and interpretation of data.

**Metode poučevanja in učenja:**

Predavanja, laboratorijske vaje, seminarji, simulacije eksperimentov.

**Learning and Teaching Methods:**

Lectures, seminars, practical training.

Delež (v %) /  
Weight (in %)

**Načini ocenjevanja:**

Izpit (ustni in pisni) (ocena > 6)  
Seminarska naloga.  
Kolokvij iz vaj.

**70 %**  
**30 %**

**Assessment:**

Oral and written exam  
Seminar work.  
Practical courses.

**Reference nosilca / Lecturer's references:**

- RITUPER, Boštjan, CHOWDHURY HAQUE, Helena, JORGAČEVSKI, Jernej, COORSEN, Jens R., KREFT, Marko, **ZOREC, Robert**. Cholesterol-mediated membrane surface area dynamics in neuroendocrine cells. *Biochimica et biophysica acta. Molecular and cell biology of lipids*, ISSN 1388-1981, Jul. 2013, vol. 1831, iss. 7, str. 1228-1238

- MILOŠEVIĆ, Milena, STENOVEC, Matjaž, KREFT, Marko, PETRUŠIĆ, Vladimir, STEVIĆ, Zorica, TRKOV, Saša, ANDJUS, Pavle, **ZOREC, Robert**. Immunoglobulins G from patients with sporadic amyotrophic lateral sclerosis affects cytosolic Ca<sup>2+</sup> homeostasis in cultured rat astrocytes. *Cell calcium*, ISSN 0143-4160, Jul. 2013, vol. 54, iss. 1, str. 17-25.

- POTOKAR, Maja, STENOVEC, Matjaž, JORGAČEVSKI, Jernej, HOLEN, Torgeir, KREFT, Marko, OTTERSEN, Ole Petter, **ZOREC, Robert**. Regulation of AQP4 surface expression via vesicle mobility in astrocytes. *Glia*, ISSN 0894-1491, Jun. 2013, vol. 61, iss. 6, str. 917-928, ilustr., doi: 10.1002/glia.22485.

- COSTA CALEJO, Ana-Isabel, JORGAČEVSKI, Jernej, KUCKA, Marek, KREFT, Marko, GONÇALVES, Paula P., STOJILKOVIĆ, Stanko, **ZOREC, Robert**. cAMP-mediated stabilization of fusion pores in cultured rat pituitary lactotrophs. *The Journal of neuroscience*, ISSN 0270-6474, May 2013, vol. 33, iss. 18, str. 8068-8078, ilustr., doi:10.1523/JNEUROSCI.5351-12.2013.

- FLAŠKER, Ajda, JORGAČEVSKI, Jernej, COSTA CALEJO, Ana-Isabel, KREFT, Marko, **ZOREC, Robert**. Vesicle size determines unitary exocytic properties and their sensitivity to sphingosine. *Molecular and cellular endocrinology*, ISSN 0303-7207. [Print ed.], 2013, vol. 376, iss. 1/2, str. 136-147,
- RITUPER, Boštjan, GUČEK, Alenka, JORGAČEVSKI, Jernej, FLAŠKER, Ajda, KREFT, Marko, **ZOREC, Robert**. High-resolution membrane capacitance measurements for the study of exocytosis and endocytosis. *Nature protocols*, ISSN 1754-2189, 2013, vol. 8, no. 6, str. 1169-1183, ilustr., doi: 10.1038/nprot.2013.069.
- JORGAČEVSKI, Jernej, KREFT, Marko, VARDJAN, Nina, **ZOREC, Robert**. Fusion pore regulation in peptidergic vesicles. *Cell calcium*, ISSN 0143-4160, 2012, vol. 52, iss. 3/4, str. 270-276, doi: 10.1016/j.ceca.2012.04.008.
- JORGAČEVSKI, Jernej, POTOKAR, Maja, GRILC, Sonja, KREFT, Marko, **ZOREC, Robert**, et al. Munc 18-1 tuning of vesicle merger and fusion pore properties. *The Journal of neuroscience*, ISSN 0270-6474, 2011, vol. 31, issue 24, str. 9055-9066, doi: 10.1523/JNEUROSCI.0185-11.2011.
- VELEBIT MARKOVIĆ, Jelena, CHOWDHURY HAQUE, Helena, KREFT, Marko, **ZOREC, Robert**. Rosiglitazone balances insulin-induced exo- and endocytosis in single 3T3-L1 adipocytes. *Molecular and cellular endocrinology*, ISSN 0303-7207. [Print ed.], 2011, vol. 333, issue 1, str. 70-77, doi: 10.1016/j.mce.2010.12.014.
- JORGAČEVSKI, Jernej, FOŠNARIČ, Miha, VARDJAN, Nina, STENOVEC, Matjaž, POTOKAR, Maja, KREFT, Marko, KRALJ-IGLIČ, Veronika, IGLIČ, Aleš, **ZOREC, Robert**. Fusion pore stability of peptidergic vesicles. *Molecular membrane biology*, ISSN 0968-7688, 2010, letn. 27, št. 2/3, str. 65-80, doi: 10.3109/09687681003597104.

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	UPORABA ENCIMOV
<b>Course Title:</b>	APPLIED ENZYMOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	6.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	6 <sup>th</sup>

**Vrsta predmeta / Course Type:** izbirni strokovni / Elective Professional

**Univerzitetna koda predmeta / University Course Code:** BKSI4

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 LV	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Brigita Lenarčič / Dr. Brigita Lenarčič, Full Professor

**Jeziki / Languages:**

<b>Predavanja / Lectures:</b>	slovenski / Slovenian
<b>Vaje / Tutorial:</b>	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):**

Varnostni in regulatorni aspekti encimske uporabe, dokumentacija.  
 Intelektualna zaščita: objave in patenti.  
 Pridobivanje encimov v industrijske namene: iskanje virov, priprava biološkega materiala, mediji za produkcijo encimov, optimizacija proizvodnje.  
 Metode pri pripravi tehničnih encimskih preparatov v industrijskem merilu: homogenizacija, centrifugiranje, filtriranje, dvofazni sistemi, kromatografije.  
 Imobilizirani encimi: ekonomski vidiki, uporabnosti, načini priprave, primeri.  
 Encimi na trgu: encimi v prehrani (procesiranje škroba pri predelavi sadja in zelenjave, pri proizvodnji piva in vina, vloga encimov v

Safety and regulatory aspects of enzyme use, documentation.  
 Intellectual property: publishing and patenting.  
 Industrial enzyme preparations: screening sources, preparation of biological material, production optimization.  
 Large-scale preparation of technical enzymes, methods (homogenisation, centrifugation, filtration, biphasic systems, cell breakage, chromatographies).  
 Immobilized enzymes: economic aspects, coupling methods, examples.  
 Enzymes on the market: food industry (starch processing, vegetable and fruit processing, brewing industry, juice- and winemaking, enzymes for dairy products and animal feed)



mlečnih izdelkih, živalski krmi), encimi v detergentih, pri strojenju kože, v tekstilni industriji, pri proizvodnji papirja, pri analizi prehrane in pri genskem inženiringu. Biosenzorji.  
Vloga encimov pri remediaciji onesnaženega okolja.  
Uporaba encimov v kliniki: določanje encimske aktivnosti v klinične namene, primeri encimov v povezavi z boleznimi.

laundry detergents, tanning industry, textile industry, paper industry, food analysis, genetic engineering.  
Biosensors.  
Role of enzymes in the remediation of polluted environments.  
Clinical use of enzymes: determination of enzyme activities for clinical diagnosis, examples of enzymes in different diseases.

### Temeljna literatura in viri / Readings:

- Enzymes in Industry: Production and Application, W. Aehle, 3rd ed. WILEY-VCH, 2007, strani 485 (50%)

### Cilji in kompetence:

Cilj predmeta je, da se študentu poda obširen pregled uporabnosti biokatalizatorjev (encimov) v tehnične namene. Študent zna kompetentno oceniti ustreznost uporabe encimov in s tega vidika ovrednotiti prednost uporabe encima v tehnološkem postopku pri pripravi ali predelavi določenega produkta.

### Objectives and Competences:

**The objective** of the course is to provide the students with novel overview of the use of biocatalysts (enzymes) for technical purposes. Students obtain **the competence** to evaluate the potential advantages of the use of enzymes in technological procedures used for the production of specific products.

### Predvideni študijski rezultati:

Znanje in razumevanje  
Poznavanje in razumevanje uporabnosti številnih encimov v različnih tehnologijah priprave ali predelave določenih produktov.

Uporaba  
Pridobljeno znanje bo študent lahko uporabil na različnih področjih: prehrabna in tekstilna industrija, medicina, klinične preiskave...

Refleksija  
Študent bo razvil znanje potrebno za načrtovanje dela pri pripravi produktov s pomočjo encimov.

Prenosljive spretnosti  
Spretnost uporabe literature in drugih virov, zbiranje podatkov in njihova interpretacija ter sposobnost ustnega in pisnega poročanja.

### Intended Learning Outcomes:

Knowledge and Comprehension  
Knowledge and comprehension of the use of various enzymes for technological purposes.

Application  
The obtained knowledge is applicable in different fields: food and textile industry, medicine, clinical application...

Analysis  
Students will develop the knowledge necessary for planning the procedures involving the use of enzymes for technological purposes.

Skill-transference Ability  
Use of literature, data collection and interpretation, oral and written reporting.

### Metode poučevanja in učenja:

Predavanja, seminar/projekt in laboratorijske vaje.

### Learning and Teaching Methods:

Lectures, seminar/project and laboratory courses.

Deež (v %) /

Načini ocenjevanja:	Weight (in %)	Assessment:
Opravljene vaje so pogoj za pristop k izpitu. Seminaraska naloga Pisni izpit Ocene: 6-10 (pozitivno), 1-5 (negativno).		Completed laboratory course is prerequisite for the exam. Seminar work Written exam Grades: 6-10 (positive), 1-5 (negative)

**Reference nosilca / Lecturer's references:**

- Oppert, B., Morgan, TD, Hartzler, K., **Lenarčič, B.**, Galeša, K., Brzin, J., Turk, V., Yoza, K., Ohtsubo, K. & Kramer, KJ. Effects of proteinase inhibitors on digestive proteinases and growth of the red flour beetle, *Tribolium castaneum* (Herbst) Coleoptera: Tenebrionidae. *Comp Biochem Physiol, Toxicol Pharmacol*, 134, 481-490, 2003.

- **Lenarčič, B.**, & Turk, V. Thyroglobulin type-1 domains in equistatin inhibit both papain-like cysteine proteinases and cathepsin D, *J Biol Chem*, 274, 563-566, 1999.

- Gruden, K., Štrukelj, B., Popovič, T., **Lenarčič, B.**, Bevec, T., Brzin, J., Kregar, I., Herzog-Velikonja, J., Stiekema, W.J., Bosch, D. & Jongsma, M.A. The cysteine protease activity of Colorado potato beetle (*Leptinotarsa decemlineata* Say) guts, which is insensitive to potato protease inhibitors, is inhibited by thyroglobulin type-1 domain inhibitors, *Insect. Biochem Mol Biol*, 28, 549-560, 1998.

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	UPORABA INFORMACIJSKO KOMUNIKACIJSKE TEHNOLOGIJE V NARAVOSLOVJU IN TEHNIKI
<b>Course Title:</b>	USE OF ICT IN SCIENCE AND TECHNOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	1.	1.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	1 <sup>st</sup>

**Vrsta predmeta / Course Type:** izbirni splošni / Elective General

**Univerzitetna koda predmeta / University Course Code:** S1101

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	/	30 SV	/	/	75	5

**Nosilec predmeta / Lecturer:** doc. dr. Mira Trebar / Dr. Mira Trebar, Assistant Professor

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

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

Študenti bodo v okviru predmeta spoznali:

1. Predstavitev podatkov (Boolova algebra, Števila v fiksni in plavajoči vejici, digitalni in analogni podatki)
2. Strojna oprema (razvoj računalnikov, Von Neumanov model, Značilnosti procesne enote, pomnilnik, periferne naprave)
3. Programska oprema (operacijski sistemi, uporabniška programska oprema – urejevalniki teksta, urejevalniki tabel, elektronska pošta, iskanje po knjižničnih bazah podatkov, ...)
4. Osnove programiranja:  
- Osnove pisanja programa, iskanje in odpravljanje napak

**Content (Syllabus outline):**

Students in this course will learn:

1. Data presentation (Boolean algebra, Fixed numbers and floating point numbers, digital and analog data)
2. Hardware (Computer design, von Neumann model, Central processing unit, memory, peripheral devices)
3. Software (operating systems, user software- text editors, table editors, electronic mail, database search, ...).
4. Programming:  
- Basic program writing, searching and correcting errors  
- Basic data types  
- Variables

- Osnovni podatkovni tipi
- Spremenljivke
- Vhod in izhod
- Pogojni in ponavljalni stavki
- Podprogrami
- Sestavljeni podatkovni tipi
- Osnovni principi objektnega programiranja
- Uporaba nekaterih knjižnic

- Input and output
- Conditional sentences and loops
- Subroutines
- Composed data types
- Basic principles of object programming
- Use of libraries

### Temeljna literatura in viri / Readings:

- G.M.Schneider, J.L.Gersting, Invitation to Computer Science, Cengage Learning, 2013 (80%)
- M.Artač, B.Batagelj, M. Jogan, Ž. Kranjec, B.Kverh, K.Mele, P. Peer, M.Peternel, F.Solina, Uporabniška programska oprema. 4.izd Ljubljana, Fakulteta za računalništvo in informatiko, 2007. XVII, 384 str., ilustr. ISBN 978-961-6209-48-9 (50%)
- M. Lutz: Learning Python, Fifth Edition, O'Reilly Media, Inc., 2013 (25%)

### Dodatna literatura:

- D.Kodek, Arhitektura in organizacija računalniških sistemov, Bi-Tim, 2008 (15%)
- D. Flanagan, JavaScript: The Definitive Guide, Sixth Edition, O'Reilly Media, 2011 (15%)

### Cilji in kompetence:

*Cilj* predmeta je spoznati glavna programska orodja in osnove algoritmičnega razmišljanja ter kodiranja v primerno izbranem programskem jeziku (npr. Python ali Java).  
*Kompetence:* V okviru predmeta se študenti naučijo uporabljati najpogostejšo uporabniško programsko opremo in osvojijo temeljne konstrukte programskega jezika.

### Objectives and Competences:

The aim of this course is to learn the main software tools, the basics of algorithmic thinking and coding in appropriately selected programming language (eg, Python or Java).  
Competences: In the context of this course, students learn to use the most common application software and learn the basic constructs of the programming language.

### Predvideni študijski rezultati:

Znanje in razumevanje  
Poznavanje osnovne zgradbe računalnika in njegovo delovanje. Poznavanje osnovnih programskih orodij.  
Poznavanje osnovnih programskih konstruktov (spremenljivke, stavki, zanke, podprogrami, ...) in njihova učinkovita uporaba za reševanje manjših programerskih problemov.

Uporaba  
Snov predmeta predstavlja osnovno poznavanje računalniške tehnologije, ki se kot orodje uporablja na številnih področjih. Znanje programiranja je temelj za boljše razumevanje delovanja računalnika in programskih orodij, ki jih strokovnjak uporablja pri svojem delu.

### Refleksija

### Intended Learning Outcomes:

Knowledge and Comprehension  
Knowledge of basic computer building and its operation. Knowledge of basic software tools. Knowledge of basic programming constructs (variables, statements, loops, subroutines...) and their efficient use to solve small programming problems.

Application  
Subject material represents a basic knowledge of computer technology, which is used as a tool in many areas. Programming knowledge is the basis for a better understanding of computer hardware and software tools that engineer uses in his work.

### Analysis

Spoznavanje osnov algoritmičnega razmišljanja in kodiranja računalniškega programa.	Getting to know basic algorithmic thinking and coding of computer program.
<b>Prenosljive spretnosti</b> Poznavanje in uporaba računalniških orodij. Poznavanje in učinkovita uporaba osnovnih konceptov programiranja.	<b>Skill-transference Ability</b> Knowledge and use of computer tools. Knowledge and effective use of basic programming concepts.

**Metode poučevanja in učenja:**

Predavanja s pomočjo različnih AV sredstev. Praktične vaje potekajo v računalniških učilnicah, kjer študenti samostojno dopolnjujejo pridobljeno znanje. Vsi koncepti so predstavljeni na nazoren in sistematičen način s številnimi zgledi, poudarek je na njihovi uporabi na praktičnih primerih.

**Learning and Teaching Methods:**

Lectures with AV. Practical exercises take place in computer labs where students self-complementary knowledge. All concepts are presented in a vivid and systematic way with numerous examples; the emphasis is on their use in practical use cases.

Deež (v %) /

**Načini ocenjevanja:**

Weight (in %) **Assessment:**

Izpit pisni in ustni. Ocene: 6-10 pozitivno	Written and oral exam. Grades: 6-10 positive.
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**Reference nosilca / Lecturer's references:**

- QI, Lin, XU, Mark, FU, Zetian, **TREBAR, Mira**, ZHANG, Xiaoshuan. C [sup] 2SLDS : a WSN-based perishable food shelf-life prediction and LFSO strategy decision support system in cold chain logistics. Food control, ISSN 0956-7135. [Print ed.], 2014, vol. 38, str. 19-29.

- **TREBAR, Mira**, LOTRIČ, Metka, FONDA, Irena, PLETERŠEK, Anton, KOVAČIČ, Kosta. RFID data loggers in fish supply chain traceability. International journal of antennas and propagation (Online), ISSN 1687-5877. [Online ed.], 2013, vol. 2013, str. 1-9.

- **TREBAR, Mira**, PARRENO MARCHANTE, Alfredo, ALVAREZ MELCON, Alejandro. Sodobne tehnologije v sledenju in preverjanju kakovosti živil. Kakovost, ISSN 1318-0002, Okt. 2012, str. 16-18, ilustr.

- **TREBAR, Mira**, STEELE, Nigel C. Application of distributed SVM architectures in classifying forest data cover types. Computers and electronics in agriculture, ISSN 0168-1699. [Print ed.], Oct. 2008, vol. 63, no. 2, str. 119-130, ilustr.

- **TREBAR, Mira**. Use of MATLAB neural networks toolbox in a character recognition problem. Computer applications in engineering education, ISSN 1061-3773, Apr. 2005, vol. 13, no. 1, str. 66-71.

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	VIROLOGIJA
<b>Course Title:</b>	VIROLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Biokemija, 1. stopnja	/	3.	6.
USP Biochemistry, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	6 <sup>th</sup>

**Vrsta predmeta / Course Type:** izbirni strokovni / Elective Professional

**Univerzitetna koda predmeta / University Course Code:** BKS15

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	15	30 SV	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Tatjana Avšič Zupanc /  
dr. Tatjana Avšič Zupanc, Full Professor

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

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

Predmet obravnava temeljne lastnosti virusov, zgradbo in pomen posameznih virusnih struktur (beljakovine). Poimenovanje in razvrstitev virusov. Razmnoževanje virusov s posebnim poudarkom na vstopu virusov v celico, virusnim združevanjem, translacijskim nadzornim mehanizmom in virusno transformacijo. Virusna genetika. Osnove patogeneze virusnih okužb. Virusi in tumorji. Imunski protivirusni odziv. Virusni kemoterapevtiki in cepiva ter imunski serumi. Pregled pomembnih družin virusov z DNA in RNA. Rastilnski virusi, prioni in bakteriofagi. Posredne in neposredne klasične in molekularne tehnike za proučevanje virusov in

**Content (Syllabus outline):**

Basic characteristics of viral structure, morphology, proteins and their functions. Overview of viral taxonomy and replication with the emphasis on virus entry, transcription, maturation and viral protein processing. Introduction into basic concepts of viral genetics, pathogenesis and viral oncogenesis. Basic principles of viruses interacting with host immune mechanisms, effects of antiviral drugs and vaccines. Overview of important RNA and DNA virus families. Application of specific techniques in virology.

njihova praktična uporaba za diagnostiko virusnih okužb.

### Temeljna literatura in viri / Readings:

- Brooks GF, Butel JS, Morse SA. Jawetz, Melnick & Adelberg's Medical Microbiology. Stamford: Appleton & Lange (all chapters on virology), latest edition.  
- Koren S, Avšič-Županc T, Drinovec B, Marin J, Poljak M. Splošna medicinska virologija. Ljubljana: Medicinski razgledi, 2002.  
- Poljak M, Petrovec M. Medicinska virologija. Medicinski razgledi, Ljubljana 2011.  
Review articles.

### Cilji in kompetence:

Glavni cilj predmeta Virologija je, da študent spozna viruse kot najmanjše mikroorganizme, ki so brez sistema za sintezo lastnih sestavin. Študent se bo seznanil z zgradbo, razmnoževanjem, medsebojnim vplivom virusov in celic, virusno genetiko in patogenezo, virusno onkogenezo, protivirusnimi kemoterapevtiki in cepivi ter temeljnimi in diagnostičnimi virološkimi tehnikami. Študent bo tako spoznal temeljne zakonitosti virusov in se hkrati seznanil z uporabno razsežnostjo področja virologije.

### Objectives and Competences:

Understanding the life of viruses as the smallest microorganisms which do not have their own protein synthesis system. Knowledge of the viral morphology, replication, interaction with the host cells, viral genetics and pathogenesis and antiviral therapy and vaccines. Knowledge of the basic principles of viral diagnostic techniques which can be applied to many other fields.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Predmet Virologija bo dovoljeval študentu razumevanje osnovnih pojmov, ki so za to skupino mikroorganizmov specifični.

#### Uporaba

Predmet Virologija bo predstavljal podlago za nadaljni magistrski študij Biokemija in molekularna biologija.

#### Refleksija

Predmet bo dovoljeval študentom razumevanje teorije in bo hkrati nakazal praktično uporabo specifičnih metod virologije.

#### Prenosljive spretnosti

Z izvajanjem skupinskih seminarjev se bodo študenti urili v iskanju literature, pripravi pismenih izdelkov, ustnih predstavitev, diskusiji in debatah.

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Ability to understand basic concepts that are specific for this group of microorganisms.

#### Application

The course is fundamental for further PhD degree studies in Biochemistry and molecular biology.

#### Analysis

Ability to understand theory and further indicate practical use of specific methods of virology.

#### Skill-transference Ability

Group seminar work will allow students to practice literature search, written skills, oral presentations and discussions and debates.

### Metode poučevanja in učenja:

### Learning and Teaching Methods:

<p>Predavanja (nosilec predmeta povabi k sodelovanju za določena poglavja strokovnjake iz posameznega ožjega področja). Skupinski seminarji (vsako seminarsko uro bo obravnavana specifične tema v skupinah) z vodeno diskusijo. Pogovori in konzultacija študentov z učiteljem in asistenti.</p>	<p>Lectures (invited specialists from particular filed). Group seminars with discussion. Consultations with the course holder.</p>
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Deež (v %) /

**Načini ocenjevanja:**

Weight (in %)

**Assessment:**

<p>Seminarska naloga Ustni izpit Ocene: 6-10 (pozitivno), 1-5 (negativno).</p>		<p>Seminary work Oral exam Grades: positive (6-10); negative (1-5)</p>
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**Reference nosilca / Lecturer's references:**

- Fajs L, Durmiši E, Knap N, Strle F, **Avšič-Županc T**. Phylogeographic Characterization of Tick-Borne Encephalitis Virus from Patients, Rodents and Ticks in Slovenia. PLoS ONE 2012; 7(11): e48420.  
Korva M, Saksida A, Kejžar N, Schmaljohn C, **Avšič-Županc T**. Viral load and immune response dynamics in patients with haemorrhagic fever with renal syndrome. Clin Microbiol Infect 2013; 19(8): E358-E366.  
- **Avšič-Županc T**. Mosquito-borne diseases – a new threat to Europe? Clin Microbiol Infect 2013; 19(8):683-4.  
- Korva M, Knap N, Resman Rus K, Fajs L, Grubelnik G, Bremec M, Knapič T, Trilar T **Avšič-Županc T**. Phylogeographic Diversity of Pathogenic and Non-Pathogenic Hantaviruses in Slovenia. Viruses 2013; 5:3071-87.  
- Fajs I, Jakupi X, Ahmeti S, Humolli I, Dedushaj I, **Avšič-Županc T**. Molecular Epidemiology of Crimean-Congo Hemorrhagic fever Virus in Kosovo. PLoS Neglected Tropical Diseases. 2014; 8(1): e2647.