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
UŠP Kemijsko inženirstvo, 1. stopnja, UŠP Biokemija, 1. stopnja, UŠP Kemija, 1. stopnja	**/**	**1.**	**2.**
USP Chemical Engineering, 1st Cycle, USP Biochemistry, 1st Cycle, USP Chemistry, 1st Cycle	**/**	**1st**	**2nd**

Vrsta predmeta / Course Type: obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code: KE108

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:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
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, oksokisline in oksosoli. Medhalogenske spojine. Reakcije disproporcionacije in vpliv sinteznih pogojev na kemijsko ravnotežje pri pripravi oksospojin halogenov. Nomenklatura.	**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.

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 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 oksokisline prehodnih elementov. Koordinacijske spojine in njihova uporaba.

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 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_2. 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:	**Objectives and Competences:**
Cilji: Študenti usvojijo temeljno in celostno znanje anorganske kemije, poznavanje določenih anorganskih spojin, njihovih lastnosti in reaktivnosti. Pri tem študent na specifičnih primerih utrjuje in poglablja 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 nomenklaturo anorganskih spojin	**Objectives: s**tudents acquire basic and complete knowledge of inorganic chemistry, knowledge of given inorganic compounds, their properties and reactivity. Along with this, the student confirms ad 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:	**Intended Learning Outcomes:**
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 nomenklaturo anorganskih spojin).	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).
Uporaba Pridobljeno znanje in razumevanje so potrebna osnovna znanja, ki jih študent uporablja za razlago eksperimentalno določenih ali drugače pridobljenih podatkov,	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

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	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.
Refleksija Študent je sposoben oceniti pomen osnovnih kemijskih zakonitosti in teoretskega znanja za razlago eksperimentalnih dejstev in lastnosti anorganskih snovi in jih zna uporabiti v praksi.	Analysis Student is able to asses the meaning of basic chemical principles and theoretical knowledge for an explanation of experimental facts and properties of compounds and is able to use them in practice.
Prenosljive spretnosti Študent zna poiskati podatke iz strokovne literature, podatke iz virov medmrežja pa zna kritično oceniti. Zna uporabljati strokovni jezik (pisno in ustno).	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:	**Learning and Teaching Methods:**
Predavanja; sodelovalno učenje/ poučevanje ter problemsko delo na seminarjih. Sprotno preverjanje znanja s testi.	Lectures; cooperative learning/teaching and problem work at seminars; regular knowledge assessment using tests.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
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:

- 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. [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. [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, 1st Cycle	/	2nd	3rd

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
45	30	/	/	/	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:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
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.	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:	**Objectives and Competences:**
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: 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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> 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.	<u>Knowledge and Comprehension</u> 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.
<u>Uporaba</u> 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.	<u>Application</u> Knowledge of the processes and their regulation in living organisms is fundamental for other biochemical courses.
<u>Refleksija</u> 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.	<u>Analysis</u> 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.
<u>Prenosljive spretnosti</u> Spretnosti uporabe domače in tuje literature in drugih virov, zbiranja in interpretiranja podatkov, uporaba IKT, uporaba različnih postopkov, poročanje (ustno in pisno),	<u>Skill-transference Ability</u> 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:	**Learning and Teaching Methods:**
Predavanja, seminarji.	Lectures, seminars.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminarska naloga Pisni izpit		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 Ii 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 A 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	
Predmet:	BIOKEMIJSKA INFORMATIKA
Course Title:	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, 1st Cycle	**/**	**2nd**	**4th**

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	**10**	**35 LV**	**/**	**/**	**75**	**5**

Nosilec predmeta / Lecturer: doc. dr. Miha Pavšič / Dr. Miha Pavšič, 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:	**Content (Syllabus outline):**
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 (restrikcijska 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.	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. Amino acid sequences: calculation/prediction of

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.	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:	**Objectives and Competences:**
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.	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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> 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.	<u>Knowledge and Comprehension</u> 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.
<u>Uporaba</u> Znanje biokemijske informatike je danes pomembno na vseh področjih biokemije. V okviru vaj in seminarske naloge študent pridobi tudi praktična znanja.	<u>Application</u> Knowledge of biochemical informatics and its tools is important in all fields of biochemistry. Applicable knowledge is achieved through practical exercises and project work.

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

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja. Laboratorijske vaje.	Lectures. Computer exercises.

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

Reference nosilca / Lecturer's references:

- Tsaktanis T, Kremling H, **Pavšič M**, von Stackelberg R, Mack B, Fukumori A, Steiner H, Vielmuth F, Spindler V, Huang Z, Jakubowski J, Stoecklein NH, Luxenburger E, Lauber K, Lenarčič B, Gires O. Cleavage and Cell Adhesion Properties of Human Epithelial Cell Adhesion Molecule (HEPCAM). Journal of Biological Chemistry 2015 Oct 2;290(40):24574-91. doi: 10.1074/jbc.M115.662700
- **Pavšič M**, Ilc G, Vidmar T, Plavec J, Lenarčič B. The cytosolic tail of the tumor marker protein Trop2--a structural switch triggered by phosphorylation. Sci Rep. 2015 May 18;5:10324. doi: 10.1038/srep10324
- **Pavšič M**, Gunčar G, Djinović-Carugo K, Lenarčič B. Crystal structure and its bearing towards an understanding of key biological functions of EpCAM. Nature Communications 2014 Aug 28;5:4764. doi: 10.1038/ncomms5764

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	BIOKEMIJSKI PRAKTIKUM
Course Title:	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, 1st Cycle	/	1st	2nd

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:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
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	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:	**Objectives and Competences:**
Študent bo spoznal osnovne biokemijske tehnike in pravila, ki veljajo za delo v biokemijskih laboratorijih. Po opravljenih obveznostih bo sposoben samostojno izvesti osnovne biokemijske analize na osnovi pisnih navodil.	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 to independently perform essential biochemical analyses following written instructions.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
Znanje in razumevanje Študent bo poznal osnovne tehnike, ki se najpogosteje uporabljajo v biokemijskih laboratorijih in razumel njihove teoretične osnove.	Knowledge and Comprehension Students will get acquainted with the basic techniques most often used in biochemical laboratories and understand their theoretical basis.
Uporaba Študent bo znal uporabljati osnovne biokemijske tehnike.	Application Students will be able to use basis biochemical techniques.
Refleksija Študent se bo zavedal uporabnosti in omejitev posameznih metod ter pomena upoštevanja pravil pri delu v laboratoriju	Analysis Students will reflect on the use and restrictions of different methods and the importance of following safety procedures during laboratory work.
Prenosljive spretnosti 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.	Skill-transference Ability 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:	**Learning and Teaching Methods:**
Seminarji in laboratorijske vaje.	Seminars and laboratory courses.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Opravljene vaje so pogoj za pristop k izpitu. Pisni izpit		Completed laboratory course is prerequisite for the exam. Written exam

Ocene: 6-10 (pozitivno), 1-5 (negativno).		Grades: 6-10 (positive), 1-5 (negative)

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	
Predmet:	CELIČNA IN MOLEKULARNA IMUNOLOGIJA
Course Title:	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, 1st Cycle	**/**	**3rd**	**5th**

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
30	**15**	**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:	Content (Syllabus outline):
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.	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. Allergy and hypersensitivity. Immune

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	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:	**Objectives and Competences:**
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: 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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Študent se pri predmetu najprej seznani z osnovami imunologije ter z nomenklaturo. Po uvodnih predavanjih pridobi dovolj znanja, da	<u>Knowledge and Comprehension</u> Basics of immunology and nomenclature. After introductory lectures the ability to understand the principles of immunochemistry methods,

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.	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.
Uporaba 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.	Application Course topics add to the basic knowledge in life sciences. Besides the theoretical fundaments 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.
Refleksija Poleg pregleda znanj s področja imunologije in imunokemije pridobi študent občutek za način dela in razmišljanja na področju biomedicine in biotehnologije.	Analysis Besides the overview of the immunology and immunochemistry, the student is directed towards biomedical and biotechnological way of work and problem solving.
Prenosljive spretnosti 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.	Skill-transference Ability Problem solving skills, team work in laboratory, collecting data, data analysis, interpretation and critical assessment, use of English scientific literature, writing laboratory reports.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, laboratorijske vaje.	Lectures, laboratory practical courses.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Opravljene vaje so pogoj za pristop k izpitu. Kolokvij iz vaj Seminarska naloga Pisni izpit		Laboratory practical completion is required to attend written exams. Laboratory practical written exam Seminar work Written exam

Reference nosilca / Lecturer's references:

- WANG, Ching-I. A.*, **GUNČAR, Gregor***, FORWOOD, Jade K., TEH, Trazel, CATANZARITI, Ann-Maree, LAWRENCE, Gregory J., LOUGHLIN, Fionna E., MACKAY, Joel P., SCHIRRA, Horst Joachim, ANDERSON, Peter A., ELLIS, Jeffrey G., DODDS, Peter N., KOBE, 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 Ii fragment bound to cathepsin L reveals the structural basis for differentiation between cathapsins L and S. EMBO j., 1999, vol. 18, str. 793-803.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	DIPLOMSKO DELO
Course Title:	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, 1st Cycle	**/**	**3rd**	**6th**

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:	Prerequisites:
Odobrena tema diplomskega dela.	Approved topic.

Vsebina:	Content (Syllabus outline):
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.	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:	**Objectives and Competences:**
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.	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:	**Intended Learning Outcomes:**
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.	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.
Uporaba Znanje in pridobljene veščine bo diplomant lahko uporabil pri opravljanju poklica.	Application Students will use the acquired knowledge and skills in their profession.
Refleksija Povezovanje vseh pridobljenih teoretičnih znanj z reševanjem problemov na področju biokemije ter kritični pogled na uporabnost teh znanj.	Analysis Integrations of theoretical knowledge with biochemical problem solving and a critical perspective on the usefulness of this knowledge.
Prenosljive spretnosti Pri delu bo diplomant pridobil znanja o metodah reševanja problemov, o načinu prezentacije teh znanj v pisani in govorjeni	Skill-transference Ability Students will acquire knowledge on the methods of problem solving, presentation of knowledge in written and oral form in

obliki povezani z ostalimi metodami posredovanja raziskav ugotovitev itd.	connection with other methods, etc.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
študijsko in raziskovalno delo pod vodstvom mentorja, po možmosti tudi delo v laboratoriju.	Study and research work under the supervision of the mentor, if possible also laboratory work.

Načini ocenjevanja:	Deež (v %) / Weight (in %)	**Assessment:**
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.		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:

/

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	ENCIMATIKA
Course Title:	ENZYMOLOGY

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, 1st Cycle	**/**	**3rd**	**5th**

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:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Nomenklatura in klasifikacija encimov: razredi encimov, reakcije, izoencimi, 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 preko vezave liganda (alosterični in	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

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:	**Objectives and Competences:**
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: 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:	**Intended Learning Outcomes:**
Znanje in razumevanje Pridobljeno znanje omogoča razumevanje encimsko kataliziranih reakcij in njihove regulacije na nivoju strukturno-funkcijskih lastnosti encimov.	Knowledge and Comprehension Acquired knowledge enables the understanding of enzyme-catalysed reactions and their regulation at the structural and functional levels.
Uporaba Poznavanje delovanja encimov ima široko uporabnost v vseh panogah, kjer so vključeni encimi (znanost, medicina, industrija).	Application Knowledge of enzyme function is widely applicable in various fields, such as research, medicine and industry.
Refleksija Študent poveže pridobljeno znanje s strategijami uporabnosti encimov.	Analysis Students are able to link the acquired knowledge with the strategies of the use of enzymes.
Prenosljive spretnosti Sposobnost uporabe domače in tuje literature, kritično branje raziskovalnih člankov, sposobnost ustnega in pisnega poročanja.	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

Načini ocenjevanja:	Delež (v %) / 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)

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 ihibition 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	
Predmet:	FIZIKA
Course Title:	PHYSICS

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Kemijsko inženirstvo, 1. stopnja, UŠP Biokemija, 1. stopnja, UŠP Kemija, 1. stopnja	**/**	**1.**	**1. in 2.**
USP Chemical Engineering, 1st Cycle, USP Biochemistry, 1st Cycle, USP Chemistry, 1st Cycle	**/**	**1.**	**1st and 2nd**

Vrsta predmeta / Course Type: Obvezni/Mandatory

Univerzitetna koda predmeta / University Course Code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
90	/	**60 SV**	/	/	**150**	**10**

Nosilec predmeta / Lecturer: prof. dr. Svjetlana Fajfer / Dr. Svjetlana Fajfer, Full Professor
prof. dr. Janez Bonča / Dr. Janez Bonča, Full Professor
prof. dr. Igor Muševič / Dr. Igor Muševič, Full Professor

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

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

Vsebina:	Content (Syllabus outline):
Kinematika: premo enakomerno in pospešeno gibanje točkastega telesa, gibanje v prostoru. **Dinamika:** sila in masa. 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. **Mehanika tekočin:** hidrostatika, hidrostatični	**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; 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.

tlak, vzgon, hidrodinamika, opis toka tekočin, Bernoullijeva enačba.
Nihanje in valovanje: amplituda, frekvenca in nihajni čas, sinusno nihanje, nihanja molekul, vsiljeno nihanje, sklopljeno nihanje, spekter nihanja, longitudinalno in transferzalno valovanje, energijski tok, gostota energijskega toka, valovna dolžina, hitrost valovanja, interferenca, stoječe valovanje, spekter valovanja, lastna nihanja, osnove akustike.
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 elektricnem polju, izoliran prevodnik v električnem polju, influenca, 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 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, lorn in interferenca svetlobe, svetlobni energijski tok, absorpcija svetlobe, fotometrija, spekter svetlobe, elektromagnetno sevanje segretih 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 Broglijeva valovna dolžina, Bohrov model atoma

Fluid mechanics: hydrostatics, hydrostatic pressure; buoyancy; hydrodynamics; description of fluid flow; Bernoulli's equation.
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.
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 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:

Osnovna/Basic:

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

Dodatna/Additional:

- 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:	**Objectives and Competences:**
Predmet je podlaga za pridobitev kompetenc s področja priprave materiala za preiskave in izvajanje nadzora kakovosti kar vključuje umerjanje analizatorjev, izvajanje kontrole kvalitete dela in sodelovanje pri kontroli kvalitete rezultatov.	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:**
Znanje in razumevanje 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.	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.
Uporaba Dobro poznavanje osnovnih fizikalnih zakonitosti olajša študentu delo s sodobno laboratorijsko opremo, mu omogoča poglobljeno razumevanje njenega delovanja in tako 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,	Application 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
Refleksija Pridobljeno znanje fizikalnih osnov bo študentu omogočilo kritično ovrednotiti rezultate laboratorijskih meritev in poglobljeno razumevanje predpisanih postopkov pri izvajanju meritev.	Analysis The acquired knowledge of physics will enable the student to critically evaluate the outcomes of laboratory measurements and rigorous understanding of prescribed measurement procedures.

Prenosljive spretnosti Sposobnost samostojnega spremljanja novih spoznanj in literature s področja laboratorijske tehnike. Razumevanje fizikalnih meritev in sposobnost njihovega ovrednotenja. Kritičen odnos do standardov kakovosti.	Skill-transference Ability 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.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja s prikazom fizikalnih eksperimentov. Računske vaje.	Lectures with demonstration of physical experiments. Problem solving.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit iz računskih vaj. Končna ocean je sestavljena iz		Written exam problem solving. Final score:
-izpita iz teorije	**50 %**	theory: 50%,
-izpita iz vaj	**50 %**	problem solving: 50%.
Ocene 6-10 pozitivno.		Grades 6-10 positive results.

Reference nosilca / Lecturer's references:

Prof. dr. Svjetlana Fajfer / Dr. Svjetlana Fajfer, Full Professor

1. Svjetlana Fajfer, Jernej F. Kamenik, Ivan Nisandzic, Jure Zupan "Implications of Lepton Flavor Universality Violations in B Decays", Phys.Rev.Lett. 109 (2012) 161801.

2. Ilja Doršner, **Svjetlana Fajfer**, Nejc Košnik, Ivan Nišandžić "Minimally flavored colored scalar in bar B ->D (*) tau bar nu and the mass matrices constraints", JHEP 1311 (2013) 084.

3. Ilja Dorsner, **Svjetlana Fajfer**, Admir Greljo, Jernej F. Kamenik "Higgs Uncovering Light Scalar Remnants of High Scale Matter Unification", JHEP 1211 (2012) 130.

4. Jure Drobnak, **Svjetlana Fajfer**, Jernej F. Kamenik "Probing anomalous tWb interactions with rare B decays", Nucl.Phys. B855 (2012) 82-99.

5. Ilja Dorsner, **Svjetlana Fajfer**, Jernej F. Kamenik, Nejc Kosnik "Light colored scalars from grand unification and the forward-backward asymmetry in t t-bar production", Phys.Rev. D81 (2010) 055009.

Prof. dr. Janez Bonča / Dr. Janez Bonča, Full Professor

1. VIDMAR, Lev, **BONCA, 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).

2. MIERZEJEWSKI, Marcin, **BONČA, Janez**, PRELOVŠEK, Peter. Integrable Mott insulators driven by a finite electric field. Phys. Rev. Lett., 107, 126601-1-126601-4, (2011).

3. 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).

4. VIDMAR, Lev, **BONČA, Ja**nez, 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).

5. 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).
6. BONČA, Janez, MAEKAWA, Sadamichi, TOHYAMA, T. Numerical approach to the low-doping regime of the t-J model. *Phys. Rev. B* 76, 035121 (2007).

Prof. dr. Igor Muševič / Dr. Igor Muševič, Full Professor

1. I. Muševič, Izpitna vprašanja iz fizike za kemike, (Zbirka izbranih poglavij iz fizike, 36). Ljubljana: DMFA - založništvo, 2002. 9 str. ISBN 961-212-126-5.
2. M. Vilfan, **I. Muševič**, Tekoči kristali, (Knjižnica Sigma, 74). Ljubljana: DMFA - založništvo, 2002. 117 str., ilustr. ISBN 961-212-136-2.
3. I. Muševič, M. Škarabot, U. Tkalec, M. Ravnik, S. Žumer, Two-dimensional nematic colloidal crystals self-assembled by topological defects. *Science* 313, 954-958 (2006).
4. U. Tkalec, M. Ravnik, S. Čopar, S. Žumer, **I. Muševič**, Reconfigurable knots and links in chiral nematic colloids. *Science* 333, 62 (2011).
5. I. Muševič, S. Žumer, Maximizing memory. *Nature Materials* 10, 1 (2011).

Predmet:	FIZIKALNA KEMIJA
Course Title:	PHYSICAL CHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UNI Biokemija, 1. stopnja	**/**	**2**	**3,4**
USP Biochemistry, 1st Cycle	**/**	**2nd**	**3rd,4th**

Vrsta predmeta / Course Type:	Obvezni/mandatory
Univerzitetna koda predmeta / University Course Code:	BK113S

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
80	**25**	**45 LV**	**/**	**/**	**150**	**10**

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:	**Prerequisites:**
Študent mora imeti predmet vpisan v VIS.	The course has to be assigned to the student in the VIS system.

Vsebina:	**Content (Syllabus outline):**
Plini. Uvod. Lastnosti plinov. Enačbe stanja, idealni in realni plini. Kritični pojavi, utekočinjanje plinov. **Prvi zakon termodinamike.** Delo in toplota. Prvi termodinamični zakon. Notranja energija, entalpija. Toplotne kapacitete. Kalorimetrija. Diferenčna dinamična kalorimetrija. Termokemija. Odvisnost entalpije od temperature.	**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. Differential scanning calorimetry. Thermochemistry. Dependence of enthalpy on temperature. **The second law of thermodynamics.** Reversible

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 in kriterij za snovno ravnotežje. Fazno pravilo. Fazna ravnotežja. Clausius-Clapeyronova enačba. Fazni diagrami.
Raztopine. Parcialne molske količine. Idealne in neidealne raztopine. Termodinamika mešanja. Raoultov in Henryjev zakon. Koligativne lastnosti. Raztopine elektrolitov. Ionske aktivnosti. Debye-Hückelov zakon. Vsoljevanje in izsoljevanje. Koligativne lastnosti raztopin elektrolitov. Donnanov efekt. Biološke membrane.
Kemijsko ravnotežje. Termodinamična konstanta kemijskega ravnotežja. Ravnotežje v plinastem stanju. Heterogeno ravnotežje. Vpliv temperature in tlaka na ravnotežje. Vezanje ligandov na makromolekule. Disociacijska ravnotežja.
Elektrokemija. Elektrokemijski členi. Napetost galvanskega člena. Termodinamika galvanskega člena. Biološka oksidacija. Membranski potencial.
Kemijska kinetika. Hitrostni zakon, red reakcije in konstanta reakcijske hitrosti. Mehanizem reakcije. Razpolovni čas. Vzporedne, postopne in obojesmerne reakcije. Vpliv temperature na hitrost reakcije. Kataliza. Aktivacijska energija. Encimska kinetika in inhibicija.

Laboratorijske vaje: Kalorimetrija. Parni tlak in izparilna entalpija. Krioskopija. Heterogeno ravnotežje. Napetost in notranja upornost galvanskih členov, merjenje pH. Termodinamika galvanskega člena. Prevodnost šibkih in močnih elektrolitov. Protolitsko ravnotežje. Kemijska kinetika.

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.
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. Equilibrium in gaseous systems. Heterogeneous equilibrium. Effect of temperature and pressure on equilibrium. Binding of ligands to macromolecules. Bioenergetics. Dissociation equilibria.
Electrochemistry. Electrochemical cells. Electromotive force (EMF) of galvanic cell. Thermodynamics of galvanic cells. Biological oxidation. Membrane potential.
Chemical kinetics. Reaction rates, reaction order and the rate constant. Reaction mechanism. The half-life. Reversible, consecutive and chain reactions. The effect of temperature on reaction rate. Catalysis. Activation energy. Enzyme kinetics and inhibition.

Laboratory practice: Calorimetry. Vapour pressure and heat of vaporization. Cryoscopy. Heterogeneous equilibrium. EMF 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; 190 strani (50 %).

P. W. Atkins: Physical Chemistry, 7th Edition, Oxford University Press, Oxford, 2002, 400 strani (38 %).

Matjaž Bončina, Janez Cerar, Andrej Godec, Barbara Hribar Lee, Andrej Jamnik, Jurij Lah, Andrej Lajovic, Miha Lukšič, Črtomir Podlipnik, Iztok Prislan, Jurij Reščič, Bojan Šarac, Matija Tomšič in Gorazd Vesnaver: FIZIKALNA KEMIJA – PRAKTIKUM, interno študijsko gradivo, Ljubljana, 2011, 260 strani (40 %).

Dopolnilna literatura:

P. Atkins and J. de Paula: Physical Chemistry for the Life Sciences, Oxford University Press, Oxford, UK, 2006.

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 delu ter k abstraktnemu in kritičnemu razmišljanju o svojih opažanjih. Osvojeno znanje mu pomaga razumeti in interpretirati pojave v naravi ter jih povezovati z drugimi naravoslovnimi vedami, še posebej s temami iz biokemije. Eden od pomembnih cilje je, da študenti preverijo razumevanje pridobljenega teoretičnega znanja v laboratoriju, kjer se spoznajo z meritvami pomembnih fizikalnih zakonitosti in lastnosti snovi.

Objectives and Competences:

Physical chemistry is a fundamental natural science course where students learn about basic physical-chemical principles and their application in solving various problems in chemistry and nature. The aim is to direct student to independent work and to critical and abstract thinking about their observations. The acquired knowledge helps students to understand and interpret phenomena in nature and to relate them with other natural sciences, in particular with subjects related to biochemistry. One of important objectives is that students verify their understanding of theoretical knowledge of physical-chemical principles in laboratory by measuring various physical properties of matter.

Predvideni študijski rezultati:

Znanje in razumevanje

Študent se pri predmetu spozna z osnovnimi naravnimi zakonitosti sistemov in fizikalno kemijskih količin. Osvoji osnovne termodinamske zakone, pojme obrnljivi in neobrnljivi procesi ter spozna kriterije za spontanost procesov in za ravnotežje. Spozna razliko med termodinamiko in kinetiko ter osvoji pristope za obravnavo preprostih in bolj zapletenih reakcijskih mehanizmov, npr. encimske kinetike. Nauči se razmišljati v okviru različnih enostavnih modelov. Osnovne termodinamične zakonitosti se

Intended Learning Outcomes:

Knowledge and Comprehension

Students learn to understand basic natural principles for various systems and physical and chemical quantities. They are acquainted with basic thermodynamic laws, with concepts reversible and irreversible processes, with criteria for spontaneity and equilibrium. Students learn to understand the difference between thermodynamics and kinetics and acquire the principles for treating simple and more complex reaction mechanisms, e.g. enzyme kinetics. They acquire critical thinking in the framework of simple models and learn to apply basic

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. Velik poudarek predmeta je tudi na laboratorijskih vajah, katerih cilj je pridobivanje spretnosti za izvajanje meritev termodinamičnih in kinetičnih količin. Študent se nauči pravilnega in kvalitetnega izvajanja meritev in ustreznega podajanja rezultatov, ki jih interpretira v skladu s teoretičnim znanjem, ki ga je osvojil pri predavanjih.	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. Emphasis of the course is also on laboratory practice where students learn about how to measure thermodynamic and kinetic quantities. They are taught how to correctly and precisely perform measurements and report their results. They interpret the results in frames of theories which they learned in courses.
Uporaba Študij predmeta Fizikalna kemija 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. Študent bo osvojil tudi veščine, ki so potrebne za kvalitetno izvajanje meritev fizikalno-kemijskih količin. Spretnosti in izkušnje, ki jih bo pridobil pri delu v laboratoriju, mu bodo koristile pri nadaljnjem strokovnem razvoju in pri vključevanje v delo v večjih interdisciplinarnih raziskovalnih skupinah in v industrijskih družbah. S tem se bo naučil posredovati znanje in rezultate drugim.	Application 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 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. Students will gain skills necessary to correctly perform measurements of physical-chemical properties. The skills and experience they acquire in team work in laboratory will be useful in their future professional work, in particular in larger interdisciplinary research groups or in teams in companies. In this way they learn how to transfer knowledge among group members.
Refleksija Študent pridobi občutek za fizikalno-kemijski način razmišljanja, razvije zmožnost abstraktne predstave o fizikalno-kemijskih količinah in se naučil povezovanja znanja. To mu omogoča interpretacijo pojavov v naravi, reševanje praktičnih problemov na raznih področjih in odločanje o smiselnosti uporabe spoznanih teorij v praksi.	Analysis Students acquire the physicochemical way of thinking, develop abstract conceptions of physical-chemical properties, and learn to correlate the knowledge. This enables them to interpret phenomena in nature, to solve practical problems in various fields, and to critically assess the use appropriate theories in practice.
Prenosljive spretnosti Študent se nauči uporabljati domačo in tujo literaturo, privadi se varnega dela v laboratoriju, dela z raznimi aparaturami ter	Skill-transference Ability Students learn to use Slovene and English (international) literature, get trained in safe work in laboratory with various apparatuses, and learn

zbiranja, obdelovanja in interpretiranja rezultatov. Nauči se uporabljati računalnik tako za obdelavo kot za prikaz rezultatov in podajati pregledna in eksaktna poročila o opravljenem delu. Predmet študenta navaja tako na timsko kot tudi na samostojno delo.	to collect, treat, and interpret results. They learn to use the computer for calculations and graphical presentation of results and to clearly and exactly write reports of their work. Students learn to work in laboratory, both in teams and independently.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, seminarji, laboratorijske vaje.	Lectures, seminars, practical course.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
A) Pisni izpit, ki ga lahko nadomestijo trije pozitivno ocenjeni pisni testi med letom. B) Delež (weight) % [pisni izpit] 70 % [kolokvij] 30 % Ocene: pozitivno 6-10; negativno 1-5.	30 % 70 %	Written examination, which can be passed by 3 written tests during the year. (weight) % [pisni izpit] 70 % [kolokvij] 30 % 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	
Predmet:	FUNKCIJSKA GENOMIKA
Course Title:	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, 1st Cycle	/	3rd	6th

Vrsta predmeta / Course Type: izbirni strokovni / Elective Professional

Univerzitetna koda predmeta / University Course Code: BKSI7

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:	Content (Syllabus outline):
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.	*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 - genotypisation 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 sistemski biologiji, osnove modeliranja bioloških mrež, orodja bioinformatike v funkcijski genomiki in sistemski biologiji. *Modelni organizmi v sistemski 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. *Urejanje genoma* – uporaba novih metod za urejanje genoma (npr. CRISPR-Cas9) v funkcijski genomiki.	*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. *Genome editing* – use of new methods for genome editing (e.g. CRISPR-Cas9) in functional genomics.

Temeljna literatura in viri / Readings:

Izbrana poglavja iz:

1) Prevsner J. 2015 Bioinformatics And Functional Genomics, 3rd edition. Wiley Blackwell, 1160 strani (~15 %)

2) Stagljar I. (Ed.) 2015 Yeast Functional Genomics and Proteomics. Humana Press, 304 strani (~25 %)

3) Palsson B.O. 2015 Systems Biology: Constraint-based Reconstruction and Analysis. Cambridge University Press, 531 strani (~20 %)

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:	**Objectives and Competences:**
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 sistemski biologiji pri sesalcih in modelnih organizmih. **Predmetno specifične kompetence**:	**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:

sposobnost načrtovanja eksperimentov s področja funkcijske genomike; sposobnost uporabe eksperimentalnih in bioinformatskih orodij, sposobnost razumevanja in interpretacije podatkov.	planning experiments in functional genomics, use of experimental bioinformatics tools, understanding and interpreting data.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
Znanje in razumevanje - Poznavanje zgradbe in vloge človeškega genoma. - Poznavanje in razumevanja osnov transkriptomke, proteomike, metabolomike ion 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.	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
Uporaba - Sposobnost uporabe specifičnih eksperimentalnih metod funkcijske genomike. - Sposobnost uporabe specifičnih bioinformatskih orodij.	Application - Ability to use specific experimental methods of functional genomics - Ability to use specific bioinformatics tools
Refleksija Študentje bodo razvili sposobnost kompleksnega vpogleda v biološke sisteme. Pridobili bodo sposobnost akstraktnejšega dojemanja organizacije in delovanje genoma ter celic in organizmov.	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.
Prenosljive spretnosti - Sposobnost intepretacije eksperimentalnih podatkov.	Skill-transference Ability - Ability to interpret experimental data

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, seminarji, laboratorijsko delo.	Lecture, seminars, laboratory-based practical work

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)

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	
Predmet:	INSTRUMENTALNE METODE ANALIZE
Course Title:	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, 1st Cycle	**/**	**2nd**	**3rd**

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:	**Prerequisites:**
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	**Content (Syllabus outline):**
Pregled pomembnih kemijskih ravnotežij v analizni kemiji, pufrske raztopine. Klasične analizne metode; njihove značilnosti in omejitve. Instrumentalne analizne metode: delitev, osnovni principi metod, kvantitativno vrednotenje meritev (umeritvena krivulja, standardni dodatek). **Pregled spektroskopskih analiznih metod:** Molekularna absorpcijska spektrometrij (UV in VIS) osnove metode (Beer-Lambertov zakon) in instrumentacije, primeri uporabe v biokemijski analitiki. Molekulska fluorescenčna spektroskopija; osnove metode, instrumentacija	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. Atomic absorption spectroscopy: flame and electrothermal atomization, hydride

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 senzorji.
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 (ionoselektrivne elektrode, potenciometrične titracije).

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:	**Objectives and Competences:**
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**: 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:	**Intended Learning Outcomes:**
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.	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 the will get practical skills for the work in the analytical laboratory.
Uporaba Poleg fizikalno-kemijskih osnov, ki so osnova razumevanje analiznih postopkov, bodo	Application Besides theoretical physical and chemical knowledge, which is the basis for the

pridobili tudi praktična znanja, ki so potrebna pri zasnovi in izvedbi analiz ter kritični interpretaciji podatkov in dobljenih rezultatov.	understanding of analytical procedures, they will get also practical knowledge which is important for planning and performing of analysis and interpretation of analytical data.
Refleksija 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.	Analysis 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.
Prenosljive spretnosti 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.	Skill-transference Ability 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.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Eksperimentalna predavanja in laboratorijske vaje.	Lectures and laboratory exercises

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pogoj za izpit so uspešno opravljene vaje s pisnim testom. 25 %	25%	Completed laboratory course with written test is prerequisite for the exam.
Pisni in ustni izpit 75 %	75%	Written and oral examination
Ocene: 6-10 pozitivno		Marks: 6-10 positive

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 hydrophilicinteraction liquid chromatography tandem mass spectrometry. J. chromatogr., A, 2011, vol. 1218, issue 28, str. 4417-4425,

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	KEMIJSKA ANALIZA ŽIVIL
Course Title:	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, 1st Cycle	/	3rd	6th

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: Izr. prof. dr. Irena Kralj Cigić / Dr. Irena Kralj Cigić, 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:	Content (Syllabus outline):
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	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

različnimi detektorji. 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 superkritično tekočino itd., 9. Izbira analizne metode, presejalne metode, hitri testi 10. Vrednotenje rezultatov analiz in validacija analiznih metod.	detectors. 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:	**Objectives and Competences:**
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 primernega 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	**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:	**Intended Learning Outcomes:**
Znanje in razumevanje Študenti spoznajo glavne analizne metode za določanje makro- in mikrosestavin živil in jih znajo kritično uporabiti: poznajo prednosti in omejitve posameznih metod, motnje, vire napak.	Knowledge and Comprehension 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.
Uporaba Študenti znajo izbrati in v laboratoriju uporabiti primerne analizne metode. Zna rokovati z enostavnejšimi analiznimi inštrumenti.	Application To choose and perform suitable analytical method in the laboratory. To handle with simple analytical instruments.
Refleksija Študentje kritično ovrednotijo analizne metode, prav tako tudi rezultate, ki jih dobijo z njihovo uporabo.	Analysis To critically evaluate different analytical methods and also evaluation of results.
Prenosljive spretnosti 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.	Skill-transference Ability 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:	**Learning and Teaching Methods:**
Predavanja, vaje, seminar.	Lectures, laboratory exercises, seminar.

Načini ocenjevanja:	Deež (v %) / Weight (in %)	**Assessment:**
Opravljene vaje so pogoj za pristop k izpitu.		Completed laboratory course is prerequisite for the exam.
Kolokvij iz vaj 30 %	**30 %**	Test from laboratory course
Pisni izpit 30 %	**30 %**	Written exam
Ustni izpit 40 %	**40 %**	Oral exam
Ocene: 6-10 (pozitivno), 1-5 (negativno).		Grades: 6-10 (positive), 1-5 (negative)

Reference nosilca / Lecturer's references:

- Navodila za vaje pri predmetu Kemijska analiza živil, H. Prosen, **I. Kralj Cigić**, UL FKKT, 2006.
- **I. Kralj Cigić**, M. Strlič, A. Schreiber, M. Kocjančič, B. Pihlar, Ochratoxin A in wine: its determination and photostability, Anal. Lett., 39 (2006) 1475-1488.
- **I. Kralj Cigić**, 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.
- **I. Kralj Cigić**, H. Prosen, An overview of conventional and emerging analytical methods for the determination of mycotoxins. Int. J. Mol. Sci., 10 (2009) 62-115.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	KEMIJSKI PRAKTIKUM
Course Title:	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, 1st Cycle	**/**	**1st**	**1st**

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, merjenj 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 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; Pufrske 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,

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 basical chemical principles.
Practical exercises - contents: Formulae of chemical compounds; Chemical reaction, 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, solubiliy of substances, chemical equilibrium, ionization and redox

protolitskih ravnotežjih in redoks reakcijah.	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:	**Objectives and Competences:**
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:** 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:	**Intended Learning Outcomes:**
Znanje in razumevanje Študent usvoji osnovne principe varnega dela v kemijskem laboratoriju ter zna osnove kemijskega računanja uporabiti pri kvantitativnem vrednotenju določenih eksperimentov.	Knowledge and Comprehension Knowledge of the basic principles of safety at work and different methods of work in a laboratory. Application of basic chemical calculations in solving practical problems.
Uporaba Pridobljene znanje oziroma spretnosti pri laboratorijskem delu in znanje osnovnega kemijskega računanja so temelji predmetom pri nadaljnjem študiju.	Application Knowledge and skills gained through laboratory practice, and the knowledge of basic chemical provide a foundation for further studies.
Refleksija Študent je sposoben kritično ovrednotiti izvedene meritve in oceniti dobljene rezultate pri tem pa razvija sposobnosti za samostojno laboratorijsko delo.	Analysis The student can critically evaluate measurements and results while developing the skills required for independent laboratory work.
Prenosljive spretnosti Študent pridobi praktične laboratorijske spretnosti in izkušnje, znanje osnovnega kemijskega računanja ter, zna uporabljati	Skill-transference Ability The student gains practical laboratory skills and experience, a knowledge of chemical calculation, and can use correct terminology in

strokovni jezik (pisno in ustno)	both written and spoken form.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
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.	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:	Delež (v %) / Weight (in %)	**Assessment:**
Opravljene vaje so pogoj za pristop k izpitu. Pisni izpit (nadomestita ga lahko dva pozitivno ocenjena kolokvija). Ocene: pozitivno 6-10; negativno 1-5		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 nanoparticels as a cathode material for lithium-ion batteries. – Angewandte Chemie, 2010, 49, 7222-7224.

UČNI NAČRT PREDMETA	
Predmet:	MATEMATIKA
Course Title:	MATHEMATICS

Študijski program in stopnja Study Programme and Level	**Študijska smer Study Field**	**Letnik Academic Year**	**Semester Semester**
UŠP Kemijsko inženirstvo, 1. stopnja, UŠP Biokemija, 1. stopnja, UŠP Kemija, 1. stopnja	**/**	**1.**	**1. in 2.**
USP Chemical Engineering, 1st Cycle, USP Biochemistry, 1st Cycle, USP Chemistry, 1st Cycle	**/**	**1.**	**1st and 2nd**

Vrsta predmeta / Course Type:	Obvezni / Mandatory
Univerzitetna koda predmeta / University Course Code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
90	/	60 SV	/	/	150	10

Nosilec predmeta / Lecturer: doc. dr. Jaka Smrekar / Dr. Jaka Smrekar, Assistant Professor
prof. dr. Petar Pavešić / Dr. Petar Pavešić, Full Professor

Jeziki / Languages:

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

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

Vsebina:	**Content (Syllabus outline):**
Limite funkcij: računske operacije s funkcijami (vsota, produkt, kompozitum, inverzna funkcija), zveznost, asimptote, lastnosti zveznih funkcij. **Odvod in njegova uporaba:** geometrijski pomen, pravila za odvajanje, odvodi elementarnih funkcij, diferencial in njegova uporaba, višji odvodi, Rollejev in Lagrangeov izrek, L' Hospitalovo pravilo, ekstremi, konveksnost, konkavnost in prevoji, uporaba odvoda pri grafih (ciklometrične, hiperbolične in area funkcije), parametrično podane krivulje. **Taylorjeva vrsta**: konvergenca zaporedja, pojem konvergence številske vrste, Taylorjeva formula, Taylorjeva vrsta za funkcije e^x, sin x, cos x, ln(1+x), (1+x)^n. **Nedoločeni integral**: osnovne lastnosti, integriranje po delih, vpeljava nove spremenljivke, integrali osnovnih elementarnih funkcij (nekaterih racionalnih, trigonometrijskih in algebraičnih). **Določeni integral**: geometrijski pomen in osnovne lastnosti, zveza z nedoločenim integralom, izlimitirani integrali. **Uporaba integrala:** ploščina, ločna dolžina, prostornina in površina vrtenine, težišče, vztrajnostni moment. **Diferencialne enačbe:** enačbe prvega reda z	**Limits of functions:** computation with functions (sum, product, composition, inverse), continuity, asimptotes, properties of continuous functions. **The derivative and its application:** the geometric meaning, rules for differentiation, the derivatives of elementary functions, the differential and its applications, higher derivatives, Rolle's and Lagrange's theorems, L'Hospitale rule, minima and maxima, convexity and concavity, application of the derivative to study the behavior of functions (cyclometric, hyperbolic and inverse hyperbolic functions), parametric curves. **Taylor's series:** convergence of sequences and series, Taylor's formula, Taylor's series for functions e^x, sin x, cos x, log(1+x), (1+x)^n. **The indefinite integral**: basic properties, integration per partes, change of variables, integration of elementary functions (rational, some trigonometric and algebraic). **The definite integral**: the geometric meaning and basic properties, the fundamental theorem of calculus, improper integrals. **Application of integration:** calculations of areas, arc lenghts, volumes and surfaces of revolution, centers of mass, moments of inertia. **Differential equations**: equations of order 1, separation of variables, homogeneous and

ločljivima spremenljivkama, homogene, linearne, znižanje reda v nekaterih enačbah drugega reda, linearne diferencialne enačbe drugega reda s konstantnimi koeficienti, sistemi linearnih diferencialnih enačb prvega reda s konstantnimi koeficienti, uporaba v kemiji in drugod. **Vektorji v R^n in C^n:** ponovitev osnovnih operacij z vektorji v R^3, koordinatni sistem v prostoru, linearna neodvisnost, podprostori, baze, skalarni produkt, vektorski in mešani produkt, determinante reda 2 in 3. **Matrike:** osnovne računske operacije , matrike kot linearne preslikave, zasuki in zrcaljenja, sistemi linearnih enačb (Gaussova metoda reševanja), determinante, inverzna matrika, Cramerjeve formule , lastne vrednosti in lastni vektorji, diagonalizacija simetrične matrike. **Funkcije več spremenljivk:** funkcija dveh spremenljivk in njen graf, zveznost, parcialni odvodi, posredno odvajanje, implicitne funkcije, totalni diferencial, gradient, Taylorjeva vrsta, ekstremi, vezani ekstremi. **Osnove verjetnosti in statistike**: poskusi, relativna frekvenca, verjetnost, porazdelitve, predstavitev podatkov, opisne statistike, populacija, vzorčenje, normalna porazdelitev, linearna regresija.	linear equations, examples of reduction of order, second-order linear differential equations with constant coefficients, systems of linear differential equations, applications to chemistry and elsewhere. **Vectors in R^n and C^n**: basic operations for vectors in R^3, coordinate systems, inner product, vector product, multiple products, determinants of order 2 and 3, R^n and C^n as vector spaces, linear independence, subspaces, basis. **Matrices**: basic operations, matrices as linear transformations, rotations and reflections, systems of linear equations (Gauss elimination method), determinants, invertible matrices, Cramer's formulas, eigenvalues and eigenvectors, diagonalization of symmetric matrices. **Functions of several variables**: functions of two variables and their graphs, continuity, partial derivatives, total differential, gradient, the chain rule, implicit functions, Taylor's series, extrema, constrained extrema. **The basics of probability and statistics:** experiments, relative frequency, probability, distributions, data presentation, descriptive statistics, population, sampling, normal distribution, linear regression.

Temeljna literatura in viri / Readings:

- R. Jamnik, Matematika, DMFA Slovenije, Ljubljana, 1994.
- P. Šemrl, Osnove višje matematike, DMFA Slovenije, Ljubljana, 2009.
- P. Moravec, Rešene naloge iz matematike, FKKT UL, Ljubljana 2009.

Dopolnilna literatura:

- A. Turnšek, Tehniška matematika, FS, Ljubljana, 2007, 306 str.
- P. Mizori – Oblak, Matematika za študente tehnike in naravoslovja, 1. del, FS, UL Ljubljana, 2001.
- P. Mizori – Oblak, Matematika za študente tehnike in naravoslovja, 2. del, FS UL, Ljubljana, 1997.
- I. Vidav, Višja matematika I, DMFA Slovenije, Ljubljana, 1994, 477 str.
- G. Doggett, B. T. Sutcliffe, Mathematics for Chemistry, Longman, 1995, 286 str.
- G. S. Gill, The Calculus Bible, 366 str., http://www.math.byu.edu/Math/CalculusBible/
- B. Magajna, Izpitne naloge, http://www.fmf.uni-lj.si/~magajna/Matematika1KEM/osnovna.htm

Cilji in kompetence:	**Objectives and Competences:**
Cilj predmeta: Seznaniti študente z osnovnimi metodami matematične analize in linearne	To familiarize students with calculus and basic linear algebra necessary for further study. This

algebre, potrebnimi pri nadaljnem študiju, ki spadajo v temeljno izobrazbo naravoslovca ali tehnika. Tak predmet je zato obvezni del programa na vsaki naravoslovni ali tehnični fakulteti. **Predmetno specifične kompetence:** Pridobljeno znanje bo študentu omogočilo boljše razumevanje drugih strokovnih predmetov. Imel bo možnost pridobiti nekaj temeljnih matematičnih pojmov in spretnosti, ki so potrebne za razumevanje strokovne literature in tudi za uspešno opravljanje dela. (Za naravoslovca ali tehnika so skoraj tako neobhodni kot poštevanka v vsakdanjem življenju.)	is a usual part of curriculum for students of science and technology. This enables students to better understnad some other areas of their study. It gives them an oportunity to acquire basic mathematical skills needed to follow the literature in their own speciality.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
Znanje in razumevanje Razumevanje pojmov funkcijske odvisnosti, limite, odvoda in integrala, poznavanje metod reševanja nekaterih elementarnih tipov diferencialnih enačb in njihove uporabe v kemiji (in drugod), osnovni prijemi linearne algebre. osnovna analiza funkcij več spremenljivk.	Knowledge and Comprehension Students should understand the concepts of functional dependence, limits, differentiation and integration, and acquire the skill of solving certain types of differential equations and their application to chemistry (and elsewhere), basic approaches of linear algebra and analysis of functions of several variables.
Uporaba Uporaba zgoraj omenjenih pojmov pri reševanju konkretnih nalog iz matematike, fizike in kemije.	Application Students should be able to apply calculus and linear algebra to problems from physics and chemistry.
Refleksija Gre za poglobitev in bistveno razširitev v srednji šoli pridobljenega znanja matematike, ki je nujno za razumevanje naravoslovnih znanosti in je zato o obvezni del študijskih programov povsod po svetu.	Analysis The course gives a considerable extension of the mathematical knowledge that the students acquired in high school, which is essential for the understanding of any natural science and chemistry in particular.
Prenosljive spretnosti Predmet daje tudi osnovo za razumevanje nekaterih računalniških postopkov in metod, ki jih bodo spoznali kasneje pri drugih predmetih in ob delu.	Skill-transference Ability The knowledge of calculus is necessary for effective use of computer modeling in science, which the students will meet later in the course of their study.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, vaje, sodelovalno učenje / poučevanje.	Lectures, exercises, homework, consultations.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**

Pisni izpit (ali štirje kolokviji), teoretični (ustni) izpit. Od 6-10 (pozitivno) oz. 1-5 (negativno) oz. opravil/ ni opravil; ob upoštevanju Statuta UL in fakultetnih pravil		Written exam (or four midterm exams), oral exam.

Reference nosilca / Lecturer's references:

Doc. dr. Jaka Smrekar / Dr. Jaka Smrekar, Assistant Professor

1. J. Smrekar: Homotopy type of mapping spaces and existence of geometric exponents. Forum Math. letnik 22 (2010), št. 3, 433–456.

2. J. Smrekar, A. Yamashita: Function spaces of CW homotopy type are Hilbert manifolds. Proc. Amer. Math. Soc. letnik 137 (2009), št. 2, 751–759.

3. J. Smrekar: Periodic homotopy and conjugacy idempotents. Proc. Amer. Math. Soc. letnik 135 (2007), št. 12, 4045–4055.

Prof. dr. Petar Pavešić / Dr. Petar Pavešić, Full Professor

1. 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]

2. 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]

3. 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]

4. 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]

5. 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, 1st Cycle	**/**	**2nd**	**4th**

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:	**Prerequisites:**
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	**Content (Syllabus outline):**
Pri predmetu se bodo seznanili s kratko zgodovino mikrobiologije, s poimenovanjem in uvrščanjem mikroorganizmov, s prikazom biotske raznovrstnosti mikroorganzmov, z njihovim biotehnološkim 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: - prokariontska celica: velikost, oblika in organizacija bakterijske celice, strukture na zunanji strani celične stene, celična stena, specifične znotrajcelične strukture, razlike med funkcionalno anatomijo prokariontske in evkariontske 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,	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, - 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 microrganisms, 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

- osnove klasifikacije mikroorganizmov in mikrobne taksonomije, ki temeljijo na morfologiji, fiziologiji in molekularnih značilnostih.	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:	**Objectives and Competences:**
Mikrobiologija je eden od naravoslovnih predmetov, pri katerem se študenti spoznajo z osnovami celične strukture prokariontske celice v primerjavi z evkariontsko; s parametri in kontrolo mikrobne rasti;z metabolnimi značilnostmi posameznih skupin mikroorganizmov (bakterij, arhebakterij, gliv in virusov); z osnovami mikrobne ekologije, evolucije, sistematike in taksonomije mikroorganizmov.	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 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:	**Intended Learning Outcomes:**
Znanje in razumevanje Znanje in razumevanje osnovnih mikrobioloških pojmov in zakonitosti, mikrobnih struktur in procesov.	Knowledge and Comprehension Knowledge and understanding of basic microbiological terms, laws, microbial structures and processes.
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.	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.
Refleksija Študent pridobi občutek za mikrobiološke dimenzije in posebnosti živega mikrobnega sveta.	Analysis To develop an understanding of the ubiquity, importance and peculiarity of microbes in the environment.
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).	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:	**Learning and Teaching Methods:**
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.	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 undersatnd the basic microbiological principles.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Opravljene vaje so pogoj za pristop k izpitu. Pisni izpit. Ocene: 6-10 (pozitivno), 1-5 (negativno).		Successful performance of practical courses is the precondition for the theoretical exam. Written exam. Marks: 6-10 (positive), 1-5 (negative).

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, 1st Cycle	/	2nd	4th

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:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
1. Mehanizem podvojevanja DNA 2. Mutacije in popravljanje 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 9. Kontrola izražanja pri evkariontih 10. Usmerjanje proteinov in posttranslacijske modifikacije 11. Transpozicijski elementi 12. Virusi	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 9. Regulation of expression in eukaryotes 10. Protein targeting and posttranslational modifications 11. Transposition elements 12. Viruses

Laboratorijske vaje: 1. Plazmidi in transformacija bakterijskih celic 2. Laktozni operon in alfa komplementacija 3. Utišanje genov s protismerno RNA	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:	**Objectives and Competences:**
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.	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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> 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 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	<u>Knowledge and Comprehension</u> Knowledge: Mechanisms of polymerases and accessory proteins in maintaining genetic information. Adapter hypothesis and mode of amino acid biding 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 and proteins. Importance of protein maturation for their activity and cellular sorting. Importance of protein degradation for cell functions and gaining amino acids for

za biosintezne reakcije. Interakcije med nukleinskimi kislinami in proteini v celicah in virusih.	biosynthetic reactions. Interactions between nucleic acids and proteins in cells and viruses.
Uporaba Sposobnost razlikovanja stopenj kompleksnosti organizmov (prokarionti, evkarionti) na osnovi poznavanja biokemijskih procesov. Delo z bakterijami in virusi: varnostni in praktični vidiki.	Application Differentiation between complexity levels of organisms (prokaryotes, eukaryotes) based on knowledge of biochemical processes. Practical considerations for work with bacteria and viruses.
Refleksija Do katere mere so prokarionti 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.	Analysis 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.
Prenosljive spretnosti 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.	Skill-transference Ability 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

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, laboratorijske vaje, individualno in skupinsko delo pri pripravi seminarjev.	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.

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, 1st Cycle	**/**	**3rd**	**5th**

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, sonde, načini označevanja DNA. Presejanje knjižnic.
9. Določanje nukleotidnega zaporedja

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.

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	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.
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. Restrikcijska 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.	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.
- učbenik za vaje: Marko Dolinar: Molekulsko kloniranje – Navodila za vaje, Ljubljana: Založba UL FKKT, 2016

Cilji in kompetence:	**Objectives and Competences:**
Vsak študent mora biti po opravljenem kolokviju in izpitu sposoben ob ustreznem vodstvu sam izvesti osnovne analize DNA, pripraviti rekombinantno molekulo DNA in	Under guidance, students will be able to perform basic DNA analyses and construct a recombinant DNA molecule. Students will understand fundamental procedures in

razumeti osnovne postopke dela pri pripravi rekombinantnih proteinov v različnih tipih gostiteljskih organizmov. Poznati bo moral tudi načela varnosti dela z gensko spremenjenimi organizmi.	recombinant protein preparation in different types of host organisms and will be aware of 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 genetsko 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.

Načini ocenjevanja:	Delež (v %) / 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	
Predmet:	ORGANSKA KEMIJA I
Course Title:	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, 1st Cycle	/	1st	2nd

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:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
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, resonačna energija, tavtomerija, dipolni moment); kislost in bazičnost organskih spojin (vpliv topila, induktivni, resonačni in sterični efekt ter vpliv hibridizacije); izomerija (konstitucijska izomerija in stereoizomerija, rotacija okrog C-C vezi v acikličnih spojinah, konformacije	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 (enatiomers, 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 sp3 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:	**Objectives and Competences:**
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.	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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Študent spozna nekatere osnovne zakonitosti,	<u>Knowledge and Comprehension</u> Understanding the fundamentals of organic

ki veljajo v organski kemiji. Poleg znanj o reaktivnosti in lastnostih obravnavanih organskih spojin je sposoben načrtovati možnosti za njihovo interkonverzijo.	chemistry. Knowledge on structural features of organic compounds, structure-reactivity relationship, and typical organic transformations.
Uporaba 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.	Application 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.
Refleksija Študent pridobi občutek za določene transformacije organskih spojin, ki jih je mogoče izvesti v laboratoriju.	Analysis Student learns basics for some transformation of organic compounds that can be conducted in laboratory.
Prenosljive spretnosti Izkušnje pri reševanju problemov, delo v skupinah, zbiranje in interpretacija rezultatov ter njihovo kritično vrednotenje.	Skill-transference Ability Experiences in solving problems, team work, collection and interpretation of results and their critical evaluation.

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

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
2 testa za sprotno preverjanje znanja in pisni izpit. Če študent na vsakem od obeh testov zbere najmanj 50% točk je lahko oproščen opravljanja izpita. Ocene: 6-10 (pozitivno), 1-5 (negativno).		Two tests for simultaneous testing, and written exam. If the result of each test is over 50% the student could be exempt from the written exam. 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.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	ORGANSKA KEMIJA II
Course Title:	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, 1st Cycle	**/**	**2nd**	**3rd**

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:	**Prerequisites:**
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	**Content (Syllabus outline):**
Karbonilne spojine (vrste transformacij karbonilnih spojin, adicija vode, alkoholov, karboanionov in dušikovih nulkeofilov 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	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-reach heterocycles: pyrroles, furans, tiophenes; porphyrins: protoporphyrin IX, hem, haemoglobin, chlorophylls; vitamin B12; indole and derivatives; pyridines: properties, synthesis, reactions, nicotinic acid, NAD, vitamin B6; pyrimidines: synthesis and reactions, hydroxypyrimidines; purines, nucleosides and

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.	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. α-Amino acids: structure and properties, isoelectric point, typical reactions of α-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:	**Objectives and Competences:**
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.	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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> 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.	<u>Knowledge and Comprehension</u> 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.

Uporaba 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.	Application 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.
Refleksija Študent pridobi občutek za različne transformacije organskih spojin, ki jih je mogoče izvesti v laboratoriju ter za primerjavo le-teh s procesi v naravi.	Analysis Student acquires feeling for different transformations that can be performed in laboratory and for their comparison with the processes in nature.
Prenosljive spretnosti Izkušnje pri reševanju problemov, delo v skupinah, zbiranje in interpretacija rezultatov ter njihovo kritično vrednotenje.	Skill-transference Ability Experiences in solving problems, team work, collection and interpretation of results and their critical evaluation.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, seminarji, laboratorijske vaje.	Lectures, seminars, practical courses.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
2 testa za sprotno preverjanje znanja in pisni izpit. Če študent na vsakem od obeh testov zbere najmanj 50% točk je lahko oproščen opravljanja izpita.		Two tests for simultaneous testing, and written exam. If the result of each test is over 50% the student could be exempt from the written exam. 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.
- 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	
Predmet:	OSNOVE BIOKEMIJSKEGA INŽENIRSTVA
Course Title:	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, 1st Cycle	**/**	**3rd**	**5th**

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:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
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 bioprocesnih brozg. Prenos toplote in snovi: toplotni in snovni tok, toplotna in snovna prehodnost in prestopnost, potencialna razlika. Vrste	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 bioprocesov: 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. *Biotehnološki postopki:* pregled izvedb tipičnih biotehnoloških 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, bioprocesov oziroma biotehnoloških 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:	**Objectives and Competences:**
Cilj predmeta je spoznanje in razumevanje osnovnih inženirskih principov in vloge kemijskega inženirstva oziroima 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, - spoznavanje tehnološkega postopka od	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 parameters which are important for the process

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 bioprocesov, - osvajanje nekaterih izbranih laboratorijskih tehnik za analizo in vodenje bioprocesa v laboratorijskem merilu.	design and control.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
Znanje in razumevanje Študent se pri predmetu seznani 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.	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.
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.	Application Student will develop the ability to participate in the development, control and analysis of biotechnological processes.
Refleksija Študent pridobi občutek za tehnični način razmišljanja in predstavo o sestavljanju posameznih faz postopka v celoto.	Analysis Student will interpret and analyse the knowledge on selected biocatalytic processes.
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.	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:	**Learning and Teaching Methods:**
- Predavanja, - laboratorijske vaje, - seminarji.	Lectures, seminars, practical training.

Delež (v %) /

Načini ocenjevanja:	Weight (in %)	**Assessment:**
Kolokvij iz laboratorijskih vaj 40 % Seminar 20 % Pisni in ustni izpit 40 % Ocene: 6-10 (pozitivno), 1-5 (negativno).	40 % 20 % 40 %	Laboratory practical exam Seminar Written and oral exam 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, 2nd 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	
Predmet:	OSNOVE FARMAKOLOGIJE
Course Title:	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, 1st Cycle	**/**	**3rd**	**6th**

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
30	**15**	**15 SV + 15 LV**	**/**	**/**	**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:	Content (Syllabus outline):
Opredelitev 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.	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 routs 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:	**Objectives and Competences:**
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: 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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> 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.	<u>Knowledge and Comprehension</u> 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.
<u>Uporaba</u> 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.	<u>Application</u> 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.

Refleksija 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.	Analysis 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.
Prenosljive spretnosti 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.	Skill-transference Ability 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.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, vaje, seminarji, problemsko naravnan študij.	Lectures, seminars, practical training, problem-based study.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni in ustni izpit. Ocene od 6-10 (pozitivno) oz. 1-5 (negativno).		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, 1st Cycle	**/**	**3rd**	**5th**

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	**/**	**25 SV + 20 LV**	**/**	**/**	**75**	**5**

Nosilec predmeta / Lecturer: prof. dr. Peter Dovč / Dr. Peter Dovč, Full Professor

Jeziki / Languages:

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

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

Vsebina:	Content (Syllabus outline):
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	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 alelles (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 anotations, 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:

Študenti bodo razumeli, kako se kvalitativne in

Objectives and Competences:

Understanding how qualitative and quantitative

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.	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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> 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.	<u>Knowledge and Comprehension</u> 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.
<u>Uporaba</u> 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.	<u>Application</u> 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.
<u>Refleksija</u> Tudi biološki procesi (dedovanje) so podvrženi matematičnim zakonitostim. Populacije imajo	<u>Analysis</u> Students should be able to reflect how inheritance is linked to biochemical and

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.	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.
Prenosljive spretnosti 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.	Skill-transference Ability 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.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, laboratorijske in seminarske vaje; vmesna kratka preverjanja znanja (kvizi); individualno reševanje problemov doma	Lectures, laboratory and seminar practicum; short quizzes; take-home individual problem solving exercises.

Načini ocenjevanja:	Deež (v %) / Weight (in %)	**Assessment:**
Pisni izpit		Written exam

Reference nosilca / Lecturer's references:

1. The Bovine Genome Sequencing and Analysis Consortium, ELSIK, Christine G., TELLAM, Ross L., WORLEY, Kim C., **DOVČ, Peter**, et al. The genome sequence of taurine cattle : a window to ruminant biology and evolution. SCIENCE, 2009, vol. 324, no. 5926, str. 522-528.
2. ČEH, Eva, **DOVČ, Peter**. Population structure and genetic differentiation of livestock guard dog breeds. Journal of animal breeding and genetics, ISSN 0931-2668, 2014, vol. 131, no. 4, str. 313-325
3. OGOREVC, Jernej, **DOVČ, Peter**. Relative quantification of beta-casein expression in primary goat mammary epithelial cell lines. Genetics and molecular research, 2015, vol. 14, no. 2, str. 3481-3490.

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	OSNOVE PROGRAMIRANJA
Course Title:	INTRODUCTION TO PROGRAMMING

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Kemijsko inženirstvo, 1. stopnja, UŠP Biokemija, 1. stopnja, UŠP Kemija, 1. stopnja	**/**	**1.**	**1.**
USP Chemical Engineering, 1st Cycle, USP Biochemistry, 1st Cycle, USP Chemistry, 1st Cycle	**/**	**1st**	**1st**

Vrsta predmeta / Course Type: obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

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. 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:	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:

1. Uvod v računalništvo
   a. Strojna oprema
   b. Predstavitev podatkov v računalniku
2. Programska oprema
   a. Sistemska (operacijski sistem, orodja)
   b. Uporabniška (table and
3. Algoritmi in podatkovne strukture – reševanje problemov
   a. Predstavitev

Content (Syllabus outline):

Students in this course will learn:

1. Introduction to computers
   a. Hardware
   b. Data presentation in computer
2. Sofware
   a. System software (operating systems, tools)
   b. User software (spreadseheets,...)
3. Algorithms and data structures – problem solving
   a. Introduction
   b. Record and analysis

b. Zapis in analiza 4. Programiranje v Pythonu a. Osnove programiranja b. Spremenljivke c. Osnovni podatkovni tipi d. Stavki (priredilni, pogojni, zanke) e. Funkcije f. Vhod in izhod g. Knjižnice h. Uporaba podatkovnih baz	4. Programming in Python a. Basics of programming b. Variables c. Basic data types d. Conditional sentences and loops e. Functions f. Input and output g. Libraries h. Use of databases

Temeljna literatura in viri / Readings:

[1] G. M. Schneider, J. L. Gersting, Invitation to Computer Science, Cengage Learning, 2013 (50%)
[2] M. Lutz, Learning Python, Fifth Edition, O'Reilly Media, Inc., 2013 (60%)
Drugi viri:
[3] Non-Programmer's Tutorial for Python, Wikibooks.org, www.it-ebooks.info, 2013
[4] J. Payne, Beginning Python, www.it-ebooks.info, 2010

Cilji in kompetence:	**Objectives and Competences:**
Cilj predmeta je spoznati osnove algoritmičnega razmišljanja in kodiranja v izbranem programskem jeziku - Python. V okviru tega študenti spoznajo osnovne konstrukte programskega jezika.	The aim of this course is to learn the basics of algorithmic thinking and coding in the selected programming language - Python.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
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.	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.
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 inženir uporablja pri svojem delu.	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.
Refleksija Spoznavanje osnov algoritmičnega razmišljanja in kodiranja računalniškega programa.	Analysis Getting to know basic algorithmic thinking and coding of computer program.

Prenosljive spretnosti Poznavanje in uporaba računalniških orodij. Poznavanje in učinkovita uporaba osnovnih konceptov programiranja.	Skill-transference Ability Knowledge and use of computer tools. Knowledge and effective use of basic programming concepts.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja s pomočjo razlage na šolski tabli in uporaba drugih AV sredstev (po potrebi). Praktične vaje potekajo v računalniških učilnicah, kjer študenti samostojno dopolnjujejo pridobljeno znanje. 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 sistematski način s številnimi zgledi, poudarek je na njihovi uporabi na praktičnih primerih.	Lectures with the explanation on the blackboard and other audio video (AV) resources (as necessery). Practical exercises take place in computer labs where students independently upgrade achieved knowledge. 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.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni (nadomestita ga lahko dva pozitivno ocenjena kolokvija) in ustni izpit. Opravljene vaje so pogoj za pristop k izpitu. Ocene: pozitivno 6-10; negativno: 1-5	**100 %**	Written (can be replaced by two positive colloquiums) and oral exam. Settled practical exercises are the prerequisite for the exam. Grades: 6-10 positive; 1-3 negative.

Reference nosilca / Lecturer's references:

1. 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.
2. 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.
3. 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.

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, 1st Cycle	**/**	**2nd or 3rd**	**/**

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. Krištof Kranjc / Dr. Krištof Kranjc, Assistant Professor

Jeziki / Languages: **Predavanja / Lectures:** **/**; **Vaje / Tutorial:** **/**

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):
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.	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, - learning about a technological process or

12. Vsebina prakse se prilagaja konkretnemu mestu kjer se opravlja. Področja na katerih študent lahko opravlja prakso so: 13. uvajanje v delo na poklicnem področju, 14. spoznavanje s tehnološkim procesom in industrijsko proizvodnjo, 15. sodelovanje pri raziskovalno razvojnih nalogah in planiranju ter načrtovanju izdelkov, 16. nadzor proizvodnega procesa, 17. vhodna in izhodna kontrola kvalitete surovin in produktov, 18. instrumentalna analitika v raziskovalnem in kontrolnem laboratoriju, 19. aktivnosti v zvezi z varovanjem okolja in zagotavljanjem varnosti, 20. vzdrževanje aparatov, merilnih in regulacijskih sistemov.	industrial production, - R&D projects and product planning, - production process control, - input and output quality control of raw materials and products, - instrumental analyses in a research or control laboratory, - environmental protection, safety at work, - maintenance of instruments, measuring and regulation systems.

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:	**Objectives and Competences:**
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.	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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Študent se pri opravljanju praktičnega dela usposobi za povezovanje teoretičnih in praktičnih znanj, ki jih je pridobil pri različnih	<u>Knowledge and Comprehension</u> Experience and knowledge of real situations in industrial environment. Application and practice of gained theoretical knowledge in solving

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 seznani s tehnološko-tehničnimi parametri, se nauči strokovne komunikacije z drugim člani tima.	practical tasks. Gaining importance of safety measures in industrial environment. Becoming familiar with organization strategies and administration protocols in real working environment.
Uporaba Praktično usposabljane 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.	Application Student can use and apply his practical knowledge and abilities during his further education and professional development.
Refleksija Študent je sposoben kritično analizirati in primerjati različne pristope pri reševanju problemov tako na laboratorijskem kot tudi industrijskem nivoju.	Analysis Student is capable critically compare and evaluate different approaches for problem solving in laboratory as well as in industrial on-line environment.
Prenosljive spretnosti Usposabljanje v konkretnem delovnem okolju mu razvija sposobnost za analitično naravoslovno tehnično vrednotenje dogajanj v praksi.	Skill-transference Ability 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.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
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.	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.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
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.		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.

Ocenjevalna lestvica: opravljeno – neopravljeno.		

Reference nosilca / Lecturer's references:

Krištof Kranjc:

1. KRANJC, Krištof, PERDIH, Franc, KOČEVAR, Marijan. Effect of ring size on the exo/endo selectivity of a thermal double cycloaddition of fused pyran-2-ones. Journal of Organic Chemistry, ISSN 0022-3263, 2009, vol. 74, no. 16, str. 6303-6306, doi: 10.1021/jo9011199. [COBISS.SI-ID 30678277]
2. KRANJC, Krištof, KOČEVAR, Marijan. Ethyl vinyl ether as a synthetic equivalent of acetylene in a DABCO-catalyzed microwave-assisted Diels-Alder-elimination reaction sequence starting from 2H-pyran-2-ones. Synlett, ISSN 0936-5214, 2008, no. 17, str. 2613-2616, graf. prikazi. http://www.thieme-connect.com/ejournals/abstract/syn- lett/doi/10.1055/s-0028-1083515, doi: 10.1088/s-0028-1083515. [COBISS.SI-ID 29447685]
3. KRANJC, Krištof, KOČEVAR, Marijan. An expedient route to indoles via cyloaddition/cyclization sequence from (Z)-1-methoxybut-1-en-3-yne and 2H-pyran-2-ones. Tetrahedron, ISSN 0040-4020. [Print ed.], 2008, vol. 64, no. 1, str. 45-52, doi: 10.1016/j.tct.2007.10.099. [COBISS.SI-ID 29109765]

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, 1st Cycle	/	3rd	5th

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:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Uvod (Rastlinski sistem, morfologija rastlin, rast. celica). Posebnosti rastlinskega metabolizma: Glioksilatni ciklus, 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,	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, esencielne 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. Prehrambeni 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 simbiontskimi 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: phenilpropanoids, lignans, lignin, flavonoids: biosynthetic pathway (shikimatna pathway), main groups, biological activity tanins, poliketids (antracinons, bensodiantrons), Compounds with sulphur: garlic, horseradish Terpenes: essential oils, steroids, saponins; biosynthtic pathway (mevalonat and Rohmers biosynthtic pathway), main groups, biological activity Compounds with nitrogen, alkaloids: biosynthtic 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:	**Objectives and Competences:**
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.	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:	**Intended Learning Outcomes:**
Znanje in razumevanje Poznavanje biosinteze rastlinskih metabolitov in njihove biološke funkcije, ter uporabnosti v farmaciji in biotehnologiji.	Knowledge and Comprehension Understanding of plant metabolism with applications in pharmacy and biotechnology
Uporaba Reševanje praktičnih nalog.	Application Solving practical problems
Refleksija Zahteva se razumevanje teorije in izkušenj v praksi, kritično ovrednotenje skladnosti med teoretičnimi načeli in praktičnim ravnanjem.	Analysis Understanding of theory and praxis is required, together with critical thinking when solving practical problems
Prenosljive spretnosti Prepoznavanje funkcionalnih skupin v formulah spojin. Samostojna uporaba literature in interneta za reševanje strokovnih nalog.	Skill-transference Ability Ability to recognise functional groups in plant specific compounds. Independent problem oriented literature and web search

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
predavanja, vaje, vodene individualne naloge, sodelovalno učenje / poučevanje.	

Načini ocenjevanja:	Deež (v %) / Weight (in %)	**Assessment:**
Pisni izpit Ocene: pozitivno 6-10; negativno 1-5.		Written assessment Grades: positive 6-10,negative 1-5

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, KOGOVŠEK, 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, KOGOVŠEK, 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	
Predmet:	SPEKTROSKOPSKE METODE V BIOKEMIJI
Course Title:	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, 1st Cycle	**/**	**3rd**	**5th**

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. 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:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
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	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 določanju 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 (1H, 13C, 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:	**Objectives and Competences:**
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**: 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 experiments in solving spectroscopic problems

spektroskopskih metod pri reševanju strokovnih problemov na področju biokemije. **Kompetence:** Sposobnost načrtovanja, izvedbe in interpretacije spektroskopskih eksperimentov za uporabo v biokemiji.	in the field of biochemistry. **Competences**: Ability to design, perform, and interpret spectroscopic experiments for biochemical applications.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
Znanje in razumevanje Razumevanje osnovnih principov spektroskopskih in spektrometričnih tehnik, prenosa energije elektromagnetnega valovanja na materijo in izkoriščanja tega efekta za določanje strukture molekul.	Knowledge and Comprehension Understanding the basic principles of spectroscopic methods, interaction of matter and electromagnetic waves, and utilization of this interaction in molecular structure elucidation.
Uporaba Uporaba naučenih principov oziroma zakonitosti za analizo oziroma določanje strukture molekul s pomočjo spektroskopskih in spektrometričnih tehnik.	Application Student will be able to apply the acquired knowledge in solving analytical problems.
Refleksija 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.	Analysis 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.
Prenosljive spretnosti Pri predmetu se študenti z reševanjem znanih in neznanih problemov izurijo v uporabi spektroskopskih in spektrometričnih tehnik, analitičnega mišljenja in uporabe literaturnih virov.	Skill-transference Ability Using known and unknown examples the student is trained in utilization of spectroscopic methods, analytical thinking and using literature sources.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, seminarske in laboratorijske vaje.	Lectures and problem solving seminars.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pisni izpit Ocene: 6-10 (pozitivno), 1-5 (negativno).		Written exam Grades: 6-10 (positive), 1-5 (negative)

Reference nosilca / Lecturer's references:

1) 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.
2) J. Košmrlj, S. Kafka, I. Leban, M. Grad: Formation and Structure Elucidation of Two Novel

Spiro[2H-indol]-3(1H)-ones, Magn. Reson. Chem. 2007, 45, 700–704.
2) B. Pinter, A. Demšar, D. Urankar, F. De Proft, **J. Košmrlj**: Conformational Fluxionality in a Palladium(II) Complex of Flexible Click Chelator 4-phenyl-1-(2-picolyl)-1,2,3-triazole. A dynamic NMR and DFT study. Polyhedron 2011, 30, 2368–2373.
4) K. Proisl, S. Kafka, D. Urankar, M. Gazvoda, R. Kimmel, **J. Košmrlj**: Fischer indolisation of N-(α-ketoacyl)anthranilic acids into 2-(indol-2-carboxamido)benzoic acids and 2-indolyl-3,1-benzoxazin-4-ones and their NMR study. Org. Biomol. Chem. 2014, 12, 9650–9664.
5) M. G. Sommer, P. Kureljak, D. Urankar, D. Schweinfurth, N. Stojanović, M. Bubrin, M. Gazvoda, M. Osmak, B. Sarkar, **J. Košmrlj**: Combining [Arene–Ru] with Azocarboxamide to Generate a Complex with Cytotoxic Properties. Chem. Eur. J. 2014, 20, 17296–17299.

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, 1st Cycle	**/**	**1st**	**1st**

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
40	**15**	**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:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
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.	**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)I
- 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:	**Objectives and Competences:**
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 seznani z osnovnimi metodami dela v biologiji. Spoznava strokovno terminologijo in je zmožen iskati in uporabljati ustrezne vire za pridobivanje in poglabljanje biološkega znanja. Na osnovi poznavanja zgradbe je študent zmožen primerjati in razložiti delovanje različnih organizmov.	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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Razumevanje osnovnih bioloških procesov, ki vzdržujejo življenje. Poznavanje zgradbe in delovanja celic enoceličnih organizmov ter celic, tkiv in organov večceličnih organizmov. Poznavanje osnovne zgradbe in delovanja človeškega organizma.	<u>Knowledge and Comprehension</u> Basic knowledge on animal cell and tissue structure and understanding of basic biological concepts and principles of life. Understanding interactions between organisms and their environment. The significance of maintenance of biological diversity and nature conservation.

Razumevanje interakcij med organizmi in okoljem ter poznavanje vplivov na okolje. Razumevanje pomena raznolikosti živih bitij za ohranjanje naravnega okolja.	
Uporaba 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.	Application 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.
Refleksija 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.	Analysis 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.
Prenosljive spretnosti 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.	Skill-transference Ability 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.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
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 teoretičnimi znanji pri predmetu. Znanje nadgrajuje s samostojnim študijem in z	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 biology through individual student work using different study and information sources.

uporabo ustreznih študijskih in informacijskih virov.	

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Opravljene vaje so pogoj za pristop k izpitu. Kolokvij iz laboratorijskih vaj 10 % Seminarska naloga 30 % Pisni izpit 60 % Ocene: pozitivno 6-10; negativno 1-5.	 **10 %** **30 %** **60 %**	Practical work is prerequisite for written exam. Colloquium from practical work Seminar Written exam 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 (Crusteceana: 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-ß-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	
Predmet:	SPLOŠNA KEMIJA
Course Title:	GENERAL CHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Kemijsko inženirstvo, 1. stopnja, UŠP Biokemija, 1. stopnja, UŠP Kemija, 1. stopnja	**/**	**1.**	**1.**
USP Chemical Engineering, 1st Cycle, USP Biochemistry, 1st Cycle, USP Chemistry, 1st Cycle	**/**	**1st**	**1st**

Vrsta predmeta / Course Type: obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code: KE103

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 , prof. dr. Iztok Turel / Dr. Iztok Turel, Full Professor

Jeziki / Languages:

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

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

Vsebina:	Content (Syllabus outline):
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); večelektronski atomi, izgradnja elektronske ovojnice (Hundovo pravilo, Paulijev princip); periodni sistem: lastnosti elementov v periodnem sistemu (radiji atomov in ionov, ionizacijske energije,	**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).

elektronska afiniteta). **Kemijska vez:** ionska vez; kovalentna vez (nepolarna, polarna vez, dipolni moment, teorija valenčne vezi: principi teorije, resonanca, hibridizacija, geometrija molekul; teorija molekulskih 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 Waalsove in vodikove vezi, vpliv teh vezi na lastnosti snovi). Struktura amorfnih in kristaliničnih trdnih snovi: ionski, kovalentni, kovinski in molekulski 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 tvorbene 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).	**Chemical bonding:** ionic bond, covalent bond (non-polar, polar, dipolar momentum, valence bond theory: principles, resonance, hybridization, molecular geometry; molecular 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. (40%) glede na interes študenta
- Erwin Riedel, Allgemeine und Anorganische Chemie, osma izdaja,Walter de Gruyter, Berlin, 2004, 380 str. (60%) glede na interes študenta
- A. Burrows, J. Holman, A. Parsons, G. Pilling, G. Price, Chemistry³: Introducing inorganic, organic and physical chemistry (Second Edition), Oxford University Press, Oxford, 2013 (1440 pages). (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, ackquired 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.

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 asses the meaning of basic chemical principles and theoretical knowledge for an explanation of experimental facts and properties of compounds.

Prenosljive spretnosti Študent zna poiskati podatke iz strokovne literature, podatke iz virov medmrežja pa zna kritično oceniti; zna uporabljati strokovni jezik (pisno in ustno).	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:	**Learning and Teaching Methods:**
Eksperimentalna predavanja z uporabo IKT; seminarji: sodelovalno učenje/ poučevanje ter problemsko delo; sprotno preverjanje znanja s testi.	Experimental lectures using the ICT; seminars: cooperative learning/teaching and problem work; regular knowledge assessment using tests.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
2 testa za sprotno preverjanje znanja in pisni izpit. Če študent na vsakem od obeh testov zbere 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. [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. [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. [COBISS.SI-ID 4386074]

1. P. Živec, F. Perdih, **I. Turel**, G. Giester, G. Psomas, Different types of copper complexes with the quinolone antimicrobial drugs ofloxacin and norfloxacin: Structure, DNA- and albumin-binding, J. Inorg. Biochem., 117, 35–47 (2012).
2. D. Čurman, P. Živec, I. Leban, **I. Turel**, A. Polishchuk, K. D. Klika, E. Karaseva, V. Karasev, Spectral properties of Eu(III) compounds with antibacterial agent ciprofloxacin (cfqH). Crystal structure of $[Eu(cfqH)(cfq)(H_2O)_4]Cl_2.4.55\ H_2O$, Polyhedron, 27, 1489-1496 (2008).
3. P. Drevenšek, J. Košmrlj, G. Giester, T. Skauge, E. Sletten, K. Sepčić, **I. Turel**, X-Ray Crystallographic, NMR and Antimicrobial Activity Studies of Magnesium Complexes of Fluoroquinolones - Racemic Ofloxacin and Its S-form, Levofloxacin, J. Inorg. Biochem., 100, 1755-1763 (2006).

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	STRUKTURA ATOMOV IN MOLEKUL
Course Title:	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, 1st Cycle	/	2nd	4th

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:	Content (Syllabus outline):
Uvod. Osnovni gradniki atomov. Poskusi, ki kažejo na kvantizacijo energije. Dvojnost narave snovi in princip nedoločljivosti. Razvoj modela atoma. Atomi v magnetnem polju. Valovna funkcija in Schrödingerjeva enačba za enostavne sisteme. Pomen tunelskega efekta v biokemiji. Sevanje in absorbcija svetlobe – izbirna pravila. **Atomi**. Opis vodikovega atoma z valovno funkcijo. Orbitalna in spinska vrtilna količina. Variacijska metoda in metoda motnje. Večelektronski atomi - Paulijev princip in Hundovo pravilo. Hartree-Fockova metoda za atome.	**Introduction.** Fundamental particles in atom. Energy quantization experiments. Wave-particle experiments and Indeterminacy principle. Models of atoms. Atoms in magnetic field. Wave function and Schrödinger equation for simple model systems. The role of quantum tunneling in biochemistry. Radiation and absorption – selection rules. **Atoms.** Wave function for hydrogen atom. The orbital angular momentum and spin. Variational method and perturbation theory. Many-electron atoms – Pauli exclusion principle and Hund's rules. Hartree-Fock method for atoms. **Molecules.** Valence bond theory, application to

Molekule. Metoda valenčnih vezi, molekula H_2 z metodo valenčnih vezi. Metoda molekulskih orbital. Hibridne molekulske orbitale. Polarnost molekulskih orbital. Elektronegativnost. Hartree-Fockova metoda za molekule. Bazni seti. Grafična predstavitev biološko pomembnih molekul. Elektrostatski potencial in hidrofobnost. Semiempirične metode. Mehanski modeli in polja sil. Osnovne zakonitosti zvijanja proteinov.	H2 molecule. Molecular orbital method. Hybride molecular orbitals. The polarity of molecular orbitals. Electronegativity. Hartree-Fock method for molecules. Basis sets. Graphical representation of biologically important molecules. Electrostatic potential and hydrophobicity. Semiempirical methods. Molecular mechanics and force fields. The basic principles of protein folding.

Temeljna literatura in viri / Readings:

- J. Koller, Struktura atomov in molekul (bolonjski program), FKKT, Ljubljana 2010, 209 str., (90 %)
- P.W. Atkins, Physical Chemistry (šesta izdaja), Oxford University Press, Oxford 1998, 998 str., (15%)
- B. H. Bransden, C. J. Joachain, Physics of Atoms and Molecules, Addison-Wesley, 2003 (20%)
- A. R. Leach, Molecular Modelling, Principles and Applications, Longman, England, 1996 (10%)

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.
- K. A. Dill, S. Bromberg, Molecular Driving Forces, Garland Science, 2003, 666 str. (20%).

Cilji in kompetence:	**Objectives and Competences:**
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. Specifične kompetence: osnovno znanje za samostojno teoretično delo na področju strukturne biokemije, strukture proteinov, membran itd.	**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. **Competence**s: Ability to interpret the atomic structure and the structure of simple molecules. Directing students to independent theoretical work.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
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	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

vzroke strukture biološko pomembnih molekul ter kje je potrebno uporabiti kvantno in kje je dovolj klasična fizika.	important molecules.
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.	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.
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.	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.
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.	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:	**Learning and Teaching Methods:**
Predavanja Seminar (računske naloge iz predelane snovi)	- Lectures - Seminars (Problem solving)

Načini ocenjevanja:	Delež (v %) / 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.

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.)

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	STRUKTURA PROTEINOV
Course Title:	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, 1st Cycle	**/**	**3rd**	**6th**

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:	**Prerequisites:**
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	**Content (Syllabus outline):**
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.	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:	**Objectives and Competences:**
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: 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:	**Intended Learning Outcomes:**
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.	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.
Uporaba Razumevanje strukture proteinov in njene povezave s njihovo funkcijo je ključnega pomena za razumevanje delovanja bioloških sistemov na molekulskem nivoju.	Application Understanding protein structure and its connection to protein function is critical for the understanding of biological systems at the molecular level.
Refleksija Študentje pridobijo način razmišljanja o funkciji proteinov z vidika njihove strukture.	Analysis Students gain the ability to evaluate protein function from the structural perspective.
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.	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:	**Learning and Teaching Methods:**
Predavanja, seminarji. Seminarske in laboratorijske vaje.	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 ihibition 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:	TEMELJI BIOKEMIJE
Course Title:	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, 1st Cycle	**/**	**1st**	**2nd**

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:	**Prerequisites:**
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	**Content (Syllabus outline):**
Molekule in življenje. Aminokisline, 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. Katabolizem maščobnih kislin in dušikovih	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.

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:	**Objectives and Competences:**
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.	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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Znanje: poznavanje zgradbe in biološke vloge makromolekul. Energetske molekule in njihove pretvorbe. Razumevanje: delovanje encimov in inhibitorjev, princip ohranjanja in prenosa genetske informacije, metabolizem.	<u>Knowledge and Comprehension</u> 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
<u>Uporaba</u> Predmet daje znanja, ki so nujno potrebna za nadaljevanje študija.	<u>Application</u> The course provides knowledge essential for a successful continuation of the study programme.
<u>Refleksija</u> Študent bo razmišljal o povezavi med strukturo makromolekul in njihovo biološko vlogo.	<u>Analysis</u> Students will reflect on the connection between structure and biological function of macromolecules.
<u>Prenosljive spretnosti</u> Samostojno in skupinsko delo za pripravo seminarjev, sposobnost uporabe literature in drugih virov, ustno in pisno in poročanje.	<u>Skill-transference Ability</u> Individual and group work in preparing seminars, the ability to use literature and other sources, oral and written reporting.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, individualni in skupinski seminarji.	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)

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	
Predmet:	TEMELJI FIZIOLOGIJE
Course Title:	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, 1st Cycle	**/**	**2nd**	**4th**

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:	Content (Syllabus outline):
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,	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	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.
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).	The practical training will be focused on measurements of selected physiological parameters and processes (e.g.: trans-membrane 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:	**Objectives and Competences:**
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.	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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> 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	<u>Knowledge and Comprehension</u> 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 level of cellular processes and processes in

na ravni molekularnih funkcionalnih modulov v celici, na ravni delovanja posamezne celice, na ravni tkiv, organov in na sistemski ravni.	tissue, organ and organism.
Uporaba 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.	Application The course is essential background for understanding processes in living organisms, which are critical in bioengineering, biomedicine and biotechnology.
Refleksija Študent pridobi vpogled v procese v bioloških organizmih in pridobi razumevanje homeostaze.	Analysis Student will learn principles of physiology in all living organisms and will understand homeostasis.
Prenosljive spretnosti Študent spozna temelje eksperimentalnega dela v fiziologiji in bioloških znanostih, spozna različne fiziološke količine, ki jih lahko merimo, analiziramo in interpretiramo rezultate.	Skill-transference Ability 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:	**Learning and Teaching Methods:**
Predavanja, laboratorijske vaje, seminarji, simulacije eksperimentov.	Lectures, seminars, practical training.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Izpit (ustni in pisni) (ocena > 6)		Oral and written exam
Seminarska naloga.	**70 %**	Seminar work.
Kolokvij iz vaj.	**30 %**	Practical courses.

Reference nosilca / Lecturer's references:

- RITUPER, Boštjan, CHOWDHURY HAQUE, Helena, JORGAČEVSKI, Jernej, COORSSEN, 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 Ca2+ 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	
Predmet:	UPORABA ENCIMOV
Course Title:	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, 1st Cycle	**/**	**3rd**	**6th**

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:

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

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

Vsebina:	**Content (Syllabus outline):**
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. WILLEY-VCH, 2007, strani 485 (50%)

Cilji in kompetence:	**Objectives and Competences:**
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.	**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:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Poznavanje in razumevanje uporabnosti številnih encimov v različnih tehnologijah priprave ali predelave določenih produktov.	<u>Knowledge and Comprehension</u> Knowledge and comprehension of the use of various enzymes for technological purposes.
<u>Uporaba</u> Pridobljeno znanje bo študent lahko uporabil na različnih področjih: prehrambna in tekstilna industrija, medicina, klinične preiskave…	<u>Application</u> The obtained knowledge is applicable in different fields: food and textile industry, medicine, clinical application…
<u>Refleksija</u> Študent bo razvil znanje potrebno za načrtovanje dela pri pripravi produktov s pomočjo encimov.	<u>Analysis</u> Students will develop the knowledge necessary for planning the procedures involving the use of enzymes for technological purposes.
<u>Prenosljive spretnosti</u> Spretnost uporabe literature in drugih virov, zbiranje podatkov in njihova interpretacija ter sposobnost ustnega in pisnega poročanja.	<u>Skill-transference Ability</u> Use of literature, data collection and interpretation, oral and written reporting.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, seminar/projekt in laboratorijske vaje.	Lectures, seminar/project and laboratory courses.

Deež (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)

Reference nosilca / Lecturer's references:

- Oppert, B., Morgan, TD, Hartzer, 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	
Predmet:	VIROLOGIJA
Course Title:	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, 1st Cycle	**/**	**3rd**	**6th**

Vrsta predmeta / Course Type: izbirni strokovni / Elective Professional

Univerzitetna koda predmeta / University Course Code: BKSI5

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:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Predmet obravnava temeljne lastnosti virusov, zgradbo in pomen posameznih virusnih struktur (beljakovine). Poimenovanje in razvrstitev virusov. Razmnoževanje virusov s posebnim povdarkom 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	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:	**Objectives and Competences:**
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.	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:	**Intended Learning Outcomes:**
Znanje in razumevanje Predmet Virologija bo dovoljeval študentu razumevanje osnovnih pojmov, ki so za to skupino mikroorganizmov specifični.	Knowledge and Comprehension Ability to understand basic concepts that are specific for this group of microorganisms.
Uporaba Predmet Virologija bo predstavljal podlago za nadaljni magistrski študij Biokemija in molekularna biologija.	Application The course is fundamental for further PhD degree studies in Biochemistry and molecular biology.
Refleksija Predmet bo dovoljeval študentom razumevanje teorije in bo hkrati nakazal praktično uporabo specifičnih metod virologije.	Analysis Ability to understand theory and further indicate practical use of specific methods of virology.
Prenosljive spretnosti Z izvajanjem skupinskih seminarjev se bodo študenti urili v iskanju literature, pripravi pismenih izdelkov, ustnih predstavitvah, diskusiji in debatah.	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:**

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.	Lectures (invited specialists from particular filed). Group seminars with discussion. Consultations with the course holder.

Načini ocenjevanja:	Deež (v %) / Weight (in %)	**Assessment:**
Seminarska naloga Ustni izpit Ocene: 6-10 (pozitivno), 1-5 (negativno).		Seminary work Oral exam Grades: positive (6-10); negative (1-5)

Reference nosilca / Lecturer's references:

- Fajs L, Durmiši E, Knap N, Strle F, **Avšič-Županc T.** Phylogeographic Characterizatio 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 l, 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.