

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

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

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

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

**Univerzitetna koda predmeta / University Course Code:** BK112

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

**Nosilec predmeta / Lecturer:** prof. dr. Janez Košmrlj / Dr. Janez Košmrlj, Full Professor

**Jeziki / Languages:**

<b>Predavanja / Lectures:</b>	slovenski / Slovenian
<b>Vaje / Tutorial:</b>	slovenski / Slovenian

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

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

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

**Content (Syllabus outline):**

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

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

#### Temeljna literatura in viri / Readings:

- Organic chemistry with Biological Applications, John E. McMurry, 3rd edition, Cengage Learning, 2015.
- Organska kemija, Darko Dolenc, UL FKKT, 2019.

#### Cilji in kompetence:

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

#### Objectives and Competences:

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

#### Predvideni študijski rezultati:

##### Znanje in razumevanje

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

#### Intended Learning Outcomes:

##### Knowledge and Comprehension

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

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

**Metode poučevanja in učenja:**

Predavanja, seminarji, laboratorijske vaje.

**Learning and Teaching Methods:**

Lectures, seminars, practical courses.

**Načini ocenjevanja:**

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)

Delež (v %) /

Weight (in %)

**Assessment:**

2 tests and written exam. If a student gets 50% in both of the tests, he/she can be exempted from taking the exam.  
Ratings: 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.