

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** ORGANSKA ANALITIKA IN SPEKTROSKOPIJA  
**Course Title:** ORGANIC ANALYSIS AND SPECTROSCOPY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
VŠŠP Kemijska tehnologija, 1. stopnja	/	3.	6.
PSP Chemical Technology, 1 <sup>st</sup> Cycle	/	3 <sup>rd</sup>	6 <sup>th</sup>

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

**Univerzitetna koda predmeta / University Course Code:** KTSI33

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

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

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

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

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

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

**Separacijske metode.** Ločba zmesi na osnovi razlik v fizikalnih lastnostih (topnost v vodnih raztopinah, raztopinah kislin in baz, organskih topilih; vrelišče). Kromatografske metode (teoretske osnove, vrste kromatografskih metod) in uporaba v analizi organskih spojin (uporaba v preparativne namene, ločba zmesi, ločba enantiomerov).  
**Identifikacija organskih spojin.** Kvalitativna in kvantitativna organska analiza. Testi na funkcionalne skupine in priprava derivatov.  
**Spektroskopske metode.** Ultravijolična in vidna spektroskopija. Infrardeča spektroskopija (karakteristični absorpcijski trakovi za funkcionalne skupine, interpretacija infrardečih spektrov, aplikacija IR na organske strukturne probleme). Jedrska magnetna resonanca (kemijski premik,

**Content (Syllabus outline):**

Separation techniques. Separation of organic compounds from the mixtures based on different physical properties (distillation, and solubility in water, organic solvents, acid-base extraction). Chromatographic techniques: Theoretical background, types of chromatographic methods (thin-layer-, column-, gas-chromatography). Qualitative and quantitative organic analyses, separation of mixtures, chiral separation. Identification of organic compounds based on chemical methods: Qualitative and quantitative analysis, analysis of functional groups and preparation of their derivatives. Molecular spectroscopy: NMR (chemical shift, integral, coupling patterns), IR (characteristic absorption bands of functional

integral, sklopitveni vzorci, aplikacija NMR na organske strukturne probleme) s poudarkom na <sup>1</sup>H NMR spektrih. Masna spektrometrija. Fragmentacije in premestitve nekaterih tipov organskih spojin. Določanje molske mase.

### Vaje

Individualni pristop k analizi sestave in strukture kompleksnega vzorca (separacija, čiščenje in identifikacija na osnovi kemijskih metod in spektroskopskih tehnik).

groups, interpretation of IR spectra). Mass spectrometry (basic ionization techniques, fragmentations). Organic analysis laboratory course is based on students individual analysis of an organic sample; separation, purification, and identification (based on chemical and spectroscopic methods).

### Temeljna literatura in viri / Readings:

- Shiner, R. L., C. K. F.; Morrill, T. C.; Curtin, D. Y.; Fuson, R. C. The Systematic Identification of Organic Compounds, 8th Edition, J. Wiley & Sons, 2003.

- Laboratory course - Dolenc, D. Vaje iz organske analize : praktikum. Ljubljana: Fakulteta za kemijo in kemijsko tehnologijo, 2007.

### Dodatna literatura / Additional literature:

- Pavia, L. D; Lampman, G. M.; Kriz, G. S. Introduction to Spectroscopy. A Guide for Students of Organic Chemistry, 3th Edition, Hartcourt, Inc. 2001.

- Harwood, L. M.; Moody, C. J. Experimental Organic Chemistry. Principles and Practice. Blackwell Scientific Publications, 1994.

### Cilji in kompetence:

Študent pridobi sposobnost analitičnega razmišljanja ter povezovanja podatkov dobljenih s posameznimi analiznimi metodami pri reševanju kvalitativnih in kvantitativnih analiznih problemov. Poudarek je na analizi funkcionalnih skupin s kemijskimi in spektroskopskimi metodami.

### Objectives and Competences:

Understanding the principles of qualitative and quantitative organic analysis using different basic analytical methods and techniques. Ability to design and perform standard experimental techniques for separation, isolation and purification of organic compounds. Analysis and characterization of organic compounds based on typical reactions at functional groups and by using basic spectroscopic methods.

### Predvideni študijski rezultati:

#### Znanje in razumevanje

Pozna osnovne kriterije za ločevanje zmesi organskih spojin. Zna povezati spektroskopske lastnosti spojin s strukturo spojin.

#### Uporaba

Zna uporabiti teoretično znanje za kvalitativno in kvantitativno analizo vzorcev organskih spojin.

#### Refleksija

Kritično vrednotenje rezultatov pri vajah na osnovi teoretičnega znanja.

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Student learns basics of separation, identification and characterization as well as spectroscopic methods and their application in characterization of organic compounds.

#### Application

Student learns to use theoretical knowledge for qualitative and quantitative analysis of organic compounds in research work.

#### Analysis

Student learns to critically evaluate results acquired at practical course and connect it to

	the theoretical knowledge.
<b>Prenosljive spretnosti</b> Študent pridobi laboratorijske spretnosti in zna eksperimentalne podatke ustrezno obdelati in primerno interpretirati. Uporaba že pridobljenega znanja iz organske kemije in analize kemije.	<b>Skill-transference Ability</b> Student gains skills for laboratory work and learns how to assess and interpret the experimental results. Student combines the knowledge from courses in organic and analytical chemistry. Learning and teaching methods: Lectures and laboratory practical courses.

**Metode poučevanja in učenja:**

Predavanja in laboratorijske vaje

**Learning and Teaching Methods:**

Lectures and laboratory practical courses.

**Načini ocenjevanja:**

a) Pri vajah se ocenjuje motivacija, samostojnost in sposobnost študenta pri reševanju praktičnih problemov in pripravi laboratorijskih poročil.  
b) Pisni izpit.  
10 (odlično), 9 in 8 (prav dobro), 7 (dobro), 6 (zadostno), 5-1 (nezadostno)

Delež (v %) /  
Weight (in %)

**Assessment:**

Written examination  
(60–100%: student passes the exam, 0–59%: student fails the exam).

**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.  
- **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.  
- D. Urankar, A. Pevec, I. Turel, **J. Košmrlj**: Pyridyl Conjugated 1,2,3-Triazole is a Versatile Coordination Ability Ligand Enabling Supramolecular Associations. *Cryst. Growth Des.* 2010, 10, 4920–4927.  
- D. Urankar, B. Pinter, A. Pevec, F. De Proft, I. Turel, **J. Košmrlj**: Click-Triazole N2 Coordination to Transition Metal Ions is Assisted by a Pendant Pyridine Substituent. *Inorg. Chem.* 2010, 49, 4820–4829.  
- 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.  
- 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.