

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Izbrana poglavja iz analizne kemije
<b>Course title:</b>	Selected Chapters from Analytical Chemistry

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Ekotehnologije, 3. stopnja Ecotechnologies, 3 <sup>rd</sup> cycle	/	1	1

**Vrsta predmeta / Course type** Izbirni / Elective

**Univerzitetna koda predmeta / University course code:** EKO3-690

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

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

**Nosilec predmeta / Lecturer:** Prof. dr. Maja Ponikvar-Svet

<b>Jeziki / Languages:</b>	<b>Predavanja / Lectures:</b>	slovenščina, angleščina Slovene, English
	<b>Vaje / Tutorial:</b>	slovenščina, angleščina Slovene, English

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

Zaključena druga stopnja bolonjskega študija ali univerzitetni študijski program.

**Prerequisites:**

Completed Bologna second level or university type of undergraduate education.

**Cilji:**

Glavni cilj predmeta je doseči poznavanje nekaterih analiznih metod, ki jih bo študent uporabljal tekom svojega dekla, pristop k zagotavljanju sledljivosti meritev in oceni merilne negotovosti ter možnosti aplikacij k reševanju konkretnih okoljskih problemov.

Študent bo ob zaključku sposoben:

- Obvladovati principe nekaterih najbolj pomembnih analiznih metod s poudarkom na elektrokemijskih in spektrofotometričnih metodah ter CHNS elementni analizi
- Obvladovati stopnje analiznega postopka: načrtovanje, izvedba, vrednotenje in obdelava analiznih rezultatov

**Objectives:**

The main goal of the course is to acquire knowledge of some of the analytical methods that the student will use during his girlfriend, the approach to ensuring the traceability of measurements and the assessment of measurement uncertainty and the possibilities of applications to solve specific environmental problems. The student will be able to:

- To master the principles of some of the most important analytical methods with an emphasis on electrochemical and spectrophotometric methods and CHNS elemental analysis
- Manage the stages of the analytical process: design, implementation, evaluation and processing of analytical results

- Razlikovati med naključnimi in sistematičnimi napakami in obvladovanju le-teh
- Razumeti pristop k obvladovanju naključnih in sistematičnih napak v analizi kemiji in ga prenesti v raziskovalni delo
- Razumeti pomen metrologije in zagotavljanja sledljivosti meritev in uporabiti principe le teh v raziskovalnem delu

- Distinguish between random and systematic errors and controlling them
- Understand the approach to managing random and systematic errors in analytical chemistry and transfer it to research work
- Understand the importance of metrology and ensure the traceability of measurements and apply the principles of these in the research work

#### Učni izidi:

Študenti bodo z uspešno opravljenimi obveznostmi tega predmeta pridobili:

- Pregled instrumentalnih tehnik analize kemije in možnosti uporabe ključnih tehnik potrebnih tekom raziskovalnega dela
- Sposobnost prepoznavanja problema in načrtovanja rešitev
- Vključevanje osnov in principov metrologije v raziskovalni delo

Prenesljive/ključne spretnosti in drugi atributi:

- Iskanje in uporaba primerne domače in tuje literature
- Pridobivanje sposobnosti razumevanja različnih pristopov k reševanju konkretnega problema
- Vključevanje znanja v gradnjo hipotez za reševanje problemov ciljano k temi raziskovalnega dela

#### Learning Outcomes:

Students successfully completing this course will acquire:

- An overview of instrumental analytical chemistry techniques and the possibility of using the key techniques required during the research work
- Ability to identify problems and design solutions
- Inclusion of the basics and principles of metrology in research work

Transferable / Key Skills and other attributes:

- Finding and using appropriate domestic and foreign literature
- Acquiring the ability to understand different approaches to solving a specific problem
- Integrating knowledge into the construction of hypotheses to solve problems targeted at the topic of research work

#### Vsebina:

Predmet obsega naslednje:

- Pregled analiznih metod v analizi kemiji
- Raztapljanje vzorca v primerjavi s popolnim razklopom vzorca
- Določanje zvrsti
- Maskiranje in/ali ločba motečih komponent
- Zagotavljanje sledljivosti meritev
- Uporaba certificiranih referenčnih materialov
- Ocena naključnih in sistematičnih napak
- Pristop k oceni merilne negotovosti; klasični pristop na osnovi standardnega odmika v primerjavi z oceno celotne merilne negotovosti v skladu z ključnim dokumentom z Vodilom za izražanje merilne negotovosti (Guide to the Expression of Uncertainty of Measurement – GUM)

#### Content (Syllabus outline):

The course includes the following:

- An overview of analytical methods in analytical chemistry
- Dissolve the sample as compared to complete sample decomposition
- Determining the genre
- Masking and / or separation of interfering components
- Ensuring the traceability of measurements
- Use of certified reference materials
- Evaluation of random and systematic errors
- Approach to the assessment of measurement uncertainty; a classical approach based on a standard deviation compared to an estimate of the total measurement uncertainty in accordance with the Guide to the Expression of Uncertainty of Measurement (GUM)

**Temeljni literatura in viri / Readings:**

- D.A. Skoog, D.M West, F.J. Holler, S.R. Crouch, Fundamentals of analytical chemistry, 9th ed., Cengage Learning, Hampshire, 2014.
- D.A. Skoog, A. Douglas A, Principles of instrumental analysis. Philadelphia: Harcourt Brace & Company (1998) ali kasnejša izdaja (or later edition).
- Evaluation of measurement data — Guide to the expression of uncertainty in measurement (GUM), 2008.
- Quantifying Uncertainty in Analytical Measurement, EURACHEM / CITAC Guide CG 4, 3rd ed., 2012.
- V.J. Barwick, S.L.R. Ellison, VAM Project 3.2.1 Development and Harmonisation of Measurement
- Uncertainty Principles, Part (d): Protocol for uncertainty evaluation from validation data, 2000.data, 2000.

**Metode poučevanja in učenja:**

- Predavanja
- Seminar
- Laboratorijske vaje

**Learning and teaching methods:**

- Lectures
- Seminar work
- Laboratory work

**Načini ocenjevanja:**

- seminar
- ustni izpit

Delež (v %) /

Weight (in %)

**Assessment:**

- Seminar
- Oral exam

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

1. PLOHL, Olivija, KRALJ, Slavko, MAJARON, Boris, FRÖHLICH, Eleonor, PONIKVAR-SVET, Maja, MAKOVEC, Darko, LISJAK, Darja. Amphiphilic coatings for the protection of upconverting nanoparticles against dissolution in aqueous media. Dalton Transactions 46 (2017) 6975-6984.
2. KOBLAR, Alenka, TAVČAR, Gašper, PONIKVAR-SVET, Maja. Stress syndrome response of nettle (*Urtica dioica* L.) grown in fluoride contaminated substrate to fluoride and fluorine accumulation pattern. J. Fluor. Chem. 172 (2015) 7-12.
3. MICHAŁOWSKI, Tomasz, GARCIA ASUERO, Agustin, PONIKVAR-SVET, Maja, MICHAŁOWSKA-KACZMARCZYK, Anna Maria, WYBRANIEC, Sławomir. Some examples of redox back titrations. The Chemical Educator 19 (2014) 217–222.
4. PONIKVAR-SVET, Maja, THOMAS, Alecia T., DOBSON, Bryan J., HENEGAR, Brittney M., BREWSTER, Mathew W., NEERCHAL, Nagarak K., LIEBMAN, Joel F. Linear model for estimating the entropy of formation of aqueous anions. Struct. Chem. 24 (2013) 2069–2082.
5. KOBLAR, Alenka, TAVČAR, Gašper, PONIKVAR-SVET, Maja. Fluoride in teas of different types and forms and the exposure of humans to fluoride with tea and diet. Food Chem. 130 (2012) 286–290.