

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

**Predmet:** INSTRUMENTALNA ANALIZA  
**Course Title:** INSTRUMENTAL ANALYSIS

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

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

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

KE135

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. Matevž Pompe /  
Dr. Matevž Pompe, 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:**

**Statistične metode in pristopi pri instrumentalni analizi:** kalibracija, linearna regresija, statistični testi, načrtovanje eksperimentov, metode optimizacije.  
**Elektroanalizne tehnike v analitiki sledov:** voltometrija (DC, PV, DPV SWV), inverzne (stripping) tehnike, voltometrični senzorji.  
**Radiokemijske metode:** radioaktivni izotopi in značilnosti radioaktivnega sevanja, zakonitosti razpada, aktivacijska analiza in instrumentacija, uporaba aktivacijske analize in radioaktivnih izotopov.  
**Rentgenska spektrometrija:** nastanek in lastnosti X žarkov, absorpcija in fluorescenca,

**Content (Syllabus outline):**

**Statistical methods and approaches to instrumental analysis:** calibration, linear regression, statistical tests, experimental design, optimization methods.  
**Electroanalytical techniques in trace analysis:** voltammetry (DC, PV, DPV, SWV), stripping techniques, Voltammetric sensors.  
**Radiochemical methods:** radioactive isotopes and characteristics of the radiation, radioactive decay, activation analysis and instrumentation, the use of activation analysis and radioisotope-  
**X-ray spectroscopic methods:** properties and formation of x-rays, absorption and fluorescence, wavelength and energy dispersive

valovno in energijsko-disperzijski analizatorji, značilnosti in uporaba.

**Atomska emisijska spektroskopija:** atomizacija in vzbujanje, značilnosti tehnik (OES), interference, občutljivost, meja zaznave, napake) in uporaba.

**Atomska absorpcijska spektrometrija:** plamenska in elektrotermična atomizacija, procesi pri atomizaciji, kemijske in spektralne interference, viri napak in korekcije ozadja.

**Separacijske metode v analizi kemiji:** ekstrakcije iz trdnih snovi, ekstrakcije na trdni fazi (SPE).

Plinska kromatografija, tekočinska kromatografija visoke zmogljivosti, superkritična kromatografija.

**Masna spektrometrija:** instrumentacija, načini ionizacije, analiza in detekcija ionov, identifikacija spojin, pomen izotopov.

**Napredne tehnike:** kromatografija-masna spektrometrija.

analyzers.

**Atomic emission spectroscopy:** atomization and excitation, characteristics of the techniques (OES), interference, sensitivity, detection limit, errors and applications.

**Atomic absorption spectrometry:** flame and electrothermal atomization, the atomization processes, chemical and spectral interferences, error sources and background correction.

**Separation methods in analytical chemistry:** extraction of solids, solid phase extraction (SPE).

Gas chromatography, high performance liquid chromatography, supercritical fluid chromatography.

**Mass spectrometry:** instrumentation, ionisation modes, analysis and ion detection, identification of the substance, the importance of isotopes.

**Hyphenated techniques:** chromatography-mass spectrometry.

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

- D.A. Skoog, F. J. Holler, S.R. Crouch, Principles of Instrumental Analysis, 6th Ed., Thomson Brooks Cole, Belmont, 2007;

- Analytical Chemistry A Modern Approach to Analytical Science, Ed. by R. J.- Mermet, M. Otto, M. Valcarcel, Founding Editors: R. Kellner, H.M. Widmer, Wiley - VCH, Weinheim, 2004.

- J.C. Miller and J.N. Miller, Statistics for Analytical Chemistry, 3rd Ed., Ellis Horwood PTR, New York, 1993.

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

V okviru predmeta dobi študent znanje o pomembnejših instrumentalnih tehnikah in pristopih k reševanju zahtevnih analiznih problemov. Spozna analizne značilnosti instrumentalnih tehnik, njihove prednosti in omejitve ter se usposobi za raziskovalno delo in analizo različnih realnih vzorcev.

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

The course provides the student with knowledge of the important instrumental techniques, and approaches for solving complex analytical problems.

One learns about the analytical features of instrumental techniques, their advantages and disadvantages. The student is trained for research work and analysis of complex real samples.

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

##### Znanje in razumevanje

Študent se seznani s postopki kalibracije in validacije pri posameznih instrumentalnih

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

##### Knowledge and Comprehension

Students get acquainted with the calibration and validation procedures of individual

<p>metodah in postopkih. Spozna postopke akreditacije in kritičnega vrednotenja merskih rezultatov. Seznan se z analiznimi karakteristikami posameznih instrumentalnih tehnik, spozna uporabo posameznih tehnik v analitiki sledov anorganskih in organskih sestavin ter se usposobi za samostojno in problemsko orientirano delo.</p>	<p>instrumental methods and procedures. Meets the accreditation process and critical evaluation of the measurement results. Pair it with analytical characteristics of individual instrumental techniques, learn about the use of individual techniques in trace analysis of inorganic and organic substances, and is trained for independent and problem-oriented work.</p>
<p><u>Uporaba</u> Pridobljena znanja so podlaga za samostojno in kreativno raziskovalno delo v analiznih in sinteznih laboratorijih. Usposobi se za merjenje anorganskih in organskih sestavin v širokem razponu koncentracij in za reševanje zahtevnih analiznih problemov na področju kemije, ekologije, analize bioloških vzorcev in materialov.</p>	<p><u>Application</u> The acquired knowledge represents basis for independent and creative research work in the analysis and synthesis laboratories. They are capable of measuring the organic and inorganic components in a wide concentration range for solving complex analytical problems in chemistry, environment, analysis of biological samples and materials.</p>
<p><u>Refleksija</u> Študenti se naučijo prednosti in slabosti različnih instrumentalnih metod in so sposobni njihove kritične izbire za reševanje določenega analiznega problema.</p>	<p><u>Analysis</u> Students learn advantages and disadvantages of various instrumental methods and are capable of their critical selection for solving particular analytical problem.</p>
<p><u>Prenosljive spretnosti</u> Ovlada izvedbo instrumentalnih meritev na osnovi literaturnih podatkov in znanstvenih člankov, razume pomen validacije in akreditacije. Zna meritve kritično ovrednotiti in merske rezultate predstaviti v ustrezni pisni in ustni obliki. Ovlada problemski in timski pristop k reševanju analiznih problemov.</p>	<p><u>Skill-transference Ability</u> Students are capable of the execution of instrumental measurements based on literature reports and scientific papers, understand the importance of validation and accreditation. Students are able to critically evaluate the results and present them in written and oral form. They are trained for teamwork and problem solving analytical problems.</p>

**Metode poučevanja in učenja:**

Predavanja in seminarji z aktualno tematiko.

**Learning and Teaching Methods:**

Lectures

Delež (v %) /

**Načini ocenjevanja:**

Weight (in %) **Assessment:**

Pisni in ustni izpit.

ocene od 6-10 (pozitivno) oz. 1-5 (negativno).

Written and oral exam.

Grades: 6-10 (positive), 1-5 (negative)

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

- S. Kose, S. Koral, B. Tufan, **M. Pompe**, A. Ščavničar, D. Kočar. Biogenic amine contents of commercially processed traditional fish products originating from European countries and Turkey. European Food Research and Technology. A, Zeitschrift für Lebensmittel-Untersuchung und -Forschung. 2012, 235, 669-683.
- 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, 1218, 1538-1543.

- J. Cerar, **M. Pompe**, M. Guček, J. Cerkovnik, J. Škerjanc. Analysis of sample of highly water-soluble T<sub>h</sub>-symmetric fullerenehexamalic acid C<sub>60</sub>(COOH)<sub>12</sub> by ion-chromatography and capillary electrophoresis. J. chromatogr. A 2007, 1169, 86-94.

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