



Univerza v Mariboru

Fakulteta za kemijo
in kemijsko tehnologijo

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Analizna kemija I
Course title:	Analytical Chemistry I

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Izobraževalna kemija / 1. stopnja UN		1.	zimski
Educational Chemistry / 1 st level UN			Autumn

Vrsta predmeta / Course type:

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
30			30		60	4

Nosilec predmeta / Lecturer:

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

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

Osnovno znanje klasične analizne kemije, matematike in fizike

Prerequisites:

Basic knowledge of classical analytical chemistry, mathematics and physics

Vsebina:

Predavanja
-Statistično ovrednotenje analiznih rezultatov, napake v analizni kemiji, natančnost, točnost, merilna negotovost
-Elektrokemijske metode
Potenciometrija (ionoselektivne elektrode)
- elektrode s stekleno membrano, elektrode s kristalinično homogeno in heterogeno membrano, elektrode s tekočinsko membrano,
Voltometrija
- direktna in pulzna polarografija, stripping analiza, ciklična voltometrija, amperometrične titracije
Konduktometrija
Elektrogravimetrija in kulometrija
- elektroliza pri konstantni napetosti in pri konstantnem toku, elektroliza pri kontroliranem potencialu, potenciostatična kulometrija, kulometrične titracije

Content (Syllabus outline):

Lectures
-Statistical evaluation of analytical results, errors in analytical chemistry, precision, accuracy, measurement uncertainty
-Electrochemical methods
Potentiometry, ion-selective electrodes, glass electrodes, solid state crystalline homogeneous and heterogeneous membrane electrodes, liquid membrane electrodes
Voltammetry
Direct and pulse polarography, stripping analysis, cyclic voltammetry, amperometric titrations, Conductometry
Electrogravimetry and coulometry
Constant cathode potential gravimetry, constant current gravimetry, potentiostatic coulometry, coulometric titrations
-Spectroscopic methods

- Spektroskopske metode

Atomska absorpcijska spektrometrija, atomska emisijska spektrometrija, molekulska spektrometrija ICP spektrometrija, masna spektrometrija

Separacijske metode

Ekstrakcijske metode, ekstrakcija na trdni fazi Tankoplastna kromatografija, plinska kromatografija, tekočinska kromatografija, ionska kromatografija, sklopljene tehnike z masno spektrometrijo

Laboratorijske vaje

Vaje zajemajo praktične primere izvedbe analiznih postopkov na področjih elektrokemijskih, spektroskopskih in separacijskih metod

Atomic absorption spectroscopy, atomic emission spectroscopy, molecular absorption spectroscopy, ICP spectroscopy, mass spectrometry

-Separation methods

Extraction methods, solid phase extraction, planar chromatography, gas liquid chromatography, high performance liquid chromatography, ion chromatography, hyphenated techniques with mass spectrometry

Laboratory work

Practical examples of analytical procedures in electrometric, spectrometric and separation methods

Temeljni literatura in viri / Readings:

- Douglas A. Skoog, F. James Holler, Stanley R. Crouch, "Principles of Instrumental Analysis, 6. izdaja, 2006.
- D. A. Skoog, F.J.Holler, T. A. Nieman: *Principles of Instrumental Analysis*, Saunders College Publishing, 5. izdaja, New York 1998.

Cilji in kompetence:

Predmet daje poglobljeno znanje teoretskih osnov in aplikacij analiznih metod elektrokemijske analize, spektroskopske analize in separacijskih metod

Podatki o sestavi materialov vodijo vsak proizvodni proces v raznih fazah od surovin do končnih produktov. Analiza je osnova za vrednotenje hrane, okolja, delovanja organizmov. Predmet analizna kemija 2 obravnava zato področje kemijske analize teoretično poglobljeno, praktično pa tako usmerjeno, da usposobi slušatelje ne samo za razumevanje, temveč tudi za reševanje analiznih problemov. Predmet daje integralni pregled teorij in metod uporabnih za identifikacijo in rešitev vrste realnih problemov kemijske analize.

Primeri iz področij anorganske kemije, organske kemije in biokemije se uporabljajo za razumevanje kemijskih in fizikalnih procesov, ki spremljajo analizni postopek.

Objectives and competences:

Subject gives the complete overview of knowledge concerning the theoretical basis and applications of analytical methods in electrochemical, spectroscopic and separation methods.

Data from the content of materials lead every production process in different phases from raw materials to final products. Analysis is the basis for quality evaluation of food, environment and living organisms. The analytical chemistry gives the complete theoretical overview and during practical work gives the knowledge not only for understanding but also for solving analytical problems. The subject gives the integral overview of theories and methods used for identification and quantitative determination of real problems of chemical analysis.

Examples from inorganic chemistry, organic chemistry and biochemistry are used for understanding of chemical and physical processes which accompany analytical procedure.

Predvideni študijski rezultati:

Znanje in razumevanje:

Po zaključku tega predmeta bo študent sposoben

- razumeti osnove kemijske analize, osnovnih instrumentalnih analiznih meritev.
- spoznati osnovne principe in zakone na katerih temeljijo instrumentalne analizne metode
- spoznati kvantitativno ovrednotenje rezultatov meritev

Intended learning outcomes:

Knowledge and Understanding:

On completion of this course the student will be able to

- understand the base of chemical analysis and basic instrumental analytical measurements
- recognize basic principles and laws on which instrumental analytical methods are based.
- recognize quantitative evaluation of

	measurements results.
<u>Prenesljive/ključne spretnosti in drugi atributi:</u> Ročne spretnosti, predvsem zmožnost praktičnega dela na instrumentih. Ovrednotenje rezultatov meritev in merilne negotovosti.	<u>Transferable/Key Skills and other attributes:</u> Manual skills, preferable the capability of practical work with instruments. Evaluation of analytical results and measurement uncertainty.

Metode poučevanja in učenja:

- Predavanja
- Laboratorijske vaje

Learning and teaching methods:

- Lectures
- Lab work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Pristopni pogoji za opravljanje vaj: opravljene vaje iz Analizne kemije I in zaključni kolokvij		<u>Conditions to access the laboratory work:</u> Concluded lab work of Analytical chemistry I and final written test
Pristopni pogoji za opravljanje izpita: Izpit iz Analizne kemije I Opravljene lab. vaje in test iz vaj Analizna kemija II. Izpit je opravljen, če so pozitivno opravljene vse naslednje obveznosti:		<u>Conditions to access the examination:</u> Analytical Chemistry I Concluded lab. Work and written test of lab. Work in Analytical Chemistry II Student has to pass successfully the following obligations:
<u>Ocenjevanje predmeta</u>		<u>Assesment of the subject</u>
• Računske naloge	30	• Course work, analytical calculations
• Ustni izpit	40	• Oral examination
<u>Ocenjevanje lab. vaj</u>		<u>Assesment of lab work</u>
• Pisni kolokvij po zaključenih laboratorijskih vajah	30	• Written colloquium after conclusion of lab work

Reference nosilca / Lecturer's references:

LIU, Mingqiang, **FRANKO, Mladen**. Thermal lens spectrometry under excitation of a divergent pump beam. *Applied physics. B, Lasers and optics*, ISSN 0946-2171. Tiskana izd., 2014, vol. 115, issue 2, str. 269-277, ilustr., doi: [10.1007/s00340-013-5601-4](https://doi.org/10.1007/s00340-013-5601-4). [COBISS.SI-ID [2827515](https://www.cobiss.si/id/2827515)]

LIU, Mingqiang, **FRANKO, Mladen**. Progress in thermal lens spectrometry and its applications in microscale analytical devices. *Critical reviews in analytical chemistry*, ISSN 1040-8347, 2014, vol. 44, no. 4, str. 328-353, doi: [10.1080/10408347.2013.869171](https://doi.org/10.1080/10408347.2013.869171). [COBISS.SI-ID [3340539](https://www.cobiss.si/id/3340539)]

JOVANOVIĆ, Pavle, GUZSVÁNY, Valeria (pisar), **FRANKO, Mladen**, LAZIĆ, Sanja, SAKAČ, Marijana, MILOVANOVIĆ, Ivan, NEDELJKOVIĆ, Nataša. Development of multiresidue DLLME and QuEChERS based LC-MS/MS method for determination of selected neonicotinoid insecticides in honey liqueur. *Food research international*, ISSN 0963-9969, 2014, vol. 55, str. 11-19, doi: [10.1016/j.foodres.2013.10.031](https://doi.org/10.1016/j.foodres.2013.10.031). [COBISS.SI-ID [2931707](https://www.cobiss.si/id/2931707)]

RADOVANOVIĆ, Tatjana, LIU, Mingqiang, LIKAR, Polona, KLEMENC, Matjaž, **FRANKO, Mladen**. Microfluidic flow injection analysis with thermal lens microscopic detection for determination of NGAL. *International journal of thermophysics*, ISSN 0195-928X, 8 str., 2014, doi: [10.1007/s10765-014-1699-9](https://doi.org/10.1007/s10765-014-1699-9). [COBISS.SI-ID [3503099](https://www.cobiss.si/id/3503099)]

FRANKO, Mladen. Thermal lens spectrometric detection in flow injection analysis and separation techniques. *Applied spectroscopy reviews*, ISSN 0570-4928, jul.-avg. 2008, vol. 43, no. 4, str. 358-388. [COBISS.SI-ID [915451](https://www.cobiss.si/id/915451)]