



Univerza v Mariboru

Fakulteta za kemijo
in kemijsko tehnologijo

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Analizna kemija II
Course title:	Analytical Chemistry II

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

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		120	6

Nosilec predmeta / Lecturer:

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

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

Osnovno znanje splošne in anorganske kemije, matematike in fizike

Prerequisites:

Basic knowledge of general and inorganic chemistry, mathematics and physics

Vsebina:

- Obdelava in interpretacija rezultatov: sistematske in slučajne napake, uporaba statistike za ovrednotenje meritev.
- tipi, selektivnost in občutljivost reagentov in kemijskih reakcij.
- ravnotežja v homogenih in heterogenih sistemih, nevtralizacija, oksidacija in redukcija, obarjanje ter tvorba kompleksov kot osnova analiznih metod.
- Volumetrija.
- titrimetrija z vizuelnimi indikatorji: priprava standardnih raztopin, acidi in alkalimetrične titracije, redukcijsko-oksidacijske, obarjalne in kompleksometrične titracije, titracija v nevodnem mediju.
- Gravimetrija.

Content (Syllabus outline):

- Evaluation and interpretation of results, systematic and random errors, statistical methods for evaluation of measurements.
- Types, selectivity and sensitivity of reagents and chemical reactions.
- Equilibrium in homogeneous and heterogeneous systems, neutralization, oxidation and reduction, precipitation and formation of complexes as a base of analytical methods.
- Volumetry.
- Titrimetry using visual indicators: preparation of standard solutions, acid/base titrations, oxidation/reduction titrations, precipitation titrations, complex formation titrations, titrations in nonaqueous media.
- Gravimetry.

Laboratorijske vaje

gravimetrija

- titrimetrija z vizuelnimi indikatorji (priprava standardnih raztopin, acidi-in alkalimetrične titracije, redukcijsko oksidacijske, obarjalne in kompleksometrične titracije).

Laboratory work

Gravimetry

-Titrimetry using visual indicators (preparation of standard solutions, acid/base titrations, oxidation/reduction titrations, precipitation titrations, complex formation titrations),

Temeljni literatura in viri / Readings:

- D. A. Skoog, D. M. West, F. J. Holler: Fundamentals of Analytical Chemistry, Saunders College Publishing, 8. izdaja, N.Y.2003.
- D. A. Skoog, , F. J. Holler S. R. Crouch: Analytical Chemistry An Introduction, John Wiley, 7. izdaja, New York, 2000.
- G. D. Christian: Analytical Chemistry, John Wiley, New York, 2003.
- D. Brodnjak Vončina, Analizna kemija 1, zapiski predavanj, UMFKKT 2011
- M. Kolar, Laboratorijske vaje iz Analizne kemije I, UM FKKT 2003

Cilji in kompetence:

Predmet daje popolni pregled znanja ter teoretskih osnov in uporabe analiznih klasičnih analiznih metod kot je gravimetrija in volumetrija.

Analiza je osnova za vrednotenje kvalitete hrane, okolja in živih bitij. Analizna kemija 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, z vidikov kemijskih ravnotežij in kinetike. Znanje se širi in pogloblja z računskimi pristopi baziranimi na fiziki ter z aplikacijo znanj anorganske in organske kemije.

Objectives and competences:

Subject gives the complete overview of knowledge and the theoretical basis concerning applications of classical analytical methods such as gravimetry and volumetry

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 the analytical procedure from the view of chemical equilibrium and kinetics. Knowledge is spread and improved using calculation principles based on knowledge of physics and using applications from inorganic and organic chemistry.

Predvideni študijski rezultati:

Znanje in razumevanje:

Po zaključku tega predmeta bo študent sposoben

- razumeti osnove kemijske analize osnovnih klasičnih analiznih meritev .
- spoznati osnovne principe in zakone na katerih temeljijo gravimetrične in titrimetrične analizne metode
- spoznati kvantitativno ovrednotenje rezultatov meritev

Prenesljive/ključne spretnosti in drugi atributi:

Ročne spretnosti, predvsem sposobnost praktičnega dela z laboratorijsko steklovino in opremo. Reševanje analiznih problemov, od

Intended learning outcomes:

Knowledge and Understanding:

On completion of this course the student will be able to

- understand the base of chemical analysis of classical analytical measurements
- recognize basic principles and laws on which gravimetric and titrimetric analytical methods are based.
- Recognize quantitative evaluation of measurements results.

Transferable/Key Skills and other attributes:

Manual skills, preferable the capability of practical work with laboratory glassware and equipment. Solving analytical problems, from simple to more

enostavnejših do bolj zapletenih in reševanje računskih nalog z uporabo stehiometričnih razmerij in ravnotežnih reakcij. Računanje merilne negotovosti.	complex ones and calculations using stoichiometric ratios and equilibrium equations. Calculation of measurement uncertainty.
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Metode poučevanja in učenja:

- Predavanja
- Laboratorijske vaje

Learning and teaching methods:

- Lectures
- Lab work

Načini ocenjevanja:

 Delež (v %) /
Weight (in %)

Assessment:

<p><u>Pristopni pogoji</u> za opravljanje vaj: opravljene vaje iz Anorganske kemije in dva kolokvija</p> <p>Pristopni pogoji za opravljanje izpita: Opravljene lab. vaje in test iz vaj Analizna kemija I.</p> <p>Izpit je opravljen, če so pozitivno opravljene vse naslednje obveznosti:</p> <p>Ocenjevanje predmeta</p> <ul style="list-style-type: none"> - Računski naloge - Ustni izpit <p>Ocenjevanje lab. vaj</p> <ul style="list-style-type: none"> - Pisni test po zaključenih laboratorijskih vajah 	<p>30</p> <p>40</p> <p>30</p>	<p><u>Conditions to access the laboratory work:</u> Concluded lab work of Inorganic chemistry and two written tests</p> <p><u>Conditions to access the examination:</u> Concluded lab. work and written test of lab. work in Analytical Chemistry I. Student has to pass successfully the following obligations:</p> <p>Assesment of the subject</p> <ul style="list-style-type: none"> - Coursework, analytical calculations - Oral examination <p>Assesment of lab work</p> <ul style="list-style-type: none"> -Written test after conclusion of lab work
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Reference nosilca / Lecturer's references:

MARTELANC, Mitja, ŽIBERNA, Lovro, PASSAMONTI, Sabina, **FRANKO, Mladen**. Direct determination of free bilirubin in serum at sub-nanomolar levels. *Analytica chimica acta*, ISSN 0003-2670. [Print ed.], 2014, vol. 809, str. 174-182, doi: [10.1016/j.aca.2013.11.041](https://doi.org/10.1016/j.aca.2013.11.041). [COBISS.SI-ID [2983675](https://www.cobiss.si/id/2983675)]

LUTEROTTI, Svjetlana, BICANIC, Dane Danijel, MARKOVIĆ, Ksenija, **FRANKO, Mladen**. Carotenes in processed tomato after thermal treatment. *Food control*, ISSN 0956-7135. [Print ed.], 2015, vol. 48, str. 67-74, doi: [10.1016/j.foodcont.2014.06.004](https://doi.org/10.1016/j.foodcont.2014.06.004). [COBISS.SI-ID [3536891](https://www.cobiss.si/id/3536891)]

JOVANOVA, 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)]

LUTEROTTI, Svjetlana, MARKOVIĆ, Ksenija, **FRANKO, Mladen**, BICANIC, Dane Danijel, MADŽGALJ, Azamela, KLJAK, Kristina. Comparison of spectrophotometric and HPLC methods for determination of carotenoids in foods. *Food chemistry*, ISSN 0308-8146. [Print ed.], 2013, vol. 140, no 1/2, str. 390-397, doi: [10.1016/j.foodchem.2013.02.003](https://doi.org/10.1016/j.foodchem.2013.02.003). [COBISS.SI-ID [2701819](https://www.cobiss.si/id/2701819)]

JOVANOVA, Pavle, GUZSVÁNY, Valeria, **FRANKO, Mladen**, LAZIĆ, Sanja, SAKAČ, Marijana, ŠARIĆ, Bojana, BANJAC, Vojislav. Multi-residue method for determination of selected neonicotinoid insecticides in honey using optimized dispersive liquid-liquid microextraction combined with liquid chromatography-tandem mass spectrometry. *Talanta*, ISSN 0039-9140. [Print ed.], 2013, vol. 111, str. 125-133, doi: [10.1016/j.talanta.2013.02.059](https://doi.org/10.1016/j.talanta.2013.02.059). [COBISS.SI-ID [2710011](https://www.cobiss.si/id/2710011)]