



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
Enovit magistrski študijski program druge stopnje Predmetni učitelj		1.	2
Five-year master's degree program Subject Teacher		1.	2

Vrsta predmeta / Course type

Obvezni / Obligatory

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
45			60		75	6

Nosilec predmeta / Lecturer:

Matjaž Finšgar

Jeziki /

Predavanja / Lectures:

Slovenski / Slovene

Languages:

Vaje / Tutorial:

Slovenski / Slovene

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

Osnovno znanje splošne in anorganske kemije, matematike in fizike.

Pristopni pogoji za opravljanje laboratorijskih vaj iz Analizne kemije I: opravljene laboratorijske vaje in dva kolokvija (ali zaključni kolokvij) iz Splošne kemije.

Pristopni pogoji za opravljanje izpita iz Analizne kemije I:

Opravljene laboratorijske vaje Analizne kemije I in kolokvij iz vaj Analizna kemija I.

Prerequisites:

Basic knowledge of general and inorganic chemistry, mathematics, and physics.

Prerequisites for attending laboratory exercises in Analytical Chemistry I:

Completed laboratory exercises and two colloquia (or a final colloquium) in General Chemistry.

Prerequisites for taking the Analytical Chemistry I exam:

Completed Analytical Chemistry I laboratory exercises and the Analytical Chemistry I colloquium.

Vsebina:

- Obdelava in interpretacija rezultatov: sistematske in slučajne napake, uporaba statistike za ovrednotenje meritev;
- tipi, selektivnost in občutljivost reagentov in kemijskih reakcij;

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;

- ravnotežja v homogenih in heterogenih sistemih, nevtralizacija, oksidacija in redukcija, obarjanje ter tvorba kompleksov kot osnova analiznih metod;
- volumetrija;
- titrimetrija z vizuelnimi indikatorji: priprava raztopin standardov, acidi in alkalimetrične titracije, redukcijsko-oksidacijske, obarjalne in kompleksometrične titracije, titracija v nevodnem mediju;
- gravimetrija.

Laboratorijske vaje

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

- Equilibrium in homogeneous and heterogeneous systems, neutralization, oxidation and reduction, precipitation, and formation of complexes as a basis 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.

Laboratory work

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

Temeljni literatura in viri / Readings:

- Poglavja 1–20 v D.A. Skoog, Fundamentals of analytical chemistry, Cengage Learning, 10. izdaja, Boston, 2017.
- M. Kolar, Laboratorijske vaje iz Analizne kemije I, UM FKKT 2003

Cilji in kompetence:

Predmet daje popolni pregled znanja ter teoretskih osnov in uporabe 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:

The course provides a comprehensive overview of knowledge, theoretical foundations, and the application of classical analytical methods such as gravimetry and volumetry.

Analysis is fundamental for assessing the quality of food, the environment, and living organisms. Analytical chemistry addresses chemical analysis both through in-depth theoretical study and practice-oriented training, enabling students to understand and to solve analytical problems.

The course offers an integrated view of theories and methods useful for identifying and resolving a wide range of real-world chemical analysis challenges.

Examples from inorganic, organic, and biochemical chemistry are used to explain the chemical and physical processes that accompany analytical procedures, focusing on chemical equilibria and kinetics.

Knowledge is further expanded and deepened through calculation-based approaches rooted in physics and through the application of concepts from inorganic and organic chemistry.

Predvideni študijski rezultati:

Intended learning outcomes:

<u>Znanje in razumevanje:</u> 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. <u>Prenesljive/ključne spretnosti in drugi atributi:</u> Ročne spretnosti, predvsem sposobnost praktičnega dela z laboratorijsko steklovino in opremo. Reševanje analiznih problemov, od enostavnejših do bolj zapletenih in reševanje računskih nalog z uporabo stehiometričnih razmerij in ravnotežnih reakcij. Računanje merilne negotovosti.	<u>Knowledge and Understanding:</u> On completion of this course, the student will be able to: • understand the basis 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 measurement results. <u>Transferable/Key Skills and other attributes:</u> Manual skills, preferably the capability of practical work with laboratory glassware and equipment. Solving analytical problems, from simple to more 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:

- Teoretični izpit
- Laboratorijsko delo

Delež (v %) /

Weight (in %)

Assessment:

- Teoretični izpit	70	- Theoretical exam
- Laboratorijsko delo	30	- Laboratory work

Opombe: Sprotni študij: Študenti lahko opravijo teoretični izpit z opravljanjem treh delnih testov iz snovi predavanj. Med semestrom bodo izvedeni trije delni testi – vsak pokriva tretjino snovi s predavanj. Študentom, ki na vsakem delnem testu dosežejo rezultat najmanj 30 % in na vseh delnih testih povprečno 55 % ali več, je ocena delnih testov priznana kot opravljen teoretični izpit.

Comments: Partial exams: Students can fulfil part of their examination requirements by taking written partial exams. Three partial exams will be offered during the semester, each of them covering one third of the course. Students who achieve a minimum score of 30 % at each of the partial exams, and an average score of 55 % or higher, have fulfilled the requirement of completed written exam.

Reference nosilca / Lecturer's references:

RANTAŠA, Matjaž, MAJER, David, FINŠGAR, Matjaž. The analysis of e-liquids : a study on chemical diversity and metal content using gas chromatography-mass spectrometry and inductively coupled plasma-mass spectrometry. *Journal of separation science*. Sep. 2024, vol. 47, no. 17, [article no.] 2400443, 16 str., ilustr. ISSN 1615-9314. [Digitalna knjižnica Univerze v Mariboru – DKUM](#), DOI: [10.1002/jssc.202400443](#). [COBISS.SI-ID [207573763](#)]

FINŠGAR, Matjaž. From surface to core : comprehensive ToF-SIMS insights into pharmaceutical tablet analysis. *Microchemical journal*. [Online ed.]. 2024, vol. 202, [article no.] 110835, 9 str. ISSN 1095-9149. DOI: [10.1016/j.microc.2024.110835](#). [COBISS.SI-ID [196997123](#)]

FINŠGAR, Matjaž, KRAVANJA, Katja Andrina. Forensic differentiation of blue pen inks using time-of-flight secondary ion mass spectrometry and multivariate statistical methods. *Microchemical*

