



Univerza v Mariboru

Fakulteta za kemijo  
in kemijsko tehnologijo

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	<b>Analizna kemija I</b>
<b>Course title:</b>	<b>Analytical Chemistry I</b>

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.	Poletni
Five-year master's degree program Subject Teacher		1.	Spring

**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.

**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 komplekso-metrične 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:**

- Poglavlja 1–20 v D.A. Skoog, D.M. West, F.J. Holler, S. R. Crouch: Fundamentals of Analytical Chemistry, Saunders College Publishing, 8. izdaja, N.Y. 2004.
- G.D. Christian: Analytical Chemistry, John Wiley, New York, 2003.
- D. Brodnjak Vončina, Analizna kemija 1, zapiski predavanj, UM FKKT 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.

### **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.

**Prenesljive/ključne spretnosti in drugi atributi:**

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.

**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 complex ones and calculations using stoichiometric ratios and equilibrium equations. Calculation of measurement uncertainty.

**Metode poučevanja in učenja:**

- Predavanja
- Laboratorijske vaje

**Learning and teaching methods:**

- Lectures
- Lab work

<b>Načini ocenjevanja:</b>	<b>Delež (v %) / Weight (in %)</b>	<b>Assessment:</b>
<p><u>Pristopni pogoji za opravljanje laboratorijskih vaj iz Analizne kemije 1:</u> opravljene vaje in dva kolokvija (ali zaključni kolokvij) iz Splošne kemije</p> <p><u>Pristopni pogoji za opravljanje izpita:</u> Opravljene lab. vaje in test iz vaj Analizna kemija I.</p> <p><u>Sprotni študij:</u> Študenti lahko opravijo del izpitnih obveznosti z opravljanjem kolokvijev iz predavanj. Med semestrom bodo izvedeni trije kolokviji - vsak pokriva tretjino snovi s predavanj. Študentom, ki na vsakem kolokviju dosežejo povprečen rezultat najmanj 30 % in na vseh kolokvijih povprečno 55 % ali več, je ocena kolokvijev priznana kot opravljen pisni del izpita.</p> <p>Izpit iz predmeta je opravljen, če so pozitivno opravljene vse naslednje obveznosti:</p> <p><b>Ocenjevanje predmeta</b> - Računske naloge (trije delni testi ali pisni izpit)</p> <p>Ocenjevanje lab. vaj - Pisni test po zaključenih laboratorijskih vajah</p>	<p><b>70</b></p> <p><b>30</b></p>	<p><u>Conditions to access the laboratory work:</u> Concluded lab work and two written tests of Inorganic chemistry</p> <p><u>Conditions to access the examination:</u> Concluded lab. work and written test of lab. Work in Analytical Chemistry I.</p> <p>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.</p> <p>Student passes the examination if s(he) successfully passed all the following obligations:</p> <p><b>Assessment of the subject</b> - Coursework, analytical calculations (partial exams or final written exam)</p> <p>Assessment of lab work -Written test after conclusion of lab work vajah</p>

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

KOSHY, Obey, YASIR BEERAN, Pottathara, THOMAS, Sabu, PETOVAR, Barbara, FINŠGAR, Matjaž. A flexible, disposable hydrogen peroxide sensor on graphene nanoplatelet-coated cellulose. Current analytical chemistry, ISSN 1875-6727. [Online ed.], Published online 2017, vol. 13, 4 str. <http://www.eurekaselect.com/151940/article>, doi: 10.2174/1573411013666170427121958.

FINŠGAR, Matjaž. Electrochemical analysis of 4-methyl-2-phenyl-imidazole adsorbed on Cu. International Journal of Electrochemical Science, ISSN 1452-3981, 2016, vol. 11, str. 6775-6790

XHANARI, Klodian, GRAH, Natalija, FINŠGAR, Matjaž, FUCHS-GODEC, Regina, MAVER, Uroš. Corrosion inhibition and surface analysis of amines on mild steel in chloride medium. Chemical papers, ISSN 1336-9075. [Online ed.], Jan. 2017, vol. 71, iss. 1, str. 81-89

MAVER, Uroš, VELNAR, Tomaž, GABERŠČEK, Miran, PLANINŠEK, Odon, FINŠGAR, Matjaž. Recent progressive use of atomic force microscopy in biomedical applications. TrAC, Trends in analytical chemistry, ISSN 0165-9936, Jun. 2016, vol. 80, str. 96-111

FINŠGAR, Matjaž, PERVA-UZUNALIĆ, Amra, STERGAR, Janja, GRADIŠNIK, Lidija, MAVER, Uroš. Novel chitosan/diclofenac coatings on medical grade stainless steel for hip replacement applications. Scientific reports, ISSN 2045-2322, Published online:24 May 2016, vol. 6, art. no. 26653, str. 1-17

FINŠGAR, Matjaž, PETOVAR, Barbara, XHANARI, Klodian, MAVER, Uroš. The corrosion inhibition of certain azoles on steel in chloride media : electrochemistry and surface analysis. Corrosion science, ISSN 0010-938X, Oct. 2016, vol. 111, str. 370-381.