

UČNI NAČRT

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Analizna kemija
Course title:	Analytical chemistry

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
MAG Kemija, 2. stopnja	Materiali za shranjevanje in pretvorbo energije	2.	3.
USP Chemistry, 2nd Cycle	Materials for Energy Storage and Conversion	2 st	3 rd

Vrsta predmeta / Course type

Obvezni / Mandatory

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	15	30	/	/	75	6

Nosilec predmeta / Lecturer:

izr. prof. dr. Mitja Kolar/ dr. Mitja Kolar, Associate Professor

Jeziki /

Languages:

Predavanja / angleški/ English

Lectures:

Vaje / angleški/ English

Tutorial:

	angleški/ English
	angleški/ English

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

Predmet imajo opredeljen kot študijsko obveznost študenti, ki so vključeni v projekt "Materiali za shranjevanje in pretvorbo energije +" (MESC+). Lahko ga vpišejo tudi drugi tuji študenti na mednarodni izmenjavi na UL. Študenti morajo biti vpisani na MŠP Kemija, 2. stopnja, ali imeti podpisan učni sporazum (LA) med UL FKKT in drugimi tujimi izobraževalnimi ustanovami.

Opravljanje študijskih obveznosti: predpogoj za pristop h kolokviju iz laboratorijskih vaj je uspešno zaključen praktični del vaj; opravljen kolokvij iz vaj je predpogoj za pristop k pisnemu izpitu.

Prerequisites:

This course will be assigned to the students who are part of the "Materials for Energy Storage and Conversion +" (MESC+) project. It is available to other foreign international exchange students as well. Students must be enrolled to the USP Chemistry, 2nd Cycle or have signed learning agreement between UL FKKT and other foreign educational institution.

Assessment prerequisites: successfully accomplished lab work is a precondition for attending the written assessment; successfully accomplished laboratory tutorial is a precondition to attend the written exam.

Vsebina:

Uvod v analizno kemijo (opredelitev, pomen, delitev analizne kemije-podpodročja, temeljni analizni pojmi: analit, matrica, merjenec, metoda, tehnika itd.). Stopnje in izbira analiznih postopkov, vrednotenje analiznih rezultatov, validacija metod in postopkov, napake v analizni kemiji. Pomen in vrste kalibracije (metoda umeritvene krivulje, metoda standardnega dodatka, metoda internega standarda).

Gravimetrija (princip in uporabnost gravimetrične analize, primeri gravimetričnih določitev).

Volumetrija: nevtralizacijske, kompleksometrične, obarjalne in redoks določitve (potek titracijskih krivulj, načini ugotavljanja končne točke, izbira indikatorjev, izbrani primeri določitev, avtomatizacija).

Content (Syllabus outline):

Introduction to analytical chemistry, terminology, specific analytical statement of a problem, selection of a procedure. Evaluation and presentation of analytical results, sources and types of errors, validation. Calibration in analytical chemistry (method of linear calibration, method of standard additions, method of internal standard).

Gravimetric analysis (properties, application and examples of gravimetric procedures).

Volumetric analytical methods: neutralisation, redox, precipitation and complex-formation titrations (titration curve, types of indicators, analytical applications, automatization.)

Introduction to electrochemistry and electrochemical methods:

Potentiometry (method characteristics,

Uvod v elektrokemijo, pregled elektrokemijskih metod: potenciometrija (značilnosti, merilni sistem, vrste elektrod in uporabnost), voltometrija (značilnosti metode, merilni sistem, voltamogram-interpretacija, sodobni elektrodni materiali, tehnike). Konduktometrija, kulometrija, amperometrija in elektrogravimetrija (značilnosti metod in njihova uporabnost).

Uvod v spektroskopijo in pregled spektroskopskih metod. Molekularna absorpcijska in fluorescenčna spektrometrija (uporaba spektrometrije v UV-VIS in IR področju, lastnosti spektrov, instrumentacija). Atomska emisijska spektrometrija (AES) v plamenu in plazmi - ICP. Elektrotermična (ETAAS) in absorpcijska spektrometrija (AAS) v plamenu.

Separacijske metode: princip kromatografske ločbe in delitev kromatografskih tehnik - tankoplastna kromatografija (TLC), tekočinska kromatografija visoke ločljivosti (HPLC) in plinska kromatografija (GC) (različne izvedbe sistemov, sklopitve, uporabnost).

Laboratorijske vaje: pri vajah se študenti usposobijo za praktično izvedbo klasičnih in instrumentalnih analiznih metod.

measuring system, types of electrodes, approaches for determining concentration, potentiometric titrations); Voltammetry (method characteristics, measuring system, voltammogram-interpretation, novel electrode materials, techniques). Conductometry, coulometry, amperometry and electrogravimetry (method characteristics and analytical applications).

Introduction to spectroscopy and principles of spectroscopic methods. Molecular absorption and fluorescence spectrometry (method and spectra characteristics, UV-VIS and IR spectrometry, instrumentation). Flame emission (AES) and inductively coupled plasma (ICP) spectrometry. Atomic absorption spectrometry (AAS) and atomic absorption spectrometry with electrothermal atomization (ETAAS).

Separation methods: fundamentals of chromatography and principles of different chromatographic methods: thin layer chromatography (TLC), high performance liquid chromatography (HPLC), and gas chromatography (instrumental setup, hyphenation, analytical applications).

Laboratory work, performing selected classical and instrumental analytical methods.

Temeljni literatura in viri / Readings:

- 1.) Harris D. C. Quantitative Chemical Analysis, W. H. Freeman and Company. Eighth Edition, 2010.
- 2.) Skoog D. A., West D. M., Holler J. F. in Crouch R. S. Fundamentals of analytical chemistry. Ninth Edition, Brooks/Cole. 2014.
- 3.) Wang J., Analytical Electrochemistry, Wiley-VCH. Second Edition, 2001.

Cilji in kompetence:

Pri predmetu študenti osvojijo temelje analizne kemije, spoznajo različne analizne pristope in uporabo klasičnih ter instrumentalnih analiznih metod za reševanje realnih primerov.

Objectives and competences:

Students learn the fundamentals of analytical chemistry, analytical approach and application of classical and instrumental analytical methods for real sample analysis.

Predvideni študijski rezultati:

Znanje in razumevanje

Študenti razumejo temelje analizne kemije, osvojijo analizni pristop ter razumejo in znajo uporabljati klasične in instrumentalne analizne metode, s poudarkom na pravilni interpretaciji analiznih rezultatov.

Uporaba

Študenti znajo podajati in vrednotiti analizne rezultate ter razlikujejo med različnimi principi določitev. Študenti obvladajo računske vidike obravnavanih analiznih metod.

Refleksija

Študenti imajo kritičen odnos do rezultatov analiz in predstavljenih analiznih metod.

Prenosljive spretnosti

Laboratorijske spretnosti, pravilno podajanje in statistično vrednotenje analiznih rezultatov.

Intended learning outcomes:

Knowledge and Comprehension

Students understand the fundamentals of analytical chemistry, analytical approach and background and applications of classical and selected instrumental analytical methods with proper interpretation of analytical results.

Application

Students develop the ability of presenting and evaluating analytical results. Students master calculation procedures related to the presented analytical methods.

Analysis

Students develop critical attitude towards analytical results and presented analytical methods.

Skill-transference Ability

Laboratory skills, expression of analytical results with statistical evaluation.

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Metode poučevanja in učenja:

Learning and teaching methods:

Predavanja, vodeni razgovori, sodelovalno učenje, reševanje problemov, laboratorijske vaje.

Lectures, guided discussions, cooperative learning, problem solving, laboratory tutorial.

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

Laboratorijske vaje:		Laboratory tutorial:
kakovost analiznih rezultatov;	25%	quality of analytical results;
kolokvij.	25%	written assessment.
Pisni izpit.	50%	Written exam.

Reference nosilca / Lecturer's references:

- 1.) IVANOVIĆ, Milena, ISLAMČEVIĆ RAZBORŠEK, Maša, KOLAR, Mitja. Simultaneous GC-MS determination of free and bound phenolic acids in Slovenian red wines and chemometric characterization. Acta chimica slovenica, ISSN 1318-0207. [Tiskana izd.], 2016, vol. 63, no. 3, str. 661-669.
- 2.) HUŠ, Sebastjan, KOLAR, Mitja, KRAJNC, Peter. Separation of heavy metals from water by functionalized glycidylmethacrylate poly (high internal phase emulsions). Journal of chromatography. A, ISSN 0021-9673, 2016, vol. 1437, str. 168-175.
- 3.) ZIDARIČ, Tanja, JOVANOVSKI, Vasko, MENART, Eva, ZORKO, Milena, KOLAR, Mitja, VEBER, Marjan, HOČEVAR, Samo B. Multi-pulse galvanostatic preparation of nanostructured bismuth film electrode for trace metal detection. Sensors and actuators. B, Chemical, ISSN 0925-4005. [Print ed.], Jun. 2017, vol. 245, str. 720-725.