

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	INSTRUMENTALNE METODE ANALIZE
Course Title:	INSTRUMENTAL METHODS OF ANALYSIS

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Kemijsko inženirstvo, 1. stopnja	/	2.	3.
USP Chemical Engineering, 1 st Cycle	/	2 nd	3 rd

Vrsta predmeta / Course Type:

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

IN115

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
75	/	/	/	/	75	5

Nosilec predmeta / Lecturer:

prof. dr. Matevž Pompe /
Dr. Matevž Pompe, Full Professor

Jeziki / Languages:

Predavanja / Lectures: slovenski / Slovenian

Vaje / Tutorial: /

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Osnovni pojmi in parametri analiznega procesa: izbira metode, priprava vzorca, občutljivost, selektivnost, meja zaznave.
Statistika in vrednotenje rezultatov: naključne in sistematične napake, statistični parametri in obdelava podatkov, ovrednotenje rezultatov, načrtovanje ekperimentov.
Ravtotežja v analizni kemiji
Pregled analiznih metod za določanje makro komponent. Prednosti in slabosti teh metod.
Pregled instrumentalnih metod za identifikacijo in kvantitativno določanje snovi. Interakcija elektromagnetnega valovanja s snovjo. Principi tehnik in

Content (Syllabus outline):

Basic concepts and parameters of the analytical process: choice of methods, sample preparation, sensitivity, selectivity, detection limit.
Statistics and evaluation of the results: random and systematic errors, statistical parameters and data processing, evaluation of the results, experimental design.
Equilibrium in analytical chemistry
Overview of the analytical methods for determination of macro components: advantages and disadvantages of the methods.
Overview of the instrumental methods for the identification and quantification of substances.

uporabnost za analitiko. Molekulska absorpcijska spektrometrija: osnovne zakonitosti, značilnosti in uporaba.

Atomska absorpcijska in emisijska spektrometrija: osnovni principi, karakteristike metod in značilne uporabe v analitiki anorganskih spojin.

IR spektrometrija, značilnosti, priprava vzorcev za merjenje.

Rentgenska fluorescenca: princip in uporaba **Elektrokemijske metode**. Potenciometrija, principi, indikatorske in referenčne elektrode, steklena elektoda in merjenje pH, uporaba za potenciometrično indikacijo pri različnih titracijah. Elektrogravimetrija, voltometrija. Kontinuirno spremljanje koncentracij snovi.

Uporaba predstavljenih metod za kvantitativno določanje komponent v realnih vzorcih. Priprava vzorcev, raztapljanje, shranjevanje.

Separacijske metode. Ekstrakcija tekoč-tekoče. Ekstrakcija na trdno fazo. Osnove kromatografije. Plinska in tekočinska kromatografija. Zmožnosti metod in uporaba za določanje organskih snovi v realnih vzorcih.

Masna spektrometrija. Osnove ionizacije. Tipi analizatorjev. Uporaba MS za identifikacijo in kvantifikacijo.

ICPMS in uporaba.

Izbira metode in kritično ovrednotenje rezultatov analiz. Osnove validacije.

NMR osnove in uporabnost.

The interaction of electromagnetic radiation with matter. Principles of the techniques and application in analytical chemistry. Molecular absorption spectrometry: basic principles, characteristics and applications. Atomic absorption and emission spectrometry: basic principles, method characteristics and applications in analysis of inorganic matter. IR spectrometry, characteristics, sample preparation.

X-ray fluorescence spectrometry: principles and applications.

Electrochemical methods. Potentiometry, principles, indicator and reference electrodes, glass electrode and measurements of pH, application in various potentiometric titrations. Electrogravimetry, voltammetry. Continuous monitoring of the concentration of the substance.

The use of the presented methods for the determination of components in real samples.

Sample preparation, dissolution, storage.

Separation methods. Liquid-liquid extraction. Solid-phase extraction. Basic principle of chromatography. Gas and liquid chromatography. The ability of the methods and the usage for the determination of the organic compounds in the real samples.

Mass spectrometry. Basics of the ionisation. Mass analyzers. Application of MS for identification and quantification.

ICP/MS and usage

Selection of the methods and critical evaluation of the analytical results. Basics of the method validation.

Basics and applications of NMR.

Temeljna literatura in viri / Readings:

- D.A.Skoog, F.J.Holler, T.A.Nieman, Principles of Instrumental analysis, 5th Saunders College Publishing, 1998, Philadelphia, str. 700 (45%)

Cilji in kompetence:

Slušatelji v okviru predmeta osvojijo temeljne principe kemijske analize. Pridobijo znanja potrebna za razumevanje in izvedbo posameznih kemijskih in osnovnih instrumentalnih tehnik. Spoznajo pristope k izvedbi analiz.
Specifične kompetence: zmožnost izbire posamezne analizne metode za reševanje enostavnih analiznih problemov.

Objectives and Competences:

Student in this course acquire basic knowledge of chemical analysis. Gains knowledge needed to understand and implement individual basic chemical and instrumental techniques. Learns about the approaches of the analyses.
Specific skills: ability to choose specific analytical methods for solving simple analytical problems.

Predvideni študijski rezultati:

Znanje in razumevanje

Študentje spoznajo instrumentalne metode in primernost njihove uporabe za reševanje konkretnih analiznih problemov. Znajo kritično uporabiti rezultate.

Uporaba

Študent je sposoben izbrati analizno metodo za rešitev problema. Razume dobljene rezultate.

Refleksija

Spozna prednosti in slabosti različnih instrumentalnih metod in jih zna kritično izbrati.

Prenosljive spretnosti

Študent bo poznal in razumel podatke, dobljene z instrumentalnimi metodami

Intended Learning Outcomes:

Knowledge and Comprehension

Students learn instrumental methods and their application to solving specific analytical problems.
Student gain knowledge for critical evaluation of the results.

Application

Students are capable of selection of analytical method for solving particular analytical problem. Students understand obtained results.

Analysis

Students learn advantages and disadvantages of various instrumental methods and are capable of their critical selection.

Skill-transference Ability

Students will know and understand the data obtained by instrumental methods.

Metode poučevanja in učenja:

Predavanja

Learning and Teaching Methods:

Lectures

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Pisni (nadomestita ga lahko dva pozitivno ocenjena kolokvija) in ustni izpit.		Written (can be substituted by two positively graded colloquium) and oral exam.

Reference nosilca / Lecturer's references:

1. S. Kose, S. Koral, B. Tufan, **M. Pompe**, A. Ščavničar, D. Kočar. Biogenic amine contents of commercially processed traditional fish products originating from European countries and Turkey. European Food Research and Technology. A, Zeitschrift für Lebensmittel-Untersuchung und -Forschung. 2012, 235, 669-683.
2. G. Arh, L. Klasinc, M. Veber, **M. Pompe**. Calibration of mass selective detector in non-target analysis of volatile organic compounds in the air. J. chromatogr. A 2011, 1218, 1538-1543.
3. J. Cerar, **M. Pompe**, M. Guček, J. Cerkovnik, J. Škerjanc. Analysis of sample of highly water-soluble T_{sub}-symmetric fullerenehexamalononic acid C_{sub}(66)(COOH)_{sub}(12) by ion-chromatography and capillary electrophoresis. J. chromatogr. A 2007, 1169, 86-94.