

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
UŠP Kemija, 1. stopnja	/	1.	2.
USP Chemistry, 1 st Cycle	/	1 st	2 nd

Vrsta predmeta / Course Type: obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code: KE111

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	30	15 LV	/	/	75	5

Nosilec predmeta / Lecturer: prof. dr. Helena Prosen / Dr. Helena Prosen, Full Professor

Jeziki / Languages:

Predavanja / Lectures:	slovenski / Slovenian
Vaje / Tutorial:	slovenski / Slovenian

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.
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Vsebina:

Osnovni pojmi in parametri analiznega procesa: faze analize, izbira metode, priprava vzorca, umerjanje, občutljivost, selektivnost, meja zaznave, napake.

Ravnotežja v analizni kemiji: pomen in pregled ravnotežij v homogenih in heterogenih sistemih. Sistematična obravnava ravnotežij: masna bilanca, električna nevtralnost, porazdelitveni diagrami. Heterogena ravnotežja in vplivi na topnost (pH, ligandi, elektroliti, topilo), kislinsko bazna ravnotežja, ravnotežja pri koordinacijskih spojinah.

Kemijske analize tehnike – precizijska analiza

Gravimetrija: principi, vplivi na kristalizacijo, značilne aplikacije in viri napak (koprecipitacija, koloidi).

Content (Syllabus outline):

Basic terms and parameters of analytical processes: aims of analytical chemistry, general steps in chemical analysis, sample preparation, calibration, sensitivity, limit of detection, errors in chemical analysis.

Aqueous solution chemistry: equilibria in homogeneous systems: systematic treatment of chemical equilibria, mass balance, charge balance, fractional composition diagrams.

Equilibria in heterogeneous systems and influences on solubility (pH, ligands, electrolytes, solvent). Monoprotic and polyprotic acid-base equilibria, metal-ligand equilibria.

Chemical analytical techniques – precision analysis.

Titrimetrija: principi, napake, indikacija končne točke. Pregled titracij: obarjalne in nevtralizacijske titracije v vodnih in nevodnih medijih, titracije eno in večprotičnih kislin/baz ter amfiprotičnih snovi, pufrska kapaciteta. Kompleksometrične titracije (teorija, računalniške simulacije, viri napak), pomembnejše aplikacije. Separacijski postopki v analizi kemiji: obarjalne separacije, kompleksiranje.

Gravimetry: principles, influences on crystallisation, applications, sources of errors (coprecipitation, colloids).
Titrimetry: principles, sources of errors, end-point indication.
Precipitation titrations.
Neutralisation titrations in aqueous and non-aqueous systems, mono- and polyprotic acid/base titrations, titration of amphiprotic species, buffer capacity.
Complexometric titrations: principles, sources of errors, computer simulations, applications.
Separation processes in analytical chemistry: precipitation separations, complex formation.

Temeljna literatura in viri / Readings:

Temeljna:

- B. Pihlar, H. Prosen, Uvod v analizo kemijo, Založba UL FKKT, Ljubljana 2021, 147 str.

Dodatna:

- D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Fundamentals of Analytical Chemistry, 9. izdaja, Brooks Cole, London 2013, poglavja 1-4, 9-17 (325 str.).

- D.C. Harris, Quantitative Chemical Analysis, 8. izdaja, W.H. Freeman and Company 2010, poglavja 1-13 (279 str.).

Cilji in kompetence:

Cilji: Služatelji osvojijo temeljne principe in značilnosti kemijske analize.

Kompetence: Spoznajo in se naučijo uporabljati pomen kemijskih ravnotežij in reakcij za analizo ter spoznajo in se naučijo uporabljati različne kemijske analize metode in osnovne separacijske postopke.

Objectives and Competences:

Objectives: Understanding of principles of basic analytical methods and approaches.

Competences: ability to solve problems connected with chemical equilibria in homogeneous and heterogeneous systems, ability to recognize sources of error in analysis and to interpret and critically evaluate analytical results.

Predvideni študijski rezultati:

Znanje in razumevanje

Študent spozna osnovne pojme značilne za kemijsko analizo, obvlada pristope k obravnavi kemijskih ravnotežij v homogenih in heterogenih sistemih in spozna njihov pomen za kemijsko analizo in posamezne tehnike. Spozna osnovne kvantitativne analize tehnike, obvlada njihove teoretske značilnosti in spozna značilne aplikacije.

Intended Learning Outcomes:

Knowledge and Comprehension

Student understands basic principles of chemical analysis, is able to find appropriate approaches for solving problems in chemical equilibrium in homogenous and heterogenous systems and is able to connect these problems with chemical analysis and analytical techniques.

Student acquires knowledge about basic quantitative analytical techniques, about their theoretical characteristics and typical applications.

<u>Uporaba</u> Študent pridobi temeljna znanja iz kvantitativne analize in osnove, potrebne za razumevanje snovi pri višjih kurzih (Analizna kemija II, Instrumentalna analiza) in drugih predmetih.	<u>Application</u> Student acquires basic knowledge of quantitative analysis, which are needed in other courses in 2 nd and 3 rd year of study (e.g. Analytical Chemistry II and Instrumental Analysis).
<u>Refleksija</u> Nauči se kritičnega pristopa do informacij in obravnave eksperimentalnih rezultatov.	<u>Analysis</u> Critical view towards the information and treatment of experimental data.
<u>Prenosljive spretnosti</u> Osvoji pristope k reševanju analiznih problemov, zna uporabiti teoretične principe v praksi, obvlada obdelovanje podatkov in njihovo predstavitev.	<u>Skill-transference Ability</u> Approaches for solving analytical problems, use of theoretical principles in practice, experimental data handling and their presentation.

Metode poučevanja in učenja:

- Predavanja z demonstracijskimi eksperimenti,
- seminarji usmerjeni v poglobljanje in razumevanje teorije in reševanje praktičnih primerov,
- laboratorijski seminar (LS) namenjen pridobivanju osnovnih eksperimentalnih prijemov in pristopov v kemijski analizi.

Learning and Teaching Methods:

Lectures with demonstration experiments. Seminars aimed at deeper understanding of theory and solving practical problems. Laboratory seminar aimed at gaining basic experimental skills and approaches in chemical analysis.

Delež (v %) /

Weight (in %)

Assessment:

Načini ocenjevanja:

Pisni in ustni izpit z oceno 6 ali več (uspešno – po Statutu UL).

Written and oral exam.

Reference nosilca / Lecturer's References:

- KLOBČAR, Slavko, **PROSEN, Helena**. Isolation of oxidative degradation products of atorvastatin with supercritical fluid chromatography. Biomedical chromatography, ISSN 1099-0801, 2015, vol. 29, iss. 12, str. 1901-1906, ilustr. <http://onlinelibrary.wiley.com/doi/10.1002/bmc.3513/abstract>, doi: 10.1002/bmc.3513. [COBISS.SI-ID 1536354499]
- ĆIRIĆ, Andrija, **PROSEN, Helena**, JELIKIĆ STANKOV, Milena, ĐURĐEVIĆ, Predrag. Evaluation of matrix effect on determination of some bioflavonoids in food samples by LC-MS/MS method. Talanta, ISSN 0039-9140. [Print ed.], 2012, vol. 99, no. 1, str. 780-790, doi: 10.1016/j.talanta.2012.07.025. [COBISS.SI-ID 36369157]
- **PROSEN, Helena**, KOKALJ, Meta, JANEŠ, Damjan, KREFT, Samo. Comparison of isolation methods for the determination of buckwheat volatile compounds. Food chemistry, ISSN 0308-8146. [Print ed.], 2010, vol. 121, no. 1, str. 298-306, doi: 10.1016/j.foodchem.2009.12.014. [COBISS.SI-ID 33728005]