UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	FIZIKALNA KEMIJA 2
Course Title:	PHYSICAL CHEMISTRY 2

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
VSŠP Kemijska tehnologija, 1. stopnja	/	3.	5.
PSP Chemical Technology, 1st Cycle	/	3rd	5th

Vrsta predmeta / Course Type: obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code: KT132

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
35	10	30 LV	/	/	75	5

Nosilec predmeta / Lecturer: prof. dr. Ksenija Kogej / Dr. Ksenija Kogej, Full Professor

Jeziki / Languages:

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:	Content (Syllabus outline):
Kemijsko ravnotežje. Sprememba Gibbsove proste entalpije in termodinamična konstanta kemijskega ravnotežja. Reakcije v plinski fazi. Vpliv temperature, tlaka in inertnega plina na kemijsko ravnotežje. Heterogeno ravnotežje. Kemijska kinetika. Hitrostni zakon, red reakcije in konstanta reakcijske hitrosti. Razpolovni čas. Vpliv temperature na hitrost kemijske reakcije. Aktivacijska energija. Elektrokemija. Galvanski členi: napetost in termodinamika galvanskih členov. Nernstova enačba. Standardni elektrodni potenciali in napetostna vrsta. Izbrana poglavja. Površinska kemija. Adsorpcija. Površinska napetost. Površinsko aktivne snovi. Laboratorijske vaje: 1. Napetost in notranja	Chemical equilibrium. The Gibbs free energy change and the thermodynamic equilibrium constant. Reactions in the gaseous phase. Effect of temperature, pressure and inert gas on equilibrium. Heterogeneous equilibrium. Chemical kinetics. Rate laws, reaction order and reaction rate constant. The half time. Effect of temperature on reaction rate. Activation energy. Electrochemistry. Electrochemical cells. Electromotive force (EMF) and thermodynamics of galvanic cells. The Nernst equation. EMF measurements. Standard electrode potentials. Selected topics. Surface chemistry. Adsorption. Surface tension. Surface active compounds. Laboratory practice. 1. Electromotive force and

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upornost galvanskega člena; merjenje pH 2. Potenciometrična titracija 3. Prevodnost elektrolitov 4. Adsorpcija 5. Kemijska kinetika. 6. Površinska napetost.	internal resistance of galvanic cells; pH measurements 2. Potentiometric titration 3. Conductivity of electrolytes 4. Adsorption 5. Chemical kinetics. 6. Surface tension.

Temeljna literatura in viri / Readings:

- R. A. ALBERTY, R. J. SILBEY: Physical Chemistry, John-Wiley, New York, 1995; 217 strani (24 %):s slikami, grafičnimi prikazi in računskimi nalogami.
- BONČINA, Matjaž, CERAR, Janez, GODEC, Andrej (avtor, urednik), HRIBAR, Barbara, JAMNIK, Andrej, LAH, Jurij, LAJOVIC, Andrej, LUKŠIČ, Miha, PODLIPNIK, Črtomir, PRISLAN, Iztok, REŠČIČ, Jurij, ŠARAC, Bojan, TOMŠIČ, Matija, VESNAVER, Gorazd. Fizikalna kemija - praktikum. 1. izd. Ljubljana: Fakulteta za kemijo in kemijsko tehnologijo, 2012. XXXII, 227 str., ilustr. ISBN 978-961-6756-32-7. [COBISS.SI-ID 261552640]

Cilji in kompetence:	**Objectives and Competences:**
Fizikalna kemija II je nadaljevanje predmeta Fizikalna kemija I. Osnovni cilj učne enote Fizikalna kemija I in II je spoznavanje in razumevanje temeljnih fizikalno-kemijskih zakonitosti. V drugem delu je poseben poudarek na praktikumu, katerega poglaviten cilj je demonstracija osvojenih teoretičnih osnov na raznih fizikalno kemijskih procesih in meritvah. Študent se spozna z načinom določanja fizikalno-kemijskih količin v laboratoriju. Pri tem razvije sposobnost samostojnega eksperimentalnega dela in kritičnega vrednotenja dobljenih rezultatov.	The course in Physical Chemistry II is a continuation of Physical Chemistry I. The main goal of both courses is to provide students the knowledge and understanding of basic physicochemical principles. In Part II, the emphasis is on laboratory practice with the main goal to demonstrate the presented theoretical concepts. Students learn how to determine (measure) physicochemical properties in laboratory. Through this they acquire skills for individual experimental work and critical evaluation of results.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Študent pri predmetu dopolni svoje znanje o osnovnih naravnih zakonitostih in fizikalno kemijskih količinah, ki ga je dobil pri študiju predmeta Fizikalna kemija I. Spozna razliko med termodinamiko in kinetiko ter nekaj pomembnih fizikalnih lastnosti tekočin ter pojavov na površinah. Študent se seznani s principi merjenja fizikalnih količin. Nauči se pravilnega izvajanja meritev in podajanja rezultatov, identificirati in vrednotiti napake pri meritvah in uporabljati enostavne modele za interpretacijo rezultatov. Pri tem razvija sposobnost kritičnega vrednotenja izmerjenih količin.	<u>Knowledge and Comprehension</u> Knowledge and Comprehension Students complete their knowledge of basic natural concepts and physicochemical quantities, which they have met already at Physical Chemistry I. They learn the difference between thermodynamics and kinetics and get to know some important physical properties and phenomena at interfaces Students learn the correct and precise way of measuring and presenting measured quantities, the way to report uncertainties in their measurements and to use simple models for interpretation of the data. Through this they learn to critically evaluate measured quantities.
<u>Uporaba</u> Teoretično in praktično znanje fizikalne kemije bo študentu pomagalo pri uporabi analitskih metod ter	<u>Application</u> Theoretical and practical knowledge of physical chemistry can be used in applications of

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pri izvajanju raznih operacij za nadziranje in usmerjanje kemijskih procesov. Nepogrešljivo je tudi pri vključevanju v razvojno in proizvodno delo, pri kontroli procesov v raznih panogah industrije in pri merjenju fizikalno-kemijskih količin v analitskem in drugih laboratorijih.	analytical methods and in executing various operations in chemical processes. It is indispensable in research and production work, in controlling technological processes in industry and in measurements of physicochemical quantities in analytical and other laboratories.
Refleksija Študent pridobi občutek za fizikalno-kemijski način razmišljanja in razvije zmožnost abstraktne predstave o fizikalno-kemijskih količinah. Nauči se uporabljati teoretično pridobljeno znanje pri eksperimentalnem delu ter kritično vrednotiti rezultate in popravljati svoje napake.	Analysis Students develop the physicochemical way if thinking and ability of abstract conception of physicochemical quantities. They learn how to use the theoretical knowledge in experimental work and how to critically evaluate their experimental results and correct mistakes.
Prenosljive spretnosti Pri študiju fizikalne kemije študenti razvijajo abstrakten, kritičen in analitičen način razmišljanja, ki je osnova za kvalitetno delo na različnih tehnoloških področjih. Naučijo se kritično vrednotiti in interpretirati rezultate meritev. Poleg tega se naučijo iskati in uporabljati domačo in tujo literaturo. Pri vajah osvojijo primeren način podajanja rezultatov in poročil o opravljenem delu. Študenti se privadijo timskega dela, kar jim bo koristilo pri vsakem delu v laboratoriju ali proizvodnem obratu. Spoznajo pravila varnega dela v laboratoriju.	Skill-transference Ability In the course on Physical chemistry students develop abstract, critical and analytical way of thinking that is the basis for competent work in various technological fields. They learn to critically evaluate and interpret results of measurements, to search data bases and literature. In laboratory, students learn to correctly handle with instruments and to collect, treat and interpret results of their measurements. They learn to work in smaller teams, which can be useful for any work in laboratory or production. They also learn safety rules for the work in chemical laboratories.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja s seminarskimi vajami. Laboratorijske vaje z vodenjem dnevnika in oddajanjem poročil o opravljenem delu in rezultatih.	Lectures and seminars (problem solving). Laboratory practice, writing laboratory diary and submitting reports of measurements and obtained results.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Predavanja: pisni izpit, ki ga študenti lahko opravijo z dvema delnima kolokvijema tekom predavanj.	**60 %**	Lectures: Written examination that can be passed by two written tests during semester.
Vaje: ocena dnevnika tekom opravljanja vaj in končni pisni kolokvij iz vaj. Ocene: 6-10 (pozitivno), 5 (negativno).	**40 %**	Laboratory practice: grade for the laboratory diary and for the final written test. Grades: 6-10 (positive), 1-5 (negative)

Reference nosilca / Lecturer's references:

- **KOGEJ, Ksenija**, FONSECA, Sofia M., ROVISCO, J., AZENHA, M. E., LUÍSA RAMOS, M., SEIXAS DE MELO,

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J., BURROWS, Hugh. Understanding the interaction between trivalent lanthanide ions and stereoregular polymethacrylates through luminescence, binding isotherms, NMR, and interaction with cetylpyridinium chloride. Langmuir, ISSN 0743-7463, 2013, vol. 29, no. 47, str. 14429-14437, [COBISS.SI-ID 1656879]

- ANŽLOVAR, Alojz, CRNJAK OREL, Zorica, **KOGEJ, Ksenija**, ŽIGON, Majda. Polyol-mediated synthesis of zinc oxide nanorods and nanocomposites with poly(methyl methacrylate). Journal of nanomaterials, ISSN 1687-4110, 2012, vol. 2012, art. no. 760872 (9 str.), [COBISS.SI-ID 36033029]
- PRELESNIK, Simona, GODERIS, Bart, HANSSON, Per, **KOGEJ, Ksenija**. Phase diagram and structures in mixtures of poly(styrenesulfonate anion) and alkyltrimethylammonium cations in water : significance of specific hydrophobic interaction. The journal of physical chemistry. B, Condensed matter, materials, surfaces, interfaces & biophysical, ISSN 1520-6106, 2012, vol. 116, no. 15, str. 4634-4645, [COBISS.SI-ID 36006917]

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