UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	FIZIKALNA KEMIJA 1
Course Title:	PHYSICAL CHEMISTRY 1

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
VSŠP Kemijska tehnologija, 1. stopnja	/	2.	4.
PSP Chemical Technology, 1st Cycle	/	2nd	4th

Vrsta predmeta / Course Type: obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code: KT116

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
40	10	25 LV	/	/	75	5

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

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

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):
Plini. Lastnosti plinov. Enačbe stanja, idealni in realni plini. Kritični pojavi, utekočinjanje plinov. Prvi zakon termodinamike. Delo in toplota. Notranja energija, entalpija. Toplotne kapacitete. Kalorimetrija. Termokemija. Odvisnost entalpije od temperature. Drugi zakon termodinamike. Obrnljivi in neobrnljivi procesi. Entropija. Računanje entropijskih sprememb. Tretji termodinamični zakon. Gibbsova in Helmholtzova prosta energija. Odprti sistemi. Kemijski potencial. Kriterij za snovno ravnotežje. Fazna ravnotežja. Clausius-Clapeyronova enačba. Fazni diagrami. Fazno pravilo. Raztopine. Parcialne molske količine. Idealne in neidealne raztopine. Termodinamika mešanja.	Gasses. Properties of gasses. Equations of state, ideal and real gasses. Critical phenomena, condensation of gasses. The first law of thermodynamics. Work and heat. Internal energy, enthalpy, and heat capacities. Calorimetry. Thermo-chemistry. Dependence of enthalpy on temperature. The second law of thermodynamics. Reversible and irreversible processes. Entropy. Calculation of entropy changes. The third law of thermodynamics. Gibbs and Helmholtz free energy. Open systems. Chemical potential. Criterion for equilibrium. Phase equilibria. The Clausius-Clapeyron equation. Phase diagrams. Phase rule. Solutions. Partial molar quantities. Ideal and non-ideal solutions. Thermodynamics of

Raoultov in Henryjev zakon. Diagrami parnih tlakov. Vrelni diagrami in frakcionirna destilacija. Koligativne lastnosti. Laboratorijske vaje: 1. Kalorimetrija 2. Parni tlak 3. Vrelni diagram 4. Določanje molske mase s krioskopsko metodo 5. Viskoznost tekočin	mixing. Raoult's and Henry's law. Vapour pressure diagrams. Temperature-composition diagrams and fractional distillation. Colligative properties. Laboratory practice. 1. Calorimetry 2. Vapor pressure 3. Boiling point diagram 4. Determination of molar mass by cryoscopy 5. Viscosity

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 I, skupaj s Fizikalno kemijo II, je osnovni naravoslovni predmet, pri katerem študenti spoznajo temeljne fizikalno-kemijske zakonitosti. Predmet študentu pomaga pri razumevanju fizikalno-kemijskih procesov v laboratoriju in ga nauči reševanja zelo različnih problemov iz naravoslovja. Pri tem razvije sposobnost logičnega sklepanja in povezovanja znanj.	Physical chemistry I, together with Physical chemistry II, is a fundamental natural science course where students learn basic physico-chemical principles. After the completion of the course they understand physical processes and learn to solve various problems in the field of natural sciences. Students develop a critical way of thinking and uniting knowledge.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Študent pri predmetu pridobi razumevanje osnovnih naravnih zakonitosti sistemov (npr. plinov, tekočin, raztopin neelektrolitov in elektrolitov) in fizikalno kemijskih količin (npr. dela, toplote, notranje energije, entalpije, entropije itd.). Sposoben je ločiti med funkcijami stanja in funkcijami poti. Spozna vse termodinamične zakone, pojme obrnljivi in neobrnljivi procesi in kriterije za spontanost procesov in za ravnotežje. Pridobljeno teoretično znanje je osnova za razumevanje številnih fizikalno kemijskih metod, ki se uporabljajo v analitskem in drugih laboratorijih. Študent svoje razumevanje snovi preveri v laboratoriju z merjenjem osnovnih termodinamskih količin.	<u>Knowledge and Comprehension</u> Students acquire understanding of fundamental natural laws in various systems (e.g. gasses, liquids, nonelectrolyte and electrolyte solutions) and for various properties (e.g, work, heat etc.). They are able to distinguish between state function and path functions. They learn all thermodynamic laws, concepts of reversibility and irreversibility, criteria for spontaneity and equilibrium. The acquired theoretical knowledge is the basis for understanding numerous physicochemical methods used in analytical and other laboratories. The understanding of the subject is verified in laboratory by measuring basic thermodynamic properties.
<u>Uporaba</u> Ker je fizikalna kemija temeljni naravoslovni	<u>Application</u> As a fundamental natural science course,

predmet, nudi učna snov študentu široko razumevanje raznih pojavov v naravoslovju. Študij tega predmeta je nujna podlaga za to, da bo študent razumel principe določenih meritev in metod, ki jih bo uporabljal v laboratoriju.	physical chemistry offers students broad understanding of various phenomena in nature. The obtained knowledge is necessary for understanding principals of measurements.
Refleksija Študent pridobi občutek za fizikalno-kemijski način razmišljanja in razvije zmožnost abstraktne predstave o fizikalno-kemijskih količinah in njihove interpretacije v okviru enostavnih modelov ter hipotez. S pridobljenim znanjem zna razne tehnološke probleme analizirati s stališča osnovnih zakonitosti in s tem bi moral biti zmožen kritično vrednotiti rezultate svojega dela.	Analysis Students gain the physicochemical way of thinking and develop abstract conception of physical-chemical quantities. They are able to interpret their observation in the framework of simple models and hypothesis and to analyse technological problems with basic laws. Through this they should be able to critically evaluate the results of their work.
Prenosljive spretnosti Pri študiju fizikalne kemije študenti razvijajo abstrakten, kritičen in analitičen način razmišljanja, kar jim bo koristilo pri prepoznavanju in reševanju problemov v raznih okoljih. Naučijo se iskati in uporabljati domačo in tujo literaturo ter poročati o izsledkih svojega dela. Predmet študenta navaja k povezovanju znanja kemije, fizike, matematike in ostalih tehnoloških ved.	Skill-transference Ability The abstract, critical, and analytical way of thinking helps the student in recognizing and solving problems in various environments. They learn to use literature and data basis and how to report their work. They are able to link knowledge of chemistry, physics, and mathematics with that of other technological fields.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja. Seminarji z računskimi primeri, kjer študenti aktivno sodelujejo in tako preizkusijo, ali pravilno razumejo pridobljeno teoretično znanje. Laboratorijske vaje z vodenjem dnevnika in oddajanjem poročil o opravljenem delu in rezultatih.	Lectures. Seminars (problem solving) with active participation of students. In this way students check their theoretical knowledge. 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), 1-5 (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, 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]