NAME OF THE COURSE	General Chemistry II					
Code	PMC003	Year of study	1st undergraduate study			
Course teacher	Dr Renata Odžak, Associate Professor	Credits (ECTS)	7.0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			45	15		
Status of the course	obligatory	Percentage of application of e-learning	20%			

COURSE DESCRIPTION

Course objectives	Students will acquire knowledge of liquids, solutions, phase changes, chemical kinetics and equilibrium, equilibrium in acid solutions and bases and solutions of soluble salts, electrochemistry.
Course enrolment requirements and entry competences required for the course	None.
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After completing the course, the students will be able to: 1. Analyze the basic legality of chemical kinetics, chemical equilibrium and electrochemistry 2. comparing basic theories and concepts of acids and bases and applying them to reaction systems such as buffer solutions and reaction processes such as neutralization and hydrolysis of salts 3. Evaluate chemical reactions to speed, order and mechanism 4. to evaluate the influence of factors on the chemical equilibrium 5. Link the theoretical knowledge by solving stoichiometric tasks
Course content broken down in detail by weekly class schedule (syllabus)	Lectures: 1. Complex compounds and their properties, geometry, ligands, nomenclature, isomers, formation of complex compounds by valence connection theory and hybrid orbitals, crystal field theory, color and magnetism of complex compounds, ligand field theory (3 hours) 2. Liquid aggregation state, physical properties of liquid: surface tension, capillarity, viscosity, vapor pressure and boiling point, phase changes and phase diagrams (2 hours) 3. Solvents, solution split, solution composition, liquid solids solution, solubility as equilibrium system, solubility heat, temperature and pressure solubility, liquid gas solutions, Henry's law, liquid liquid solution, ideal (zeotropic) solution, Raoult's law, fractional distillation, real (azeotrope) solution, status diagram for zeotropic and azeotropic solutions, positive and negative deviations from Raul's law, colligative properties of the solution: lowering of vapor pressure, lowering of freezing temperatures, boiling of the syringe, and isotonicity of differences in the coligative properties of electrolytic and non-electrolytic solutions, van't Hoff's factor, colloidal solution, types of colloid systems, properties of colloid systems, Tyndall's phenomenon (8 hours) 4. Kinetics velocity and mechanisms of chemical reactions, factors affecting reaction speed, chemical reaction rate (average, instantaneous, initial), measurement of the reaction speed with devices in the laboratory, expression of the chemical reaction rate, reaction sequence, reaction rate constant and its measuring unit , an integrated expression for chemical reaction rate, graphical determination of activation energy, time response, temperature response to chemical reaction rate, Arrhenius equation, collision theory and transition theory, reaction mechanisms, elemental step, molecularity, reaction intermediate, step determining the rate of chemical reaction , energetic representation of the reaction mechanism, catalysis (homogeneous and heterogeneous), autocatalysis, biocatalysts (8 hours) 5. Chemical equilibrium, equilibrium in homogeneous and heterogeneous systems, mass action law, equilibrium constant (Kc and Kp), reaction quotient, equilibrium

	equilibrium computation, if known concentrations of reactants and products (and vice versa), bond between chemical equilibrium and kinetics, The Chatelier principle, the influence of temperature on the equilibrium constant, the van't Hoff equation (6 hours) 6. Acids and bases -Arrhenius definition of acids and bases, acid and base acidity, acid and base dissociation constant, water auto-ionization and pH scale, ionic product water balance, pH, pOH and pKw ratio, pH and acid base indicators, Bronsted- Lowry Acid and Base Definition, conjugated acid base pair, equilibrium in weak acid solutions and bases, acid dissociation degree, polypropionic acid, acid strength trend, acidity of hydrated metal cations, acid base salt - hydrolysis solution, Lewis acid and base definition, amphoteric, ionic equilibrium in aqueous systems - buffer solution, Henderson-Hasselbalch equation, buffer capacity and buffer zone, buffer preparation, acid-base titration curve, weak acid-base titration, and complex ions, the solubility product constant (Ksp), the influence of the common ion and the addition of selenium on solubility, constant of formation of complex ions (Kf) (10 hours) 7. Electrochemistry, Electrolytic Properties, Galvanic and Electrolysis Articles, Daniel's article, electrolyte bridge, electron and ion movement direction, galvanic article writing, standard electrode potential of the article, standard hydrogen electrode, relative strength of oxidants and reductions, volts, different behavior of metals in water and the acidic medium, commercial articles, corrosion and protection from the same, the relationship between the standard article potential and the constant of constant equilibrium, the influence of electrolyte concentration on electrode potential (Nernste equation), potential change during the work of the article, concentrating article, electrochemical determination of pH electrolysis, electrolysis of salt salts and their aqueous solutions, water electrolysis, overvoltage, first and second Faraday's law (8 hours) Seminars: 1. Electron configuration of transition metal ions, nomenclature of complex compounds, high and low molecular octahedral complexes, partial ionic orbital diagram of complex ions, hybridization of central metal ions and ions geometry, magnetic properties 2. Physical properties of the liquid: capillary, surface tension, viscosity, vapor pressure and boiling point, phase changes and phase diagrams. 3. Preparation of the solution of the given composition, dilution, solubility of gases and solids in liquids. 4. Fluid Liquid Solutions, Use of Raoult Law, Condition Diagrams for Zeotropic and Azeotropic Liquid Mixtures 5. Coligative properties and colloids 6. Kinetics of chemical reactions, writing of the expression for instantaneous speed and total reaction rate, chemical reaction rate constant, determination of reaction order from experimental data, integrated expression for chemical reaction rate, calculation of reactor instant concentration, first, second and second order reactance, at the rate of reaction velocity (Arrhenius equation). 7. Half-reaction time for first, second and second order reactions, reaction mechanisms, energy diagrams for non-catalyzed and catalyzed reactions. 8. Chemical equilibrium equilibrium, writing the equation for balance equations Kc and Kp of homogeneous and heterogeneous equilibrium responses, computing the equilibrium equilibrium equation and the feedback reaction of conversion Kc to Kp. 9. Calculation of equilibrium or initial concentration of reactants or products from known equilibrium equilibrium values, influence of temperature and activation energy on molecular collisions, influence of temperature on equilibrium equilibrium value (van't Hoff equation), Le Chatelier principle in homogeneous and heterogeneous equilibrium systems . 10. Acids and bases, Arrhenius and Bronsted-Lowry's definition. conjugated acid-base pairs, acid and base solubility, pH and pOH computation, acid and base dissociation constants, concentration compaction of diluted strong and weak acids and weak bases, dissociation of weak acids and bases, hydrolysis.

	11. Equilibrium in aqueous systems - buffer solution (Henderson-Hasselbach equation), neutralization, acid-base titration curve. 12. Equilibrium in soluble salt solutions (Ksp) and constants of complex ion formation (Kf). 13. Electrochemistry, Comparison of Metal Reduction Properties and Oxidative Properties of Certain Cations, Galvanic Articles, Galvanic Article Presentation, Writing Schemes and Reactions taking place in the same, Computation of Standard Electromotive Force Article, Concentration Article (Nernst's Equation). 14. SHE and calomel electrodes, pH counting in electrolytic solution, calculation of the balance constant for reactions occurring in galvanic articles. 15. Electrolysis, writing arrays taking place in electrolysis of molten and aqueous salt solutions, solving problems related to Faraday's electrolysis laws.
Format of instruction	☒ lectures ☒ seminars and workshops ☐ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work ☐ independent assignments ☐ multimedia ☐ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1.0	Research		Practical training	
	Experimental work		Report		(Other)	
	Essay		Seminar essay		(Other)	
	Tests	2.0	Oral exam	3.0	(Other)	
	Written exam	1.0	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester, 3 partial exams are held, and 60% of the exam is required for the passing grade, with the possibility of repeating a partial exam of 40 to 60%. Passing grade on a written exam is a prerequisite for passing an oral part of the exam.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Martin S. Silberberg, Chemistry, The Molecular Nature of Mater and Change, 5th ed., McGraw-Hill Higher Education, 2009.	12	5
	Milan Sikirica, Stehiometrija, XX. Izd., Školska knjiga, Zagreb, 2008.	12	
	Ivan Filipović, Stjepan Lipanović, Opća i anorganska kemija I dio, 9. izd., Školska knjiga, Zagreb, 1995.	12	

Optional literature (at the time of submission of study programme proposal)	J. McMurry & R. C. Fay, General Chemistry, Atoms first., International edition, Prentice Hall, 2010. D. D. Ebbing & S. D. Gammon, General Chemistry, 9th ed., Houghton Mifflin, Boston, New York, 2007. S. S. Zumdahl, Chemical Principles, 6th ed., Houghton Mifflin, Boston, New York, 2007.
Quality assurance methods that ensure the acquisition of exit competences	Conversation with students, anonymous student survey, student success on the course, self-analysis.

Other (as the proposer wishes to add)	