1. COURSE DECRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Assistant Professor Viktor Pilepić, PhD	1.6. Year of study	1st
1.2. Name of the course	**Physical Chemistry 1**	1.7. Credit value (ECTS)	7.5
1.3. Associate teachers	Cvijeta Jakobušić Brala, PhD Ivana Fabijanić, PhD Ana Karković Marković, MPharm	1.8. Type of instruction (number of hours L+E+S+e-learning)	30+30+15
1.4. Study programme (undergraduate, graduate, integrated)	Medical Biochemistry integrated study programme	1.9. Expected enrolment in the course	25
1.5. Status of the course	Compulsory	1.10. Level of use of e-learning (1, 2, 3 level), percentage of instruction in the course on line (20% maximum)	2nd
2. COURSE DESCRIPTION			
2.1. Course objectives	Identify the thermodynamic systems and processes, understand the basic principles of thermodynamics and electrochemistry and know how to apply them to explain and interpret the observations in other areas of chemistry and related fields. The course gives basic knowledge necessary for the course Pharmaceuticals.		
2.2. Enrolment requirements and required entry competences for the course	Entry competences: acquired knowledge in the subject of General Chemistry and Stoichiometry.		
2.3. Learning outcomes at the level of the study programme to which the course contributes	• The application of fundamental knowledge in physical chemistry (physical chemistry principles in the field of chemical thermodynamics and electrochemistry) necessary for defining, analyzing and proposing methods (modern physical chemistry methods, techniques and instrumentation) related to research, production and quality assurance, and implementation of new laboratory methods for detection and monitoring diseases and tracking the performance and effectiveness of therapy. • The implementation of solution for practical problems in the field of physical chemistry in the laboratory diagnostics.		
2.4. Expected learning outcomes at the level of the course (4-10 learning outcomes)	After completing this course, students will be able to: 1. List and explain the basic principles of thermodynamics and electrochemistry; 2. Identify the thermodynamic systems and processes; 3. Explain the processes taking place in solution and at interfaces;		

	4. Describe simple electrochemical and thermodynamic measurements; 5. Experimentally determine certain physical variables; 6. Apply calculation in solving physical and chemical problems.
2.5. Course content broken down in detail by weekly class schedule (syllabus)	LECTURES: • Basic concepts of thermodynamics, the zeroth and first law of thermodynamics, internal energy, the work and heat in process. • Enthalpy, heat capacity, thermochemistry, properties of the state functions. • Joule-Thomson effect, adiabates and isotherms of an ideal gas, the second law of thermodynamics, entropy. • Entropy, entropy changes in the environment, entropy of the irreversible processes, Clausius inequality, the entropy dependence on temperature. • The third law of thermodynamics, Helmholtz and Gibbs energy, the dependence of Gibbs energy on temperature and pressure. • Chemical potential, fugacity, physical transformations of pure substances, the Clapeyron and Clausius-Clapeyron equation. • Gibbs energy, enthalpy and entropy of liquid mixing, the chemical potential of liquid, Raoult's law, properties of solutions, colligative properties of solutions. • Activity, chemical equilibrium, spontaneous chemical reaction, Gibbs reaction energy, egzergonic and endergonic reactions. • The reaction system in equilibrium, thermodynamic equilibrium constant. • The dependence of the equilibrium on pressure and temperature, biological activity, thermodynamics of the aerobic and anaerobic metabolism. • The properties of electrolyte solution, the average activity coefficients of electrolyte solution, Debye-Hückel limiting and expanded law. • Electrochemical cells, cell potential, types of the electrochemical cells, reactions at the electrodes. • Nernst equation, standard potential, electrochemical series, potentiometric measurement, selective electrodes. • Potentiometric titration, conductivity of ions in solution, the mobility of ions. • Electron transfer in heterogeneous systems, processes at the interface of the electrode and electrolyte solution, titrations. SEMINARS: • The zeroth and the first law of thermodynamics, internal energy, work and heat in the process. • Enthalpy, heat capacity, thermochemistry. • The second law of thermodynamics, entropy. • The third law of thermodynamics. • Chemical potential, systems in equilibrium. • Electrochemical cells, cell potential. • Nernst equation, electrolyte solutions. EXERCISE:

<table>
<tr><td></td><td colspan="6">• Determination of the enthalpy of the neutralization reaction.
• Coagulation of colloidal particles.
• Determination of the molar mass from melting point.
• pH-metric titration.
• Conductometric titration of neutralizing.
• Amperometric titration.
• Potentiometric titration.</td></tr>
<tr><td>2.6. Type of instruction</td><td colspan="2">lectures
seminars and workshops
exercises
online in entirety
mixed e-learning
field work</td><td colspan="2">independent study
multimedia and the internet
laboratory
work with the mentor
(other)</td><td>2.7. Comments:</td></tr>
<tr><td>2.8. Student responsibilities</td><td colspan="6">Regular attendance and active participation in all forms of teaching, successfully completed the Physical Chemistry Laboratory 1, preliminary exams during the semester, written and oral exams.</td></tr>
<tr><td rowspan="5">2.9. Screening of student's work (specify the proportion of ECTS credits for each activity)</td><td>Class attendance</td><td>1.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1</td><td>Report</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other--describe)</td><td></td></tr>
<tr><td>Tests</td><td>1</td><td>Oral exam</td><td>2</td><td>(Other—describe)</td><td></td></tr>
<tr><td>Written exam</td><td>2</td><td>Project</td><td></td><td>(Other—describe)</td><td></td></tr>
<tr><td>2.10. Grading and evaluation of student work over the course of instruction and at a final exam</td><td colspan="6">During the course students are evaluated on seminars and in the Physical Chemistry Laboratory 1. Students will be evaluated during the class on preliminary exams during the semester and on written and oral exams.</td></tr>
<tr><td rowspan="4">2.11. Required literature (available at the library and via other media)</td><td colspan="6">Title</td></tr>
<tr><td colspan="6">P. W. Atkins i J. de Paula, Atkins' Physical Chemistry, 9. izdanje, 2010, Oxford University Press.</td></tr>
<tr><td colspan="6">P. W. Atkins i J. de Paula, Physical Chemistry For The Life Sciences, 2. izdanje, 2011, Oxford University Press.</td></tr>
<tr><td colspan="6">C. A. Trapp, M. P. Cady i C. Giunta, Students' Solutions Manual To Accompany Atkins' Physical Chemistry, 9. izdanje, 2010, Oxford University Press.</td></tr>
<tr><td>2.12. Optional literature</td><td colspan="6">T. Cvitaš: Physical chemistry, manuscript in preparation, chapters accessible in Central Chemical Library of Science.</td></tr>
<tr><td>2.13. Methods of monitoring quality that ensure acquisition of exit competences</td><td colspan="6">Outcomes 1-4 are validated by written and oral exams, the outcomes 5-6 are validated durring the Physical Chemistry Laboratory 1 and preliminary exams.</td></tr>
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