GENERAL INFORMATION		
Course	**Medical Chemistry**	
Course coordinator	**Asst Prof. Barbara Viljetić, PhD**	
Assistant/Associate	Prof. Ljubica Glavaš-Obrovac, PhD Asst. Prof. Srećko Kirin, PhD Asst Prof. Marina Šekutor, PhD Asst. Prof. Teuta Opačak-Bernardi, PhD Asst Prof. Martina Šrajer Gajdošik, PhD Josip Grbavac, MD	
Study Programme	**Integrated undergraduate and graduate university study of Medicine in German language**	
Status of the course	Mandatory	
Year of study, semester	1st year, 1st semester	
Grading scale and workload	ECTS	**6**
	Hours (L+S+E)	**70** (30+20+20)

COURSE DESCRIPTION

Course objectives

Acquisition of knowledge and skills in general and inorganic chemistry, including the fundamentals of organic compounds and important biological molecules accompanied by chemical and energetic changes involved in their transformation, the kinetics of chemical reactions, thermodynamic relationships, and electrochemical processes, including nuclear reactions.

Enrolment requirements and entry competencies

-

Learning outcomes at the Programme level

1.1.; 2.1.; 2.2.; 3.4., 4.2.

Learning outcomes (5-10)

After successfully completing the course, students will be able to:

1. Explain the main types of chemical reactions.
2. Describe and explain the fundamentals of chemical bonding between compounds and analyze and calculate the basic physicochemical principles that apply to gases and solutions.
4. Explain structural and energetic changes and kinetics in chemical reactions and physical processes.
5. Describe and explain the structures and reactions of major biochemical compounds, including small, large, and supramolecular structures found in the cell.
6. Develop practical skills for working in a chemistry and biochemistry laboratory (fundamentals of safe work in the laboratory, calculating basic laboratory parameters, and monitoring and interpreting the results of laboratory measurements).
7. Observing a specific chemical change and linking that change to the appropriate

physiological or pathophysiological process.

Course content

Fundamentals of general and inorganic chemistry. Structure of atoms and molecules. Basic terms and generally accepted symbols in chemistry. Writing formulas and equations. Quantum theory. Atomic orbitals and hybridization. Periodic table and classification of chemical elements. Theory of molecular orbitals.
Chemical bonds. Types of chemical bonds. Covalent bond. Hydrogen bond. Metallic bond. Electronegativity. Polar bonds and dipoles. Structure and properties of water and ice. *Crystals*. Bonds in solids. Stacking in a crystal lattice. Types of crystal lattices. Phase diagrams. *Solutions*. Solubility. Colligative properties of aqueous solutions. Reactions in aqueous solutions. Acids and bases. Salt hydrolysis. Electrolyte solutions. pH and buffers. Mechanism of action of buffers. Biological buffers. Colloidal solutions. *Chemical kinetics*. Reaction order. Reaction mechanism. The rate of chemical reactions and factors affecting rate. Catalysis. Collision theory. Theory of transition states. *Gases*. Gas laws. Ideal gas and ideal gas equation. Dalton's law. Kinetic theory of gases. Equation of state of a real gas. Raoult's law. *Thermodynamics*. Basic concepts. Work and heat. Principle of conservation of energy (first law of thermodynamics). Thermodynamic quantities - functions of the state of the system. Second law of thermodynamics. Free energy (Gibbs energy) and direction of chemical reactions. Energy value of a chemical bond. Calorimetry. *Chemical equilibrium*. Law of mass action. Equilibrium constant. Kinetic and thermodynamic equilibrium conditions. The influence of external factors on equilibrium. La Chatelier's principle. The law of dilution. Equilibrium in a homogeneous and heterogeneous system. *Electrochemical processes*. Galvanic article and reactions at electrodes. Standard potential. EMS article. Nernst equation. Corrosion and electrolysis. *Photochemical reactions*. Biological photochemical reactions (visual process). Absorption of light in solutions. Lambert-Beer law. Chemiluminescence: application in medicine. *Nuclear chemistry*. Radioisotopes and their application.
Chemistry of organic compounds. Classification of organic compounds. Reaction types in the chemistry of organic compounds. Isomers and isomerisms. Organic compounds containing oxygen: alcohols and phenols, ethers, aldehydes and ketones, carboxylic acids and their derivatives. Chemical properties and characteristic reactions. Biologically important representatives. Organic compounds containing nitrogen and sulphur: chemical properties and characteristic reactions. Biologically important representatives. Heterocyclic compounds. Biologically significant derivatives.

Mode of teaching	☒lectures ☒seminars and workshops ☒exercises ☐distance education ☐field teaching	☐independent tasks ☐multimedia and network ☒laboratory ☐mentoring work ☐other

Student obligations

Attending lectures, seminars and exercises. Exercises: taking entrance exams, keeping a work diary, writing reports, taking the final exam. Seminars: passing the stoichiometry exam. Part of the seminar will be in the form of a focused discussion, so students should prepare for the seminar. Passing the partial exam, a written final exam and an oral exam.

Monitoring student work

Attending classes	x	Class activity	x	Seminar work		Experimental work	x
Written exam	x	Oral exam	x	Essay		Research	

Project		Continuous knowledge verification	x	Paper		Practical work	x
Portfolio							

Grading and evaluation of student work during classes and of the final examination

Teaching activity	ECTS	Learning outcome	Student activity	Assessment methods	Grade points	
					Min.	Max.
Lectures	0.5	1-7	Class attendance	Attendance record	1	2
Seminars	1	1-5	Preparation and presentation of seminar	Seminar presentation	11	18
Exercises	1	6-7	Entrance exams, performing exercises, keeping work diary	work diary, entrance exam	12	20
Knowledge test (partial exams)	1.5	1-7	Studying for partial exams	2 partial exams	8	30
Final exam	2	1-7	Studying for the final exam	Written exam	18	30
Total	**6**				**50**	**100**

Evaluation of the final written exam:

Correct answers	Grade points
36	18
37-38	19
39-40	20
41-42	21
43-44	22
45-46	23
47-48	24
49-50	25
51-52	26
53-54	27
55-56	28
57-58	29
59-60	30

Calculation of final grade:
Based on the total sum of the points awarded during the course and the final exam, the final grade is determined according to the following distribution:
A – excellent (5): 90-100 grade points; B – very good (4): 70-79,99 grade points; C – good (3): 60-69,99 grade points; D – sufficient (2): 50-59,99 grade points.

Required reading

1. Axel Zeeck, Stephanie Grond, Sabine C. Zeeck. Chemie für Mediziner, 10. Auflage, Elsevier

Additional reading

1. Helmut Wachter, Arno Hausen, Gilbert Reibnegger. Chemie in der Medizin, 10. Auflage, De Gruyter

Number of copies of required literature in relation to the number of students currently attending classes in the course

Title	Number of copies	Number of students
Axel Zeeck, Stephanie Grond, Sabine C. Zeeck. Chemie für Mediziner, 10. Auflage, Elsevier	5	50

Course evaluation procedures

Anonymous, quantitative, standardized student survey providing feedback on the course as well as on the work of course coordinators and their assistants/associates is being conducted by the QA Office of the Faculty of medicine Osijek.