



COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
World of Medicinal Chemistry	

Annotation
During this module, students will be introduced to the subjects of medicinal chemistry, the knowledge of which is very important not only for students of medicine and related specialties, but also for all persons interested in medicine. The course will examine the nature of chemical bonds and their importance in biochemical reactions, the rate of chemical reactions in humans, the dependence of human reactions on catalysts (otherwise known as enzymes). Also, the listeners of the module will learn the energetic basis of our body, what and how the processes in the human body depend on the acidity of the medium. During this module, students will be introduced to the chemical materials used in the diagnosis and therapy of diseases. The lectures will also provide other relevant information related to the application of chemical materials and processes in medicine, the latest discoveries and their connection with the social, political, economic and cultural challenges of society.

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: prof. Aivaras Kareiva Other(s):	Faculty of Chemistry and Geosciences, Institute of Chemistry

Study cycle	Type of the course unit (module)
First	Elective

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
Face to face	Spring semester	English

Requirements for students
Prerequisites: English B1 or B2 level. Additional requirements (if any): -

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	130	48	82

Purpose of the course unit (module): programme competences to be developed		
Module aim - to develop analytical, critical and creative thinking skills by describing and evaluating: - general chemical processes in the human body; - chemical compounds used in the diagnosis of human disease; - technological processes for the determination of chemical parameters of the human body; - the benefits of chemical compounds - medicines and the potential risks to natural pollution and human health; - the social, political, economic and cultural challenges associated with the production and use of medicines.		
Learning outcomes of the course unit (module)	Teaching and learning methods	Assessment methods
- Students will know the concepts of medicinal chemistry, production methods of chemicals used in medicine, principles of development, social, political, economic and cultural challenges related to the use of drugs.	Literature analysis studies, active lecture, comparative analysis.	
-Students will be able to analyse, identify, formulate and evaluate chemical and biochemical processes in the human body.	Lectures, self-study, discussions.	

- students will be able to creatively assess the importance of scientific medical findings, to communicate effectively with individuals and other groups on human health and issues affecting it.	Lectures, self-study, discussions.	Colloquium (written answers to mixed questions) - Writing a test, exam.
- Students will be able to understand and critically evaluate the chemical materials which are recommended for use in medical diagnostics by bioethics committees, also therapy and teranostics and the specifics of their use.	Problem-based teaching, group discussion.	
- Students will be able to understand and critically evaluate the general dangers to human health and environmental pollution due to incorrect treatment of chemical materials and processes.	An overview of various sources of information.	

Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work	Contact hours	Self-study hours	Assignments
1. The concept of chemical bonding. Its importance for the formation of compounds in the living organism. Hydrogen bond and protein. Basics of statistics.	1		1				2	2	Preparation for discussion, answers to open questions. Literature: 1. S. S. Zumdahl. Chemistry. (1993, 2007). (330-350 psl.) 2. R. H. Petrucci, W. S. Harwood. Bendroji chemija. (2000). (1-50 psl.)
2. Diversity of complex compounds, more important their properties and their use in human life. Introduction to medical inorganic chemistry.	3		1				4	5	1. S. S. Zumdahl. Chemistry. (1993, 2007). (955-961 psl.) 2. S. Hanessian ir kt. Natural Products in Medicinal Chemistry (2014). (1-50 psl.)
3. Use of complex compounds in medicine. Magnetic resonance imaging contrast agents. Radiopharmaceutical reagents	3		2				5	5	1. G. Thomas. Medicinal Chemistry. An introduction (2000). (5-28 psl.) 2. G.L. Patrick. An Introduction to Medicinal Chemistry (2021). (5-31 psl.)
4. Anti-infectious reagents. Antibacterial reagents of silver, antimony, iron, zinc. Interesting insights of nanomedicine.	4		2				6	5	1. G. Thomas. Medicinal Chemistry. An introduction (2000). (498-501 psl.) 2. G.L. Patrick. An Introduction to Medicinal Chemistry (2021). (150-196 psl.)

5. Reagents acting on the cardiovascular system. Insulin substitutes. Photodynamic therapy reagents. Anticancer reagents. Antiarrhythmic drugs. Antiulcer agents	4		2				6	5	1. J.S. Qadry. Textbook of Inorganic Pharmaceutical and Medicinal Chemistry (2017). (33-37 psl). 2. T. Storr. Ligand Design in Medicinal Inorganic Chemistry (2014). (1-45 psl.).
Preparation for Colloquium								20	Study of compulsory literature
6. Electrolyte solutions and their importance in human life. Acid-base balance in the human body. pH. Physiological fluids.	4		2				6	5	Pasirengimas dalyvauti diskusijose, atsakymai į atvirus klausimus žodžiu. Diskusijos pagal dėstytojo suformuluotas užduotis, dalyvavimas diskusijoje, užduočių rengimas. Literatūra:
7. Hydrolysis of salts and its importance in the functioning of a living organism. Buffer solutions - basis of human life. Blood. Osmotic pressure and dialysis.	5		2				7	5	1. S. S. Zumdahl. Chemistry. (1993, 2007). (485-520 psl.) 2. R. H. Petrucci, W. S. Harwood. Bendroji chemija. (2000). (10-70 psl.) 3. S. Hanessian ir kt. Natural Products in Medicinal Chemistry (2014). (1-50 psl.)
8. Bone tissue and implants. Heterogeneous equilibrium and its influence on the formation of stones in the human body. The importance of precious metals in social life.	4		2				6	5	1. S. S. Zumdahl. Chemistry. (1993, 2007). (588-600 psl.) 2. G. Thomas. Medicinal Chemistry. An introduction (2000). (497-501 psl.) 3. G.L. Patrick. An Introduction to Medicinal Chemistry (2021). (150-196 psl.)
9. Speed of chemical reactions in the human body. Influence of temperature. The role of bioaccumulators. Chemical thermodynamics and thermochemistry.	4		2				6	5	1. R. H. Petrucci, W. S. Harwood. Bendroji chemija. (2000). (50-100 psl.) 2. F. A. Bettelheim, W. H. Brown, M. K. Campbell, S. O. Farrell. INTRODUCTION TO General, Organic and Biochemistry. (2009). (327-336 psl.) 3. J.S. Qadry. Textbook of Inorganic Pharmaceutical and Medicinal Chemistry (2017). (37-41 psl.) 4. T. Storr. Ligand Design in Medicinal Inorganic Chemistry (2014). (321-354 psl.).
Preparation for Exam								20	Study of compulsory literature
Iš viso	32		16				48	82	

Assessment strategy	Weight,%	Deadline	Assessment criteria
Colloquium (written answers to mixed questions) - Writing a test.	50	8th semester week.	Answers to mixed questions on the topics covered. Colloquium questions include the topics covered in the first part of the course, lectures and discussions. It is necessary to answer 10 questions, each of which is evaluated by 1 point (evaluation criteria below) and the general assessment summarizes individual questions. 10 points consist of 33.3% of total grade of Exam. Evaluation Criteria: 1 point evaluates the answer, giving a detailed and clear answer to a question based not only on lecture material but also on its own, substantiated reasoning. The 0.5 point evaluates the answer in detail, but not very accurately. A score of 0.25 is considered the answer to be vague or incomplete, with several major errors. 0 points no answer or it's completely wrong.
Exam (written answers to mixed questions) - Writing a test.	50	During exam session	Answers to mixed questions on the topics covered. Exam questions include the topics covered in the first part of the course, lectures and discussions. It is necessary to answer 10 questions, each of which is evaluated by 1 point (evaluation criteria below) and the general assessment summarizes individual questions. 10 points consist of 33.4% of total grade of Exam. Evaluation Criteria: 1 point evaluates the answer, giving a detailed and clear answer to a question based not only on lecture material but also on its own, substantiated reasoning. The 0.5 point evaluates the answer in detail, but not very accurately. A score of 0.25 is considered the answer to be vague or incomplete, with several major errors. 0 points no answer or it's completely wrong.
Exam assessment is a summative assessment, summed from colloquium and exam assessments. To pass exam, the student has obtained minimum grade 5.			

Author	Year of publication	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsory reading				
R. H. Petrucci, W. S. Harwood.	2000	Bendroji chemija		Vilnius: Tvermė
S. S. Zumdahl.	2007	Chemistry		D C Heath Canada
J.S. Qadry.	2017	Textbook of Inorganic Pharmaceutical and Medicinal Chemistry		Pvt Ltd, India
F. A. Bettelheim, W. H. Brown, M. K. Campbell, S. O. Farrell.	2009	Introduction to General, Organic and Biochemistry.		Brooks/Cole
Optional reading				
G. Thomas.	2011	Medicinal Chemistry. An introduction.		Wiley
T. Storr.	2014	Ligand Design in Medicinal Inorganic Chemistry.		Wiley
S. Hanessian ir kt.	2014	Natural Products in Medicinal Chemistry.		Wiley
G.L. Patrick.	2021	An Introduction to Medicinal Chemistry.		Oxford University Press

D. W. Oxtoby, H. P. Gillis, N. H. Nachtrieb.	1999	Principles of Modern Chemistry.		Fort Worth : Saunders College Pub
T. L. Brown, H. E. LeMay, B. E. Bursten.	2000	Chemistry. The Central Science.		<u>Pearson Prentice Hall</u>
D. D. Ebbing, S. D. Gammon.	2009	General Chemistry.		Brooks Cole