COURSE UNIT (MODULE) DESCRIPTION

COURSE UNIT (MODULE) TITLE IN LITHUANIAN	COURSE UNIT (MODULE) TITLE	Code
Medicininė neorganinė chemija	**Medical Inorganic Chemistry**	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: dr. Andrius Laurikėnas	**Faculty of Chemistry and Geosciences, Institute of Chemistry**

Study cycle	Type of the course unit (module)
Second	Optional

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
Face to face	2nd (spring) semester	English

Requirements for students	
Prerequisites: Main courses of chemistry and inorganic chemistry	**Additional requirements (if any):** -

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	135	64	71

Purpose of the course unit (module): programme competences to be developed		
The aim of the course is to deepen students' knowledge of medical preparations containing metal ions and complex compounds. To provide students with the necessary knowledge about bioceramic materials, their preparation and processing technologies, and their application in biomedicine. Also developing the ability to find, analyze, systematise and deliver information from various sources; ability to study independently, in accordance with established deadlines; the ability to critically assess the key technological developments in the field of biomaterials and the innovations in chemistry, nanochemistry and related disciplines.		
Learning outcomes of the course unit (module)	**Teaching and learning methods**	**Assesment methods**
- Will be able to analyze, systematize and critically evaluate the quality of scientific information and research on professional activity.	Research methods (information search, reading of literature, preparation of a report), lectures	Presentation of reports, written examination
- Will be able to react appropriately and proactively to new situations and emerging problems, to operate effectively without specific information or instructions	Research methods (information search, reading of literature, preparation of a report), preparation of a plan	Presentation of reports, written examination
- Will be able to present and explain the results of research to the audience of professionals and non-specialists.	Presentation of reports, discussion.	Presentation of reports
- Will be able to integrate the latest	Lectures, preparation of reports	Presentation of reports, written

pharmacology, chemistry and biology knowledge and describe complex compounds and bioceramic substances used in medicine.		examination
Students will be able to analyze and evaluate the latest aspects of metal ion-based compounds and bioceramic applications, to recommend innovative solutions to emerging problems.	Lectures	Written examination

Topics	Contact hours								Self-study work: time and assignments	
	Lectures	Consultations	Seminars	Exercises	Laboratory work	Practise	E. Learning	Total contact	Self-study hours	Assignments
1. Introduction to Medical Inorganic Materials. Use of metal ions in medicine. Nomenclature of complex metal compounds and ligands.	1		1					2	3	Reading scientific literature. Tasks of complex metal compound nomenclature, and the influence of ligands on complex compounds.
2. The role of metals in the human body. Effects of metal deficiency and excess on the human body, prevention of deficiency and excess.	2		1					3	4	Reading scientific literature. Tasks of metal ions and complex compounds on the human body.
3. Anti-cancer platinum complex compounds. Influence of ligands on platinum complex compounds. Modification of ligands with regard to selectivity and photochemical activation.	4		1					5	6	Reading scientific literature. Tasks of platinum complex compounds used to treat cancer. Possibilities of modification of platinum complex compounds
4. Metal compounds are used in nuclear medicine. Characteristics of radiopharmaceuticals. Review of Tc, Re, Ga, In, Y, lanthanide, halogen radiopharmaceuticals	3		2					5	7	Reading scientific literature. Tasks associated with the properties and application of classical and modern radiopharmaceuticals
5 Use of transition metal complex compounds in sensors and contrast agents. Modification of ligands with regard to the stability of the complexes and photophysical properties. Complex compounds of lanthanides. Nuclear Magnetic Resonance Contrast Agents.	4		2					6	6	Reading scientific literature. Tasks are linked to the core principle of magnetic resonance imaging and the use of contrast media.
6. Antimalarial complex compounds and their properties. Gold complex compounds are used in cancer and arthritis therapy	3		1					4	4	Reading scientific literature. Tasks on antimalarial preparations.
7. Protein interaction with metal complex compounds. Complex compounds for the treatment of neurodegenerative (Alzheimer's, Parkinson's) diseases. Metal ion cofactors and enzyme inhibitors.	3		1					4	5	Reading scientific literature. Tasks are related to the chemical properties of proteins and the application of complex compounds to treat Alzheimer's, Parkinson's.
8. Iron and copper chelates. Applying chelates to treat liver diseases. Iron and copper metabolism.	2		1					3	4	Reading scientific literature. Tasks associated with the use of iron and copper compounds in the treatment of liver diseases (cirrhosis, etc.)
9. Classification of bioceramic substances and their main uses.	2		2					4	4	Reading scientific literature. Preparing for discussion.
10. Bioglass and its importance in	2		2					4	5	Reading scientific literature.

medicine.										Preparing for discussion.
11. Hydroxyapatite. Chemical and structural properties, medical applications. Synthetic substituted hydroxyapatite.	4		4					8	8	Reading scientific literature. Preparing for discussion.
12. Bioceramic coating forming technologies.	2		2					4	6	Reading scientific literature. Preparing for discussion.
13. Various methods of analysis for the analysis of bioceramic substances.	4		4					8	4	Reading scientific literature. Preparing for discussion.
14. Nanocomposites of bioceramic materials.	2		2					4	5	Reading scientific literature. Preparing for discussion.
Total	**38**		**26**					**64**	**71**	

Evaluation strategy	**Weight, %**	**Deadlline**	**Assessment Criteria**
Research project and its presentation	40%	During the semester	4 points: Presentation is informative, the content corresponds to the topic, there are all the necessary parts of the presentation structure, actively participates in the discussion, answers questions, formulates problems and questions, gives critical comments; 3 points: Presentation is informative, the content corresponds to the theme, some parts of the presentation structure are missing, participates in the discussion, answers to the provided questions; 2 points: Presentation is informative, content does not correspond to the topic, some parts of the presentation structure are missing, participates in the discussion, answers to the provided questions; 1 point: The presentation is not informative, the content does not correspond to the topic, participates in the discussion, answers the provided questions; 0 points: Unsolicited presentation, almost absent in discussions or missed more than 1/3 of seminars.
Written exam	60%	During the session	Open-ended questions with a maximum score of 20. Evaluation is divided into the following order: • Excellent knowledge and skills. 18-20 correct answers. • Good knowledge and skills, there may be minor mistakes. 14-17 correct answers. • Average knowledge and skills. There are mistakes. 10-13 correct answers. • Knowledge and skills still meet minimum requirements. 9 correct answers. • Minimum requirements are not met. 0-8 correct answers.

Author	**Year of Publication**	**Title**	**Issue of a periodical or volume of a publication**	**Place of publication and publishing house**	**Access to the Internet or VU Library**
Mandatory literature					
Fuchs Jacob, Kossler Wolffe	2009	Bioceramics : Properties, Preparation and Applications	ISBN: 9781617281488 (el. knyga)	New York: Nova Science Publishers,	E-book. Available in VU library resources.
Zhang, Xiang	2014	Inorganic Biomaterials : Structure, Properties and Applications	ISBN: 9781909030398 (el. knyga)	Shawbury, Shrewsbury : Smithers Rapra.	E-book. Available in VU library resources.
Thompson, K.H.	2011	Medicinal inorganic chemistry: an introduction, in Encyclopedia of Inorganic		John Wiley & Sons	Online DOI: 10.1002/978111995

		and Bioinorganic Chemistry			1438.eibc0362
Tim Storr	2014	Ligand Design in Medicinal Inorganic Chemistry		John Wiley & Sons	Online DOI: 10.1002/9781118697191.ch1
Jonathan L. Sessler	2005	Medicinal Inorganic Chemistry		American Chemical Society	ISBN: 9780841238992
Additional literature					
J. Kadziauskas	2008	Biochemijos pagrindai		VU leidykla	Available at VU library
Akin Ipek, Goller Gultekin, Kayali Eyup Sabri	2012	Bioceramics 23 : Selected, Peer Reviewed Papers From the 23rd Symposium and Annual Meeting of International Society for Ceramics in Medicine (ISCM 2011), November 6-9 2011, Istanbul, Turkey	ISBN: 9783037852552 (el. knyga)	Durnten-Zurich : Trans Tech Publications.	E-book. Available in VU library resources.
Liu Qing Wang Hongjun	2014	Tissue Regeneration: Where Nano-structure Meets Biology	ISBN: 9789814494830 (el. knyga)	New Jersey : World Scientific.	E-book. Available in VU library resources.
Shen James Zhijian Kosmač Tomaž	2014	Advanced Ceramics for Dentistry	ISBN: 9780123946195 (el. knyga)	First edition. Waltham, MA : Butterworth-Heineman n.	E-book. Available in VU library resources.
Teoh Swee Hin	2004	Engineering Materials For Biomedical Applications	ISBN: 9789812560612 (el. knyga)	Hackensack, NJ : World Scientific.	E-book. Available in VU library resources.