COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Theory of Sol-Gel Processing	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: Prof. Aivaras Kareiva **Other(s):**	Institute of Chemistry

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

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
Face to face	1st semester	English

Requirements for students	
Prerequisites: The main objectives from first cycle of Chemistry, or Biochemistry, or Chemical Engineering programmes of studies.	**Additional requirements (if any):**

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	**135**	32	103

Purpose of the course unit (module): programme competences to be developed		
Ability to explain the principles of modern methods used for the synthesis of classical and nanomaterials. Ability to explain processes taking place during the sol-gel synthesis and formation of materials. Ability to characterize the properties and possible applications of sol-gel derived materials and explain their peculiarities.		
Learning outcomes of the course unit (module)	**Teaching and learning methods**	**Assessment methods**
After successful completion of this course student should be able to:	Lectures, Laboratory work, Self-study	Final exam (written form)
Determine the peculiarities of methods used for the synthesis of classical and nanomaterials.		
Determine the peculiarities of sol-gel processing.		
Explain modern methods of materials formation and application.		
Explain properties of inorganic functional materials.		

Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work placement	**Contact hours**	**Self-study hours**	**Assignments**
1. Electrolytic dissociation. Acid-base equilibrium in solutions. Hydrolysis. Buffer solutions.	4							**10**	
2. Fundamentals of sol-gel processing. Hydrolysis and condensation reactions in the aqueous solutions of inorganic salts of transition metals.	4							**10**	
3. Role of the anion on the hydrolysis and condensation reactions in the aqueous solutions of inorganic salts of transition metals	4							**13**	
4. Solution chemistry of transition metal alkoxide precursors. Sol-gel chemistry route to the preparation of different ceramic materials.	4							**14**	
5. High-T_C Superconductors. Mixed-Metal Garnets. Nanoparticles, Nanowires, Nanorods. Thin Films.	2				2			**14**	
6. Sol-gel design of bioceramics. Synthesis of hydroxyapatite using different sol-gel methods. Characterization of obtained CHAp materials.	2				2			**14**	
7. Synthesis of lanthanide-doped CHAp samples. Investigation of luminescent properties. Sol-gel derived CHAp thin films.	2				2			**14**	
8. Synthesis of low crystallinity tricalcium phosphate. Conservation sol-gel chemistry.	4							**14**	
Total	**26**				**6**			**112**	

Assessment strategy	Weight,%	Deadline	Assessment criteria
Final exam	100 %	January 26	Answering into open type questions.

Author	Year of publication	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsary reading				
C. J. Brinker, G. W. Scherer.	1990	Sol-Gel Science: The Physics and Chemistry of Sol-Gel Processing.		Academic Press, London.

J. Livage, M. Henry, C. Sanchez.	1988	*Progr. Solid State Chem.*, 18, 259		
F. A. Bettelheim, W. H. Brown, M. K. Campbell, S. O. Farrell.	2009	INTRODUCTION TO General, Organic and Biochemistry.		Mary Finch, USA
Optional reading				
John N. Lalena, David A. Cleary	2010	PRINCIPLES OF INORGANIC MATERIALS DESIGN		Wiley
A. Kareiva et al.	2011-2017	*Materials Science (Medžiagotyra),* 17 (2011) 428-437. *J. Sol-Gel Sci. Technol.,* 64 (2012) 643-652. *J. Lumin.,* 136 (2013) 17-25. *J. Lumin.,* 147 (2014) 290-294. *Ceram. Int.,* 41 (2015) 4504-4513. *Surf. Coat. Technol.,* 307 (2016) 935-940. *J. Sol-Gel Sci. Technol.,* 81 (2017) 261-267.		