COURSE UNIT DESCRIPTION

Course unit title	Code
Methods of Inorganic Synthesis	

Lecturer(s)	Department, Faculty
Coordinating: Dovydas Karoblis **Other:**	Faculty of Chemistry and Geosciences, Institute of Chemistry Naugardukas str. 24, LT-03225 Vilnius

Study cycle	Type of the course unit
The first	Optional

Mode of delivery	Semester or period when it is delivered	Language of instruction
Face to face	8th semester	Lithuanian

Requisites	
Prerequisites: General Chemistry, Inorganic Chemistry, Organic Chemistry	**Co-requisites (if relevant):**

Number of ECTS credits allocated	Student's workload (total)	Contact hours	Individual work
5	135	48	87

Purpose of the course unit: programme competences to be developed		
Introduce students to the methods of inorganic synthesis in order to obtain modern compounds.		
Learning outcomes of the course unit (module)	**Teaching and learning methods**	**Assessment methods**
To appreciate advantages or outs of various methods of synthesis;	Lectures; Laboratory work; Mind maps; Individual literature study and presenting scientific information.	All laboratory works, Colloquium, final exam
Individually to perform operations of synthesis in laboratory;		Laboratory works
To explain kinetic of occurring chemical processes during the synthesis;		All laboratory works, Colloquium, final exam
To determine the conditions for synthesis on purpose to obtain chemical compounds with proper structure and functional features;		All laboratory works, Colloquium, final exam
To choose up the most economical method of synthesis;		All laboratory works, Colloquium, final exam
To prepare and present synthesis sheets and reports;		Laboratory works

Course content: breakdown of the topics	Contact hours							Individual work: time and assignments	
	Lectures	Tutorials	Seminars	Workshops	Laboratory work	Internship/work placement	**Contact hours, total**	**Individual work**	**Assignments**
1. Introduction. Course objectives.	1						**1**	**1**	
2. Types of reactions. Equipment of Laboratory. Suitable Materials for Laboratory Facilities. Devices for Temperature Measurement. Freezing and Heating of Reactors. Phase diagrams. Manners of Separation and Purification of Chemicals.	1			1			**2**	**8**	Textbook reading. Literature search. Problem solving. Preparation of synthesis sheets and reports.
3. Solid-State Reactions. Ceramic Method. General Aspects of Solid State Reactions. Examples of Precursors. Carbothermal Reduction. Reaction Mechanism of Reaction for the Synthesis of SiC. Synthesis of Various Carbides, Borides and Silicides by Carbothermal Reduction Reactions.	1		2	2	4		**9**	**10**	Textbook reading. Literature search. Preparation of synthesis sheets and reports. Preparation of oral presentation.
4. Classification of Combustion Synthesis Reactions. Thermite-Type Reactions. Sintering. Stages of Sintering. Factors affecting Sintering. Ceramics Processing. Solid-Gas Reactions. Direct Nitridation of Elemental Silicon to give Si_3N_4. Decomposition and Dehydratation Reactions.	1		2	2			**5**	**9**	Textbook reading. Literature search. Preparation of synthesis sheets and reports. Preparation of oral presentation.
5. Intercalation Reactions. Structure of Layered Lattices. Types of Intercalation Reactions. Electrointercalation. Rechargeable Lithium Ion Battery. Intercalation of Polymers in Layered systems. Pillaring of Layered Compounds.	1		2	2			**5**	**9**	Textbook reading. Literature search. Preparation of oral presentation.
6. Formation of Solids from Gas Phase. Chemical Vapour Transport. Transport Reactions for the Purification of Solids and for Growth of Single Crystals. Halogen lamps.	1						**1**	**10**	Textbook reading. Literature search. Preparation of oral presentation.
7. Chemical Vapour Deposition. General Aspects. Classification of precursors utilized by CVD. CVD equipment. CVD and CVD-Related Techniques. Metal and Diamond CVD, CVD of Metal Oxides, CVD of Metal Nitrides, CVD of Compound Semiconductors. Chemical Composition of Precursors.	2		2	2			**6**	**10**	Textbook reading. Literature search. Preparation of oral presentation.
8. Aerosol Processes. Routes – Gas-to-Particle conversion and Spray Pyrolysis. Types of Reactors. Products.	1						**1**	**9**	Textbook reading. Literature search. Preparation of oral presentation.
9. Sol-Gel Processes. Sol-Gel Processing Options. The Physics of Sols. The Sol-Gel Transition (Gelation). Hydrolysis and Condensation Reactions. Sol-Gel Chemistry of Metal Oxides. Inorganic-Organic Hybrid Materials.	2		2	2	4		**10**	**11**	Textbook reading. Literature search. Preparation of synthesis sheets and reports.

									Preparation of oral presentation.
10. Nanostructured Materials. Properties of Nanostructured Materials. Preparation of Nanoparticles and Nanocrystallline Materials.	1		2	1	4		**8**	**10**	Textbook reading. Literature search. Preparation of oral presentation.
Total	**12**		**12**	**12**	**12**		**48**	**87**	

Assessment strategy	Weight %	Deadline	Assessment criteria
Laboratory work	10%	April	Oral defense (understanding of theoretical knowledge), safe work in the laboratory. Ability to obtain reliable results. All work must be completed, detailed job descriptions provided and defended orally. If the work is not done, the course must be repeated.
Presentation	20%	Once per semester	Prepare a presentation based on the requirements given in the lecture. The works are evaluated by the teacher and students according to the given evaluation table. Average based on presentation and slides context (15%). Test from from presentations (5%).
Colloquium	30%	March	Open questions. Failure to pass may result in retaking during the exam.
Final exam	40%	May	Open questions.

Author	Year of publication	Title	Issue of a periodical or volume of a publication; pages	Publishing house or internet site
Required reading				
U. Subert, N. Husing	2000	Synthesis of Inorganic Materials	Wiley-VCH, Germany	1
P. W. Atkins, T. L. Overton, J. P. Rourke, M. T. Weller and F. A. Amstrong	2010	Inorganic Chemistry	Oxford University Press	28
C. E. Housecroft and A. G. Sharp	2008	Inorganic chemistry	Pearson Education Limited	32
Recommended reading				
C. C. Koch, I. A. Ovid'ko, S. Seal, and S. Veprek	2007	Structural Nanocrystalline Materials. Fundamentals and Applications	Cambridge University Press	
R. Xu, W. Pang, Q. Huo	2011	Modern Inorganic Synthetic Chemistry	Elsevier, Amsterdam	