COURSE UNIT DESCRIPTION - ORGANIC CHEMISTRY

Course unit title	Code
ORGANIC CHEMISTRY	

Lecturer(s)	Department(s)
Coordinator: Doc. Virginija JAKUBKIENĖ	Vilnius University, Faculty of Chemistry, Naugarduko 24, LT-03225 Vilnius

Cycle	Level of the course unit	Type of the course unit
Full-time studies (1st stage)	1 out of 1	Compulsory

Mode of delivery	Period of delivered	Language(s) of instruction
Face to face	1th semester, autumn	Lithuanian

Prerequisites and corequisities	
Prerequisites: a student must be learned the course of General chemistry	**Corequisities (if any):**

Number of credits allocated to the course unit	Student's total workload	Contact hours	Self-study and research hours
6	**162**	**80**	**82**

Purpose of the course unit: programme competences to be developed

The course unit aims to develop:

Subject-specific competences:

- knowledge about the features of chemical bonds and interactions of atoms in the molecule;
- skills to predict properties of organic compounds from the analysis on their structure and presence of various functional groups in the molecules;
- knowledge about the basic mechanisms of organic reactions;
- knowledge about the basic methods of isolation, purification and identification of organic compounds and to develop corresponding practical skills;
- skills to analyze, compare, and critically evaluate the organic chemistry information.
- skills to work safely in organic chemistry laboratory;
- skills to perform experiments and interpret the data obtained;
- skills to perform reliable measurements, document and analyse the results of the measurements;

General competences:

- analytical and critical thinking ;
- skills for self-development, learning skills in order to study general science resources;

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
• Describes principles of classification and nomenclature of organic compounds; • Analyses, compares and critically evaluates the organic chemistry information related to this topic.	Lectures, seminars, self-directed learning	Midterm exam
• Describes peculiarity of interactions the chemical bonds and atoms in organic molecule; • Analyses, compares and critically evaluates the organic chemistry information related to this topic.	Lectures, tutorials, seminars, self-directed learning	Midterm exam
• Describes classification of organic reactions and reagents and acidity and basicity of organic compounds; • Analyses, compares and critically evaluates the organic chemistry information related to this topic.	Lectures, tutorials, seminars, self-directed learning	Midterm exam

• Describes the structure of organic molecules and isomerism; • Analyses, compares and critically evaluates the organic chemistry information related to this topic.	Lectures, tutorials, seminars, self-directed learning	Midterm exam
• Describes reactivity of hydrocarbons and alkyl halides and their basic reactions mechanisms; • Analyses, compares and critically evaluates the organic chemistry information related to this topic.	Lectures, tutorials, seminars, laboratory work, self-directed learning	Exam
• Describes characteristic reactions of alcohols, phenols, ethers and thiols; • Analyses, compares and critically evaluates the organic chemistry information related to this topic.	Lectures, seminars, laboratory work, self-directed learning	Exam
• Describes nucleophilic addition and alpha-substitution reactions of aldehydes and ketones; • Analyses, compares and critically evaluates the organic chemistry information related to this topic.	Lectures, tutorials, seminars, laboratory work, self-directed learning	Exam
• Describes reactivity of carboxylic acids and derivatives; • Analyses, compares and critically evaluates the organic chemistry information related to this topic.	Lectures, tutorials, seminars, laboratory work, self-directed learning	Exam
• Describes basicity of amines and their reactions; • Analyses, compares and critically evaluates the organic chemistry information related to this topic.	Lectures, tutorials, seminars, laboratory work, self-directed learning	Exam
• Describes aromaticity, basicity and reactions with electrophiles and nucleophiles the most important five- and six-membered heterocycles; • Analyses, compares and critically evaluates the organic chemistry information related to this topic.	Lectures, tutorials, seminars, self-directed learning	Exam
• Describes basic methods of isolation, purification and identification of organic compounds and develop corresponding practical skills; • Analyses, compares and critically evaluates the organic chemistry information related to this topic.	Laboratory work, self-directed learning	Requital of laboratory work

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. Classification and nomenclature of organic compounds	3		1				**4**	**4**	Textbook reading; solving of practical assignments.
Classification of organic compounds	1						**1**	**2**	
Nomenclature of organic compounds	2		1				**3**	**2**	
2. Chemical bonds and interaction of atoms in organic molecules	4		1				**5**	**6**	Textbook reading; solving of practical assignments.
Hybridization theory	1						**1**	**2**	
Nature of chemical bonds	1						**1**	**2**	
Inductive and mesomeric effects	2		1				**3**	**2**	
3. Classification of organic reactions and reagents; acidity and basicity of organic compounds	4		1				**5**	**6**	Textbook reading; solving of practical assignments.
Kinds of organic reactions and reagents	1		1				**2**	**2**	

Acids and bases: Brønsted-Lowry definition	2						**2**	2	
Acids and bases: Lewis definition	1						**1**	2	
4. Structure of organic molecules and isomerism	**5**		2				**7**	**7**	Textbook reading; solving of practical assignments.
Constitution isomers	1						**1**	2	
Configuration isomers	2		1				**3**	2	
Conformations of molecules	2		1				**3**	3	
5. Hydrocarbons and alkyl halides	**10**		4		**1**		**15**	**15**	Textbook reading; solving of practical assignments; preparation of Lab Report.
Alkanes and mechanism of S_R reaction	2		1				**3**	3	
Alkenes and mechanism of A_E reaction	2		1		1		**4**	4	
Conjugated dienes and alkynes	2						**2**	2	
Aromatic compounds and mechanism of S_E reaktion	2		1				**3**	3	
Alkyl halides: nucleophilic substitution (S_N1, S_N2) and elimination (E1, E2) reactions	2		1				**3**	3	
6. Alcohols, phenols, ethers and thiols	**4**		1		**2**		**7**	**9**	Textbook reading; solving of practical assignments; preparation of Lab Report.
Properties of alcohols: acidity, S_N, E and oxidation reactions	2		1		1		**4**	**5**	
Properties of phenols, ethers and thiols	2				1		**3**	**4**	
7. Aldehydes and ketones	**4**		**2**		**1**		**7**	**7**	Textbook reading; solving of practical assignments; preparation of Lab Report.
Nucleophilic addition (A_N) reactions	2		1		1		**4**	**4**	
Enolate ion and mechanism of aldol reaction	2		1				**3**	**3**	
8. Carboxylic acids and derivatives	**6**		**2**		**1**		**9**	**10**	Textbook reading; solving of practical assignments; preparation of Lab Report.
Nucleophilic acyl substitution reactions: mechanism of esterification reaction	2		1				**3**	**4**	
Condensation of esters: mechanism of Claisen condensation reaction	2		1				**3**	**3**	
Hydroxy- and oxoacids	2				1		**3**	**3**	
9. Amines	**4**		**1**		**1**		**6**	**6**	Textbook reading; solving of practical assignments; preparation of Lab Report.
Basicity of amines and their S_N reactions	2				1		**3**	**3**	
Reactions of amines with nitrous acid: diazonium salts	2		1				**3**	**3**	
10. Heterocyclic compounds: important five- and six-membered nitrogen heterocycles	**4**		**1**				**5**	**4**	Textbook reading; solving of practical assignments.
Aromaticity, acidity and basicity of nitrogen heterocycles	2						**2**	**2**	
Reactions with electrophiles and nucleophiles	2		1				**3**	**2**	

11. Basic methods of isolation, purification and identification of organic compounds					**10**		**10**	**8**	Textbook reading; preparation of Lab Report.
Crystallization and measurement of melting point					3		**3**	**3**	
Distillation and measurement of refraction index					3		**3**	**3**	
Extraction and thin-layer chromatography					4		**4**	**2**	
Total	**48**		**16**		**16**		**80**	**82**	

Assessment strategy	**Weight, %**	**Assessment period**	**Assessment criteria**
1. Midterm exam	30	7th week of the course	Written answers to 10 questions from topics 1– 4 (0.3 point each). Minimal positive assessment – 1.5 point.
2. Requital for laboratory work	20	16th week of the course	For description of laboratory work – 1 point, for written answers to questions – 1 point. Minimal positive assessment – 1 point.
3. Exam	50	During examination session	Written answers to 10 questions from topics 5–10 (0.5 point each). Minimal positive assessment – 2.5 point.
Total	100		The sum of points (1 + 2 + 3) is equivalent to final mark.

Author	**Year of publica-tion**	**Title**	**Issue of a periodical or volume of a publication**	**Publishing place and house or web link**
Compulsory reading				
V. Jakubkienė	2009	Organic chemistry (textbook, in Lithuanian)		www.chf.vu.lt/mokomoji_medziaga/organine_gam.php
T. W. Graham Solomons, Craig B. Fryle Organic chemistry	2008	Organic chemistry	U (angl.) 54 / So.62 (VU Library)	Hoboken (NJ): Wiley Blackwell Publishing
V. Jakubkienė, A. Brukštus	2005	Organic chemistry laboratory works (in Lithuanian)	547 / Ja-239 (VU Library)	Vilnius: VU Publishing
Z. J. Beresnevičius, P. R. Kadziauskas	2006	Organic chemistry. Task book (in Lithuanian)	547 / Be-247 (VU Library)	Kaunas: Technologija Publishing
Optional reading				
V. Laurinavičius	2002	Organic and bioorganic chemistry (textbook, in Lithuanian)	54 / La-486 (VU Library)	Vilnius: Žiburio Publishing