VILNIUS UNIVERSITY

Physical Sciences

First cycle study programme

NANOMATERIALS CHEMISTRY (Code – 612F10003)

SELF EVALUATION REPORT

Vice Rector of Vilnius University …… …….. doc. dr. Nijolė Radavičienė
(signature)

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Vilnius
2016 May

Data on the Study Programme

Title of the Study programme	*Nanomaterials Chemistry*
State code	612F10003
Study area	*Physical sciences*
Study field	*Chemistry*
Type of studies	*University studies*
Level of studies	*first cycle*
Language of instruction	*Lithuanian*
Form and duration of studies	*Full-time, 4 years*
Extent of study programme (in credits)	*240 credits*
Minimal admission requirements	*Secondary education*
Degree and /or qualification awarded	*Bachelor's Degree in Chemistry*
Programme registration date	*31/05/2011*

Self-evaluation group and responsibilities

No.	Name and contacts	Position	Responsibilities
1.	Rimantas Raudonis, dr.	Vice dean, Faculty of Chemistry, professor at Department of Applied Chemistry	Coordination of the analysis of the programme. Summarizing of the information about aims, competences and learning outcomes and structure of the programme.
2.	Ieva Balevičiūtė, dr.	Lecturer at Department of Physical Chemistry	Summarizing of the information about the academic staff and programme management.
3.	Inga Čikotienė, dr.	Professor at Department of Organic Chemistry	Summarizing of the information about the study process.
4.	Aleksandra Prichodko, dr.	Senior specialist at Dean's office	Summarizing of the information about aims, competences and learning outcomes and structure of the programme.
5.	Ramūnas Skaudžius, dr.	Lecturer at Department of Inorganic Chemistry	Summarizing of the information about the material resources.
6.	Loreta Tamašauskaitė-Tamošiūnaitė, dr	Senior research fellow, Department of Catalysis, Center for Physical Sciences and Technology	Analysis of the aims, competences and learning outcomes and structure of the programme.
7.	Ieva Paklonskaitė	Student of the programme Chemistry	Summarizing of the information about the study process and student's support.

Work Schedule of the Self-Evaluation Group

Jobs performed	Date
Collection of data for self-evaluation	December 2015 – January 2016
Compilation of initial text of Self-Evaluation Report.	March 2016
Discussions of the text of the Self-Evaluation-Report	March – April 2016
Presenting of the Self-Evaluation-Report to the teachers and social partners, analysis of questions and comments.	April 2016
Preparation of the final version of the self-evaluation report	25 May 2016

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Abbreviations

LO – Learning Outcomes
SPC – Study Programme Committee

Introduction

1. Vilnius University is oldest and largest higher education institution in Lithuania, established in 1579. Since establishment Vilnius University plays significant role in cultural and scientific development of Lithuania. Vilnius University currently has 23 core academic (or equivalent divisions) including 12 Faculties, 2 Institutes with faculty rights (Foreign languages, International relations and political sciences), 5 research institutes (Applied Research, Mathematics and Informatics, Theoretical Physics and Astronomy, Biotechnology and Biochemistry), and 4 inter-faculty Study and research centers (Centre of Oriental Studies, Religious Studies and Research Centre, Centre for Gender Studies, Sports and Health Centre). In 2016, there were 3634 employees working at the University, of which 1334 represented the teaching staff and 448 research workers. 256 University staff members hold Professor's degree, 451 associate professors. In 2016, there were 20487 students studying at the University of which 11257 were first cycle, 2864 integrated studies students, 3600 second cycle students, 863 doctoral students and 803 residents. More detail information about University subdivisions may be found in: www.vu.lt/en/about-us/structure/departments.

2. First Department of Chemistry at Vilnius University was established in 1784 when Chemistry course was started to deliver for medical students. Separate Faculty of Chemistry was established in 1944. Now Faculty of Chemistry consists of 6 departments (Analytical and Environmental Chemistry; Inorganic Chemistry; Physical Chemistry; Organic Chemistry; Polymer Chemistry; Applied Chemistry). Each department has its own area of scientific research and that is reflected in the name of department. Scientists of our faculty work in areas connected with development of chromatographic and electromigrational methods of analysis, electrochemical adsorption, interfacial processes, synthesis and investigation of functional inorganic and organic compounds, hydrophilic polymers and biopolymers. Faculty of chemistry delivers three first cycle study programs (Biochemistry, Chemistry, Nanomaterials chemistry), three second cycle study programs (Biochemistry, Chemistry, Nanomaterials chemistry) and one third cycle study program (Chemistry). The pedagogical work of the teaching staff is connected with the area of their scientific research. For example, the subjects that are related to organic chemistry are delivered by the teaching staff from the Department of Organic Chemistry and so on. Study programmes are not attached to a specific department. All staff participates in delivery of all study programmes and is

responsible for courses connected with specific area. Subjects from other study areas are taught by the teaching staff from a relevant faculty, e.g., the Faculty of Mathematics and Informatics, the Faculty of Physics or the Institute of Foreign Languages. Some elective courses can be provided in other faculties as well.

3. Faculty staff consists of 19 professors, 17 associate professors, 10 lectors. Total number of all cycles students in the faculty is about 600.

4. Nanomaterials Chemistry study programme was evaluated by Lithuanian Centre for Quality Assessment in Higher Education and started to deliver in 2011. Last time this study program passed external evaluation in 2013 and was accredited in 26 September 2013. Evaluation was done by Lithuanian Centre for Quality Assessment in Higher Education. Program got accreditation for 3 years. Summary of evaluation report is presented in Appendix 10. Initially the title of programme was "Nanotechnologies and Material Science". During the external evaluation was concluded that this title not fully corresponds to the contents of study programme. After external evaluation title of the study programme has been changed inti Nanomaterials Chemistry. Students of this programme share material resources with the students of other study programmes. As will be shown in this report, resources for implementation of study programmes are continuously improving. Cycle of introductory lectures about nanomaterials and their application was introduced as a part of Course "Introductory studies". Because of problems with the course of Physics module of introductory physics are prepared and will start to deliver in 2016. After introduction of elective General Education University courses the students are able to choose courses that are connected with business, management, cultural issues and so on. Courses of Chemistry of Crystals and Colloid Chemistry at the launch of the programme were not included in to the syllabus. Now these courses are introduced into the syllabus.

1. Aims and Learning outcomes

1.1. Aims, competences and Learning Outcomes

5. Aim of the Study Programme "Nanomaterials Chemistry" is to train specialists who have a good grounding in the core areas of chemistry and nanomaterials chemistry as well as background in mathematics and physics, have practical skills necessary for work in chemical laboratory, have generic skills in the context of chemistry which are applicable in many other contexts, have attained a standard of knowledge and competence which will give them access to second cycle programmes.

6. Competences to be developed and learning outcomes of the study programme are presented in detail in Table 1. Those involve:

A. Development of the cognitive competences directly related to the science of chemistry and nanomaterials chemistry.

B. Formation of the practical laboratory work skills.

C and D are associated with the development of general competences, which are accomplished through activities related to chemistry.

Table 1. Competences and Learning Outcomes of the First Cycle of Study Programme "Nanomaterials Chemistry"

Competences to be developed	Learning outcomes of the studies
A. Ability to apply theoretical knowledge when explaining and predicting properties of materials and nanomaterials on the basis of the principles of thermodynamics, kinetics, and quantum chemistry.	A1. will apply appropriate terminology, nomenclature, units of measurement used in describing chemical substances and their structure including nanostructures. A2. will describe the nature and structure of elements and compounds and predict their characteristic properties. A3. will characterise the main reactions of inorganic, organic, nanostructured and biologically active substances. A4. will apply the principles of thermodynamics to describe chemical processes. A5. will apply the principles of quantum chemistry to describe properties of atoms, molecules and nanostructures. A6. will apply the principles of kinetics to describe chemical reactions. A7. will be able to explain physical phenomena and apply them for the examination of chemical substances and nanostructures.
B. Ability to perform standard laboratory procedures, synthesize and analyse classical and nanostructured chemical substances, to work with standard chemical equipment and apply instrumental methods.	B1. will choose appropriate methods of qualitative and quantitative analysis and perform the analyses. B2. will choose appropriate methods for the investigation of the properties of chemical compounds, will be able to perform measurements and interpret the data obtained. B3. will choose and compare the most appropriate materials and reaction conditions to achieve a specific goal. B4. will choose appropriate instrumental methods for the examination of the structure of a material, interpret the data of this examination. B5. will synthesize materials and nanostructured materials using common methods; will describe various methods of synthesis. B6. will work with chemicals safely. B7. will perform reliable measurements, document and analyse the results of the measurements, will be able to use computer programmes for the above mentioned purposes. B8. will be able to conduct standard laboratory procedures and use laboratory equipment.
C. Ability to evaluate critically chemical information, data, solve quantitative and qualitative problems of familiar and unfamiliar nature, analyse novel problems and plan their solution strategies.	C1. will apply theoretical knowledge in solving quantitative and qualitative problems of both familiar and unfamiliar nature. C2. will plan problem-solving strategies. C3. will evaluate and mathematically process the data.

D. Ability to communicate in writing and orally in Lithuanian and English, to work autonomously and in a team, organize and plan time, study and continuously develop professionalism and general literacy.	D1. will communicate in writing and orally using correct Lithuanian. D2. will communicate in writing and orally using correct English; will be able to use information sources in English. D3. will present scientific information to informed audience. D4. will acquire skills for self-development, study skills in order to study chemistry, nanomaterials chemistry and general literature on the world outlook. D5. will be able to work both independently and in a team. D6. will be able to organize and plan their work and time.

7. Links of learning outcomes with specific courses in the study programme are presented in chapter "Programme structure".

8. After successful completion of this study program graduates may continue education in second cycle study programmes or start to work in chemistry related enterprises. Qualification of Bachelor of Chemistry diploma holder corresponds 6th Lithuanian qualification level.

1.2. Posting of the information about the study programme

9. Information about the study programme, the aims and learning outcomes of the studies are posted on the Internet in Lithuanian and English:

www.vu.lt/kviecia/

https://klevas.vu.lt/pls/pub/public_ni$www_progr_app.show?m=psa&p_pad=13&p_k=en&p_fm=1&p_apr=1146

https://www.aikos.smm.lt/en/StudyProgramm/_layouts/15/Asw.Aikos.RegisterSearch/ObjectFormResult.aspx?o=PROG&f=ProgEn&key=4370&pt=of&ctx_sr=5Ap4z%2bWIEVrI04xeoygUSHetiaQ%3d

10. Special sections for students and applicants are available on the website of the Faculty of Chemistry:

http://www.chf.vu.lt/informacija-stojantiems/

Consultations on the study programmes are also provided online:

http://www.vu.lt/kviecia/klausk/

11. Study programmes are presented for potential applicants during the Open Door events held in October-December at Vilnius University and at the exhibition „Studies" (Lithuanian Exhibition Centre LITEXPO) in February, during some other events (National Chemistry Olympiads, Extramural Chemistry School, lectures at Children's University, visits of groups of students to the Faculty of Chemistry, visits of teaching staff and students to the gymnasiums). Also twice a year University organizes project "Student for one day". In this project high school students participate in lectures together with university students and see how the real teaching process looks like. Every year Vilnius University publishes catalogue of study programs "Vilnius University invites". Also Faculty itself publishes brochure which includes information about study programmes. The catalogues and brochures are distributed for gymnasium students and teachers during Open Door events, visits to gymnasiums, exhibitions and other events. Information about studies are posted also on Facebook account: https://www.facebook.com/events/1539280709710547/

1.3. Formulation of the study programme outcomes

12. The aims and learning outcomes of the Study programme are formulated in compliance with the "Tuning" methodology (http://www.unideusto.org/tuningeu/) and European Chemistry Thematic Network methodology (http://ectn-assoc.cpe.fr/chemistry-eurolabels/).

1.4. The place of study programme among other programmes

13. Students may receive Chemistry Bachelor degree when studding "Applied Chemistry" programme at Kaunas Technological University and "Chemistry" programme at our Faculty. Study programme "Nanomaterials Chemistry" is oriented into developing deep understanding of all main branches of chemistry with special accents in nanomaterials chemistry.

1.5. Strengths and weaknesses of the study programme

Strengths:

14. The aims and learning outcomes of the study programme are well defined and clear. They are formulated in compliance with the "Tuning" methodology and European Chemistry Thematic Network methodology.

15. Information about the study programme, the aims and learning outcomes of the studies are posted on the Internet in Lithuanian and English. Study programme is presented for potential applicants during various the Open Door events, in catalogue of study programs of VU and in brochure of Faculty of Chemistry.

16. The study programme provides very good coverage in fundamental chemistry and shows connections with nanomaterials chemistry. Study programme prepares students for future education and partially for starting professional activities.

17. The aims and learning outcomes are consistent with the type of study, cycle and level of qualifications.

18. The title of the study programme, learning outcomes and programme content match each other.

2. Structure of the Programme

2.1. Syllabus, compliance with general requirements, links with learning outcomes

19. Table 2 illustrates how the Study programme complies with general requirements approved by Ministerial order No. V- 501 (9 April 2010) of the Ministry of Education and Science of Lithuania and "Descriptor of the study field of chemistry" approved on 15 July 2015 (Ministerial order No. V-808).

Table 2. Compliance of the study programme with the general requirements

Requirement	In programme
Extent of the first cycle study programme 210-240 credits.	240 credits
Courses in the field of study must comprise at least 165 credits.	199 credits
General university education courses must make up at least 15 credits.	15 credits
Elective in-depth specialization courses, elective courses from other fields of study, free choice course or additional general university education courses may comprise up to 60 credits.	26 credits
Practice workload not less than 15 credits.	15 credits
The number of courses studied per semester must not exceed 7.	Mostly 5 courses per semester.
Workload of the Bachelor Thesis not less than 12 credits.	15 credits

Table 3. Syllabus of the Study Programme "Nanomaterials Chemistry"

Legend: C – credits; L – lectures; T/S – tutorials, seminars; LW – laboratory work; Ind. – independent work;

I semester

Course	C	Hours				
		L	T/S	LW	Ind.	Total
General Chemistry	10	48	48	64	105	265
Mathematics I	10	64	64		137	265
Introduction to studies (for Nanomaterials Chemistry students)	5	32	32		71	135
English I	5		64		71	135
Total:	**30**	**144**	**208**	**64**	**384**	**800**

II semester

Course	C	Hours				
		L	T/S	LW	Ind.	Total
Analytical chemistry	8	48	32	64	71	215
Mathematics II	10	64	64		137	265
Physics I	7	48	32	48	62	190
English II	5		64		66	130
Total:	**30**	**160**	**192**	**112**	**336**	**800**

III semester

Course	**C**	Hours				
		L	T/S	LW	Ind.	Total
Organic chemistry I	8	48	32	64	76	220
Quantum chemistry	5	32	32		71	135
Physics II	7	48	32	32	73	185
Elective courses (1 to be chosen) 1. Modern and Postmodern Concept of Science 2. Theory of Science 3. History of Museum Collections and Techniques of Visual Arts	5	32	16		82	130
GUE (Elective from all University list)	5	32	16		82	130
Total:	**30**	**192**	**128**	**96**	**384**	**800**

IV semester

Course	**C**	Hours				
		L	T/S	LW	Ind.	Total
Organic chemistry II	8	32	32	64	92	220
Inorganic Chemistry and Nanomaterials	5	32	32	32	39	135
Chemical Thermodynamics in Nanotechnologies	7	32	32	48	73	185
Elective courses (1 to be chosen) 1. History of Chemistry 2. Food Chemistry 3. Databases of Scientific Information	5	32	16		82	130
GUE (Elective from all University list)	5	32	16		82	130
Total:	**30**	**160**	**128**	**144**	**368**	**800**

V semester

Course	**C**	Hours				
		L	T/S	LW	Ind.	Total
Analysis of Nanomaterials	7	32	16	64	73	185
Biochemistry	5	32	16		87	135
Physical chemistry	8	48	32	64	66	210
Practical Material Science	5	32		32	71	135
Chemistry of Crystals	5	32	32		71	135
Total:	**30**	**176**	**96**	**160**	**368**	**800**

VI semester

Course	**C**	Hours				
		L	T/S	LW	Ind.	Total
Inorganic chemistry	8	32	32	64	92	220
Polymers in Nanotechnologies	7	32	16	64	78	190
Spectroscopy	5	32	32		66	130
Colloid Chemistry	5	32		32	66	130
GUE (Elective from all University list)	5	32	16		82	130
Total:	**30**	**160**	**96**	**160**	**384**	**800**

VII semester

Course	**C**	Hours				
		L	T/S	LW	Ind.	Total
Student practice (September- October)	15	Practice 320			80	400
Nanobiotechnology (November-December)	6	48		48	64	160
Project of Final Thesis	3				80	80
Elective courses (1 to be chosen) 1. Electrochemical Formation and Investigation of Nanostructures 2. Basic Principles of Synthesis of Nanoparticles	6	32	16		112	160
Total:	**30**			**48**	**288**	**800**

VIII semester

Course	**C**	Hours				
		L	T/S	LW	Ind.	Total
Graduation paper	15	Laboratory seminars 10 Consultations with the supervisor 20 Research work 240 Collection, generalization of literature and preparation of the paper 130				400
Surface Chemistry	5	32	32		76	140
Elective (2 to be chosen)	10					260
Analysis of Food, Medications and Biologically Active Materials	5	32		32	66	
Stereochemistry of Biomolecules	5	32	16		82	
Statistics of Chemical Experiment	5	32	16		82	
Mathematical Modelling of Chemical Processes	5	32	16		82	
Methods of Inorganic Synthesis	5	32		32	66	
Chromatography and Spectroscopy of Organic Compounds	5	24	16	24	66	
Pigments and Dyes	5	32		32	66	
Polymeric Materials in Restoration	5	32			98	
Polymer Processing	5	32	16		82	
Theoretical Electrochemistry	5	32		32	66	
Total:	**30**					**800**

Table 4. Links between the Study programme learning outcomes and courses

1st semester	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6
Compulsory courses																								
English I																				+	+	+	+	+
General Chemistry	+		+	+		+	+						+	+	+	+	+	+	+	+	+	+		
Introduction to studies	+	+							+				+				+		+	+				+
Mathematics I	+													+		+	+	+				+	+	+
2nd semester	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6
Compulsory courses																								
Analytical Chemistry	+						+	+					+		+	+	+	+	+			+		
English II																				+	+	+	+	+
Mathematics II	+													+		+	+	+				+	+	+
Physics I	+			+										+		+	+						+	+
3rd semester	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6
Compulsory courses																								
Organic Chemistry I	+		+				+			+		+	+		+	+	+	+	+			+		
Quantum Chemistry		+			+		+									+	+	+	+	+	+	+		
Physics II	+			+										+		+	+							+
Elective courses																								
History of Museum Collection and Techniques of Visual Art	+		+				+												+			+		
Modern and Postmodern Concept of Science																			+			+		+
Theory of Science																	+				+	+		
4th semester	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6

Compulsory courses																								
Chemical Thermodynamics in Nanotechnologies	+	+		+			+	+	+	+	+			+	+	+	+	+	+			+		
Inorganic Chemistry and Nanomaterials	+	+	+				+	+	+	+	+	+	+	+	+	+	+	+		+			+	+	+
Organic Chemistry II	+		+				+			+		+	+		+	+	+	+	+			+		
Elective courses																									
Databases of Scientific Information	+	+															+	+	+	+		+	+		+
Food Chemistry	+		+								+						+	+		+	+	+			
History of Chemistry																				+	+	+	+	+	+
5th semester	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6	
Compulsory courses																									
Analysis of Nanomaterials	+						+	+					+		+	+	+	+	+	+	+	+			
Biochemistry	+	+	+	+		+	+									+	+	+	+	+	+	+			
Chemistry of Crystals	+	+					+				+					+		+	+			+			
Physical Chemistry						+	+			+			+	+	+	+	+	+	+			+			
Practical Material Science	+	+		+	+			+	+	+	+										+	+			
6th semester	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6	
Compulsory courses																									
Colloid Chemistry	+			+			+				+		+	+		+			+	+					
Inorganic Chemistry	+	+	+				+		+	+	+	+		+	+	+		+				+			
Polymers in Nanotechnologies	+	+	+	+		+	+		+	+		+	+	+	+	+	+	+	+			+	+	+	
Spectroscopy	+				+		+		+		+					+	+	+	+			+			

7th semester	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6
Compulsory courses																								
Nanobiotechnology			+				+			+			+		+	+	+		+		+	+	+	+
Practice	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Project of Bachelor Thesis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Elective courses																								
Basic Principles of Synthesis of Nanoparticles	+		+		+					+						+					+	+	+	
Electrochemical Formation and Investigation of Nanostructures	+		+			+	+									+	+	+	+	+	+	+	+	+
8th semester	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6
Compulsory courses																								
Bachelor Thesis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Surface Chemistry				+		+										+	+							
Elective courses																								
Analysis of Food, Medications and Biologically Active Materials							+	+	+				+		+	+	+		+		+		+	+
Chromatography and Spectroscopy of Organic Compounds	+						+		+		+			+	+	+	+	+	+		+	+		
Mathematical Modelling of Chemical Processes				+		+	+			+				+		+	+	+			+	+	+	+

Methods of Inorganic Synthesis			+			+				+		+	+		+	+			+	+	+	+	+	+
Pigments and Dyes	+	+	+					+	+		+	+	+			+	+		+			+		
Polymeric Materials in Retoration	+						+			+	+					+	+		+				+	
Polymer Processing	+	+		+			+		+	+	+		+			+	+		+	+	+	+	+	+
Statistics of Chemical Experiment	+							+	+		+			+		+	+	+	+			+		
Stereochemistry of Biomolecules	+	+	+													+			+	+				
Theoretical Electrochemistry				+		+	+	+			+			+	+	+		+				+		
	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	D1	D2	D3	D4	D5	D6

2.2. Programme arrangement principles

20. Length of study programme – 4 years, total student's workload – 240 credits. Study programme starts with intense studies of Mathematics (1st and 2nd semesters, total workload 20 credits), Physics (2nd and 3rd semesters, total workload 14 credits), chemistry oriented English course (1st and 2nd semesters, total workload 10 credits) and chemistry basics (General chemistry (10 credits) and Analytical chemistry (classical chemical analysis) (8 credits). This forms basis for subsequent studies of main branches of chemistry. After completion of Mathematics students have Quantum chemistry (3rd semester), Spectroscopy (6th semester). Core chemistry courses: Physical chemistry (thermodynamics – 4th semester, kinetics and electrochemistry – 5th semester), Organic chemistry block (Organic chemistry – 3rd and 4th semesters, Biochemistry – 5th semester, Polymer chemistry – 6th semester), Inorganic chemistry block (main group elements - 4th, Crystal chemistry 5th semester, transition elements 6th semester). Since 3rd year of studies students have more specialized courses, such as Practical Material Science, Nanobiotechnology, Surface chemistry and others).

21. Lectures of main courses are delivered together with students of first cycle Chemistry programme. Seminars/Tutorials and labworks are delivered separately for academic group of Nanomaterials Chemistry students. During external evaluation experts suggested to organize introductory course that familiarizes students with nanomaterials. Such module has been created and included into "Introduction to studies" course. In the course "Introduction to studies" students are familiarized with system of studies at the University, nanomaterials and their applications, get training in application of computers. Since autumn 2016 some introductory Physics will also be included in this course. This was decided to do because of many problems with understanding the course of Physics (substantial part of students didn't have Physics at 11th and 12th grade in Secondary school). Since autumn 2015 the courses of Quantum Chemistry and Crystal Chemistry were started to deliver for students of Nanomaterials Chemistry separately from Chemistry programme. First part of Physical Chemistry is taught separately from Chemistry programme under the title Chemical Thermodynamics in Nanotechnologies. Methods of characterization of materials are studied in the course "Practical Material Science" which is delivered in the Faculty of Physics together with students of Physics programme. Specific for only Nanomaterials Chemistry programme is courses Nanobiotechnology, Electrochemical Formations and Investigation of Nanostructures, Basic Principles of Synthesis of Nanoparticles, Surface Chemistry. Polymer chemistry course is delivered partially together with Chemistry programme students, but has additional module of application of polymers in nanotechnologies and is taught separately from Chemistry programme. After external evaluation courses "Chemistry of Crystals" and "Colloid Chemistry" was introduced into this programme.

22. At the end of the third year students of this programme, as well as Chemistry programme students, has to choose department and laboratory where they will prepare their Graduation Thesis. In the 7th semester students have two-month length practice. Final semester is appointed to preparation of final thesis, taking Surface Chemistry and some elective courses.

23. During studies students must take at least 3 courses from General university education block. This block consists from elective modules that are general for all the University. All General Education courses are delivered in equivalent modules each of 5 credits in scope. These courses are created by faculties of Vilnius University and approved by special board that is appointed by Study Comity of Vilnius University. Students are free to select modules according to their desire. Examples of modules that are available for the students are: Sociology, Psychology, Aesthetics, Philosophy, Logics, Strategies of Logical Thinking and Creativity, Religions of the World, Public Communication, Science Philosophy and History, Music and Mathematics, Climate Changes and Ecosystems, Understanding of

Physical World, Gender Studies, History of Civilizations, History of Europe: Epochs and Regions, Quality Management, Management, International Politics, Children's Literature and so on.

2.3. Study methods, contact and independent workload

24. For each course students have theoretical part (lectures) and practical part (tutorials, seminars and for chemistry and physics courses – laboratory work). Lectures are delivered by most experienced teaching staff members. Lectures may be delivered for big group of students (up to 150 when the same lecture is devoted to students of several programmes) and for small groups of 5-6 in the final semesters when students take specialized courses. Format of lecture depends on how large is the group. For large groups lectures are mostly oriented into transfer of information. For small groups lectures are more problem based, discussion based. For tutorials/seminars group cannot be large than 25 students. Tutorials/seminars are oriented into problem solving, discussions and individual consultations. For laboratory work group is divided into two subgroups (not more than 13 students). Each subgroup has one teacher who supervises student work in the laboratory and checks laboratory reports. Technical staff of teaching laboratory also participates in the process of the laboratory work. In the laboratory students are working individually or in pairs. Each laboratory work should be reported and defended. During the laboratory work defense student and teacher are discussing one-to-one on the topics connected with the laboratory work. In the lectures students get concepts, those concepts are elaborated in seminars/tutorials and applied in practice in the laboratory work. Laboratory work defenses give possibilities to diagnose individual misconceptions and make corrections because those are organized in one-to-one format. For preparation of graduation thesis each student gets its supervisor. When students start to prepare their graduation thesis, they are experimenting in the scientific laboratories under guidance of their supervisor. Study methods applied in the delivery lets to develop deep understanding of chemistry concepts.

25. Approximately half of the student's workload is allocated for contact time and half for independent work (Table 5). Independent work designated for literature reading, problem solving, preparation for laboratory works.

Table 5. Sudent workload distribution

Semester	Contact hours (percentage)			Total contact hours (percentage)	Independent work hours (percentage)
	Lectures	Seminars / Tutorials	Laboratory work, practice, graduation thesis		
1	144 (18%)	208 (26%)	64 (8%)	416 (52%)	384 (48%)
2	160 (20%)	192 (24%)	112 (14%)	464 (58%)	336 (42%)
3	192 (24%)	128 (16%)	96 (12%)	416 (52%)	384 (48%)
4	160 (20%)	128 (16%)	144 (18%)	432 (54%)	368 (46%)
5	176 (22%)	96 (12%)	160 (20%)	432 (54%)	368 (46%)
6	160 (20%)	96 (12%)	160 (20%)	416 (52%)	384 (48%)
7	80 (10%)	16 (2%)	416 (52%)	512 (64%)	288 (36%)
8	96 (12%)	48 (6%)	270 (34%)	414 (52%)	386 (48%)
Total	1168 (18%)	912 (14%)	1422 (22%)	3502 (55%)	2898 (45%)

2.4. Bachelor thesis

26. Thesis is an integral and important part of the Programme. Students must demonstrate the ability to conduct research under supervision of supervisor, describe and analyze experimental results, present research-based conclusions in a proper form of Thesis and defend it. The Bachelor Thesis must be orally defended by each student publicly in the presence of a Thesis Examination Committee that consists of four members (appointed by the Rector) and a reviewer. Chairman of the committee must be an external member (invited from other institutions). Reviewer should have read the thesis in its final form and submit his/her report at least two days before the defense. Thesis Examination Committee, after evaluation of student's ability to express verbally his/her research objectives, methodological approach, primary findings and present research-based conclusions, establishes the final grade. General Vilnius University rules for preparation of Graduation thesis are published http://www.vu.lt/site_files/SD/Studentams/st._reglamentuojantys_dok/Rasto_darbu_rengimo_gynimo_kaupimo_tvarka_11_27.pdf . More specific advices are given in Faculty website http://www.chf.vu.lt/mokomoji-medziaga/ (Rašto darbų rengimo metodiniai nurodymai – Instructions for preparation written papers). Additional information on graduation thesis is presented in course unit description (Appendice 1).

2.5. Practical training (practice)

27. In the seventh semester students have practice for 2 months (September and October). A professional practical training workload is 15 credits in scope. Professional practical training may be undertaken not only at Lithuanian industrial entities, but also at scientific institutions or even in foreign countries according to the *Traineeships within the framework of the Erasmus+ Programme*. Within the period analyzed the University and Faculty of Chemistry concluded 8 cooperation agreements with different social partners in Lithuania concerning facilities for development of practical skills of students.

28. The information concerning Practice is presented at [*https://kedras.mif.vu.lt/prakt-vld/chemfak/*]. The place for Practice is freely selected by the students from the list of institutions provided by the administration of Faculty of Chemistry or it could be found by students themselves. The tripartite *Learning agreement for students* between institution, student and Faculty of Chemistry must be signed. The mentors are appointed at receiving institution and at the Faculty of Chemistry. On completion of practice, practice report is prepared and defended, practice supervisor's report is to be attached. The report must be delivered to the mentor of Faculty of Chemistry. Practice report is presented in special seminar. Report must be orally defended by each student publicly in the presence of a Practice Examination Committee that consists of three members (appointed by the Head of Department). Practice aassessment are including components, such as: work placement report; ability of student to present results and make conclusions and opinions of mentors from institution and at the Faculty. General rules for practice and requirements for Practice Report are adopted by the Senate of Vilnius University [http://www.vu.lt/lt/studijos/studiju-procesas/praktika] and by the „Regulations of practical training of Faculty of Chemistry of Vilnius University", appointed by Faculty Council [*https://kedras.mif.vu.lt/prakt-vld/chemfak/*].

29. Practice benefits: After practice student should be able to: apply knowledge in practice; adapt to new situations; evaluate and maintain the quality of work produced; use unlike equipment and technologies; appreciate the experimental approaches, methods and limitations in their field; develop

critical thinking, including the critical analysis of current literature. List of students participated in Erasmus+ practice is presented in Appendix 8.

2.6. Strengths and weaknesses of the study programme

Strengths:

30. The curriculum is designed in accordance with formal regulations and oriented to give students a high level of knowledge and skills.

31. The sequence of courses is oriented into developing of deep understanding of chemistry and gives necessary background from physics and mathematics.

32. The contents of courses match bachelor level of education and gives possibility to achieve learning outcomes.

33. The student's workload is distributed evenly between semesters. Approximately half of workload goes for contact studies, and half for individual studies.

34. The theory in the lectures and the laboratory practice are well linked.

35. The students have possibility to individualize their studies by electing General Education courses from all University list (that includes culture, history, health, management, psychology etc.)

36. The content of the study programme meets the level of modern chemistry science.

3. Academic Staff

3.1. General characteristics of the teaching staff

37. List of teaching staff is presented in Appendix 2. Teaching staff profiles are presented in Appendix 3. Information about scientific projects implemented by Faculty staff is presented in Appendix 4.

38. In this programme participate 44 teachers. 15 of them are professors, 16 associate professors, 10 lectures, holders of dr. degree, 1 lecturer without degree and 2 PhD students. Average age of all teachers is 46 years. According regulations at least half of workload from field of study should be delivered by scientists. In the Programme 36 from 39 teachers are scientific degree holders and are delivering main part of workload. Second and third year PhD students are involved in this Study Programme as instructors during laboratory work or tutorials. Involvement of PhD students in the study programme is a form of growing new generation of university teachers. University teachers are delivering lectures in the field that is connected with their scientific interests.

3.2. Employment, age and turnover of teaching staff

39. The University selects persons for the academic and research positions by way of public competitions for a five-year term of office. Such competitions at faculties are organized and the employees are assessed by the attestation commission set up by the Rector. Attestation commission makes decision by taking into account number of scientific papers published in scientific journals, participation in scientific conferences, preparation of scientific monographs, elaboration of patents, participation in research projects, publishing of study material. According regulations of Vilnius University person over 65 years is not allowed to participate in competition for academic position. Their contract may be prolonged maximum for two 3-years long terms by Rectors decision.

40. Distribution of teaching staff by age is presented in Table 6. The average age of the teachers involved in the Programme is approximately 46 years. On the basis of data in Table 6 it may be concluded that recruiting of young scientists and turnover of teaching staff is satisfactory.

Table 6. Distribution of teaching staff by age

Age	<30	30-39	40-49	50-59	60-69	>70
Number of teachers	2	17	6	10	9	0

3.3. Teaching staff competences and workload

41. In 2009, the Rector by his Order approved the *Introductory training programme of newly admitted employees (teaching staff).* The purpose of the programme is to introduce employees of the University to key functioning principles of the University, possibilities for information provision, internal rules and regulations, as well as the relevant requirements. Ordinarily such training sessions are held twice per year. *The University Lecturer Manual*, drafted in 2012 provides information to newly-recruited lecturers on work at the University, helping the lecturers to smoothly integrate in the University community.

42. Workload for the teaching staff on average is about 300 contact hrs. per year (including all study programs). Moreover, the teachers supervise the students' work on the final (graduation) paper, mark written assignments, so the real pedagogical workload is heavier. In addition to pedagogical work, all teachers do scientific research and participate in various scientific research projects. In table 7 are presented publication numbers and in Appendix 4 information about participation in projects.

Table 7. Numbers of publications, prepared by scientists of Faculty of Chemistry

	01	**02**	**03**	**04**	**05**	**06**	**Total**
2011	8	7	71	11	81		**178**
2012	8	13	62	14	69	2	**168**
2013	1	4	57	9	64		**135**
2014	2	10	71	17	78	1	**179**
2015	7	12	74	15	92	1	**201**
Total	**26**	**46**	**335**	**66**	**384**	**4**	**861**

Publication types:

01	Books: Monographs, studies, textbooks, dictionaries.
02	Summaries (PhD thesis summaries, summaries for habilitation procedure)
03	Scientific papers (journals in list of ISI Web of Science)
04	Scientific papers in materials of conferences.
05	Conference abstracts
06	Patents

3.4. Mobility of teaching staff

43. Teaching staff members participate in scientific and pedagogical internships that are funded by Erasmus program and by scientific projects (Table 8). When professors from other universities are visiting Faculty, they are giving at least one lecture about their university and research. But we don't have visiting teachers who deliver full module or course. Inviting of foreign teachers for giving full course is to expensive.

Table 8. Number of teachers that had internship in designated years

Titles	2011		2012		2013		2014		2015	
	LT	Abroad	LT	Abroad	LT	Abroad	LT	Abroad	LT	Abroad
Professors		4		3		3		1		1
Assoc. Prof.		4		4		1		1		2
Lecturers, dr.		2		4		4		1		2
Lecturers / Assistants		2		2		3		2		2

3.5. Strengths and weaknesses of the programme.

Strengths.

44. The teaching staff is well-qualified, experienced and meets formal requirements. Nearly all teachers are scientists (scientific degree holders). The teaching staff is very active at academic community in local and international area. Young scientists are involved in teaching process.

45. Most of the PhD students are involved in teaching process, they guide laboratory works and also they are able to directly supervise last year students during preparation of their Bachelor thesis.

46. The distribution of teachers according age is quite even and teacher turnover is satisfactory.

47. The teachers develop their professional skills by participating in various projects and programs with partners abroad. Part of the teachers participated in qualification courses organized by the University.

48. The teaching staff is active in research and in preparation and granting of scientific projects. According number of scientific publications teachers of Faculty are leaders in the University. Educational activities of the teachers are connected with the fields of their research.

49. The staff is usually willing to help students; teachers are available for consultations during their working time.

Weaknesses of the programme.

50. Educational workload of the teachers is quite high.

51. Only small number of teachers uses virtual learning environment (Moodle system vma.sec.vu.lt) in their courses.

Actions for improvement

52. Show the advantages offered by virtual learning environment and promote to use this system in teaching.

4. Material resources

4.1. Premises used for teaching process and number of working places

53. In Table 9 information on auditoriums at Faculty of Chemistry is presented. In addition, students listen to lectures of Physics in the Grand Auditorium of Physics of the Faculty of Physics (Sauletekio str. 9), which is equipped with demonstration facilities; perform experiments in two teaching laboratories of Faculty of Physics. Also they take elective General courses at the auditoriums in other faculties. Students can use the computer class set up in the Digital Science and Computing Centre of the Faculty of Mathematics and Informatics which is in the same campus as Faculty of Chemistry. Nearly in all places of the Faculty students may use WIFI internet connection by using Eduroam account.

54. Big part of the programme is devoted to the laboratory works. Information about teaching laboratories is presented in Table 10. For the research and preparation of Bachelor thesis students use facilities of scientific laboratories (Table 11).

Table 9. Auditoriums used for teaching at Naugarduko str. 24

Name of auditorium	Area, m^2	Number of working places	Equipment
Prof. Kazys Daukšas Auditorium	172	110	Multimedia, wired and wireless audio equipment
Auditorium of Inorganic Chemistry	162	110	Multimedia, wired and wireless audio equipment
Auditorium of Analytical Chemistry	48	32	Multimedia
Auditorium of Physical Chemistry	52	45	Multimedia
Auditorium of Organic Chemistry	62	50	Multimedia
Auditorium of Polymer Chemistry	47	30	Multimedia
Prof. Andrius Sniadeckis auditorium	40	25	Multimedia
Prof. T. Grotthuss auditorium	42	24	Multimedia

Table 10. Teaching laboratories

#	Teaching laboratory	Number of working places	Area, m^2	Area per one working place, m^2
1	Laboratory of Analytical and Environmental Chemistry	50	80	1.6
2	Specialized Laboratory of Analytical and Environmental Chemistry	20	46	2.3
3	Laboratory of Inorganic and General Chemistry	35	105	3
4	Organic Chemistry Laboratory No. 1	30	70	2.3
5	Organic Chemistry Laboratory No. 2	12	34	2.83
6	Laboratory of Physical Chemistry	26	56	2.15
7	Laboratory of Polymer Chemistry	12	46	3.83
8	Specialized Laboratory of Polymer Chemistry No. 1	12	45	3.75
9	Specialized Laboratory of Polymer Chemistry No. 2	12	44	3.67
10	Specialized Laboratory of Electrochemistry	5	24	4.8

Table 11. Research laboratories where students run experiments for their final thesis.

#.	Research laboratories at Naugarduko str. 24	Number of working places	Area, m^2	Area per one working place, m^2
1.	Laboratory of Sol-gel Chemistry, rooms 237 (prof. A. Kareiva) and 247 (prof. A. Beganskiene)	12	85.46	7.1
2.	Laboratory of Carboneous Materials, room 202 (prof. A. Barkauskas)	5	49.65	9.9
3.	MOCVD laboratory, rooms 1-3 (prof. A. Abrutis)	5	75.56	15.1
4.	Centre of Nanotechnologies and Material Science (Nano Technas), rooms 225, 226 (prof. Ramanavičienė)	8	60.98	7.6
5.	Laboratory of Liquid Chromatography (prof. A. Padarauskas)	6	51.38	8.6
6.	Laboratory of Gas Chromatography (prof. V. Vičkačkaitė)	6	49	8.2

7.	Laboratory of Spectral Analytical Methods, (prof. S. Tautkus)	7	52.46	7.5
8.	Laboratory of Electrochemical Research, rooms 102, 108 (prof. A. Cesiulis)	10	76.44	7.6
9.	Laboratory of Biosensors, rooms 101, 105 (prof. A. Ramanavičius)	8	59.78	7.5
10.	Laboratory of Synthesis of Carbocyclic Compounds and Stereochemistry, room 215 (doc. E.Orentas, room 216 (prof. A. Žilinskas)	10	78.5	7.9
11	Laboratory of Synthesis of Heterocyclic Compounds, rooms 152, 217 (prof. S. Tumkevičius), 117 (V. Masevičius)	15	140.08	9.3
12	Laboratory of Organic Synthesis, room 113 (prof. I. Čikotienė)	12	79.25	6.6
13	Laboratory of Synthesis and Characterization of Polymeric Compounds, rooms 248, 249, 251 (prof. R. Makuška)	25	140.21	5.6
14	Material Science Laboratory, rooms 159-163 (doc. S. Šakirzanovas)	15	146.46	9.8
15	Electrochemical Laboratory, room 204 (prof. V. Daujotis, Prof. R. Raudonis)	6	44.61	7.4

55. National Center of Physical and Technological Sciences was opened in March 2016. Total area of this center is 27 thousand square meters. Center is located in Sauletekio str. 3. There starts to operate the largest and most modern research base in Lithuania and the Baltic states. There are 46 research laboratories. Infrastructure of these laboratories will be available not only to scientists and students, but also business representatives. In these laboratories over 700 scientists and students will be able to perform their experiments simultaneously. For creation of this center 69 million EUR was spent. In this center 1785 m^2 area is designated for scientists and students of Chemistry Faculty. Laboratories of Organic chemistry, Polymer chemistry, Inorganic functional materials, Chemical analysis and sensors, Electrochemical material science and Active coatings are starting their activities in this new modern center (Table 12).

56. Building of the Faculty is old, constructed in year 1901. There are need for permanent renovations of Faculty facilities. Information about renovations in years 2013-2015 is presented in Table 13.

Table 12. Chemistry laboratories in National Center of Physical and Technological Sciences.

#	Research laboratories (Sauletekio str. 3)	Number of working places	Area, m^2	Area per one working place, m^2
1.	Laboratories of Organic and Polymer Compounds, rooms E309-E316	25	460	18.40
2.	Laboratories of Synthesis and Characterization of Inorganic Functional Materials, rooms E407-E412, E422, E423	20	341	17.05
3.	Laboratories of Chemical Analysis and Sensors, rooms E413-E416, E437	16	245	15.31
4.	Laboratories of Electrochemical Material Science, rooms E438, E439	12	103	8.58
5.	Laboratories of Active Coatings, rooms C024-C026	5	52	10.40

Table 13. Renovation of teaching laboratories and auditoriums (2011-2015)

#	Room	Works performed and financial costs in €
1.	Laboratory of Inorganic and General Chemistry	Overhaul renovation in 2011–2012 (17000 €) and new furniture, hoods and so on (52000€)
2.	Various places of the Faculty	Installation of WiFi connection (7240 €)
3.	Auditorium of Inorganic Chemistry	Floor renovation, new multimedia (8640 €)
4.	Prof. Kazys Daukšas Auditorium	Audio-video equipment (2610 €)

4.2. Equipment for studies

57. In period 2011-2015 Faculty of Chemistry participated in projects funded by Lithuanian governement and by EU („Saulėtekio slėnis (valley of sunrise)“, LaMaTech, „Darnioji chemija (sustainable chemistry)“, „Biotefa“). Nearly 5 million Euro of projects funds were spent for acquiring new equipment for the laboratories. This equipment is used for laboratory works and for research during preparation final thesis. List of new equipment bought by funds of tehse projects is presented in Appendix 5.

4.3. Library and books

58. Vilnius University library has it’s subdivisions in each faculty. Such subdivisions have reading room and library holdings that are collected on the basis of the study programmes and research fields of the faculty. The holdings of Vilnius University library materials are available to all the students and academic staff of Vilnius University and other persons who have a membership card.

59. Library of Faculty of Chemistry has reading hall for 32 students. 6 places are computerized. Since autumn 2012 there is also a wireless access to the Internet not only in the reading room, but nearly in all area of Faculty of Chemistry. Access to internet is supported by EDUROAM service. To update the holdings of the Library of Faculty of Chemistry with study literature, approximately 6000 € are allocated annually.

60. A new brand National Open Access Scholarly Communication and Information Center as part of VU Library has been opened in 2013 at the VU Saulėtekis Campus. Reading rooms in this center are open 24 hour per day.

61. From any computer connected to university computer network, it is possible to access all e-resources available at the Vilnius University Library. Detailed list of full-text databases could be found at: http://www.mb.vu.lt/istekliai/index.php?browse=db . These databases could be accessed using VPN service as well (from home). All dormitories of University of Vilnius are connected to University computer network, so students living in dormitories have possibility to access these resources directly from their room computers.

62. New printed books are added each year to library stock (amount of funds for purchasing books for the reading room of Faculty of Chemistry are presented in Table 14. Electronic materials for studies prepared by the teachers of the Faculty of Chemistry are posted on the faculty website http://www.chf.vu.lt/mokomoji-medziaga/. For some courses e-materials are posted at server of virtual learning center of Vilnius University (vma.esec.vu.lt (protected by passwords)).

Table 14. Finances spent for the purchase of books

Year	2011	2012	2013	2014	2015
€	9300	10400	6500	10100	6000

63. Each year teachers are asked to present information about necessary books and level of necessity. Preference is given to books for the compulsory courses.

4.4. Strengths and weaknesses of the programme:

64. The most of auditoriums and laboratory facilities were partially or completely repaired or reconstructed, a large part of laboratory equipment was replaced.

65. All auditoriums are equipped by multimedia systems, the biggest auditoriums also are equipped with stationary and wireless audio equipment.

66. In all area of Faculty WIFI connection to internet is available.

67. New modern research equipment is involved in teaching process (in preparation of Bachelor thesis and in specialized courses).

68. Faculty of Chemistry has several laboratories in new Centre of Physical and Technological Sciences. Facilities of this laboratories will be used for preparation of Bachelor thesis.

69. University library subscribes for big list of scientific databases that could be accessed from computers at the University, at dormitories and from home (in that case needs to install Virtual Personal Network).

70. Students and staff may use library resources by taking books to home or in the reading rooms at the Faculty, at the central library or new Centre of Scientific Communication.

71. Funds of Faculty Library is constantly updated with new textbooks (mostly in English).

Weakness of the programme

72. Timetable of some educational laboratories and auditoriums are very busy. Because of this it is difficult to draw up an optimal timetable of the use of classrooms and laboratories; students have the so-called gaps between their lectures.

73. In some occasions due to financial procedures we had temporary interruptions in subscription to some scientific databases.

Actions for improvement:

74. To ensure continuous subscription of scientific databases.

75. To install at least one new teaching laboratory and two auditoriums.

5. The studies process

5.1. Admission for a study programme

76. Admission for a study programme of the first cycle "Nanomaterials Chemistry" is implemented according to the rules for the admission for the first level studies of Vilnius University. The persons who have chosen the studies can apply for the state-funded places or/and study without financial support, i.e., pay for the studies themselves.

77. Persons are admitted by way of competition based on the maturity examinations and annual marks in the subjects taught. The composition of the competition score is as follows: Chemistry examination (weighting coefficient 40%), Mathematics or Biology examination (the weighting coefficient 20%), the examination in the Lithuanian language (weighting coefficient 20%), the examination or annual grade of any other subject that not coincides with first three subjects (weighting coefficient 20%). The applicant is awarded additional points if she/he won prizes in the National and International Olympiads in the 11^{th} or 12^{th} form.

78. The data about numbers of applicants and students admitted to the programme is presented in Table 15. It is clear from the table that the overall number of applications is significantly higher than the numbers of the students admitted.

Table 15. Numbers of applications and admitted students.

Year	Applications as the first priority	Applications as the I-VI priority	Total number of applications	Students admitted to the programme
2011	8	103	147	20
2012	19	139	184	25
2013	30	168	248	31
2014	35	206	284	28
2015	19	169	212	26

79. The average scores of the admitted students as well as the highest and the lowest scores are shown in Table 16. The maximal possible competitive score without additional points for Olympiad could be 10 points since year 2014 and 20 points in earlier years. Number of admitted students are quite stable despite demographic issues in Lithuania. Competitive scores are satisfactory.

Table 16. The scores of those admitted for the programme

	For state-funded places			Without state funding		
Year	The maximal score on admission	The lowest score on admission	The average score of admitted students	The maximal score on admission	The lowest score on admission	The average score of admitted students
2011	18.8	15.94	17.2	No adm.	No adm.	No adm.
2012*	19.86	16.52	18.2	12.96	12.96	12.96
2013*	19.84	15.72	18.33	15.42	15.42	15.48
2014**	9.74	6.14	7.91	6.04	6.04	6.04
2015**	8.82	5.52	7.19	4.1	4.1	4.1

* Scale of 20 points

** Scale of 10 points

5.2. Dropout rates

80. Information about dropout numbers and reasons are presented in table 17 and 18. Total dropout rate is quite high, especially in the first year of studies. In the admission process students are able to choose several programmes ranking them by priorities. In case they are not admitted to more desirable study program, students try other programmes which they ranked with lower priority. Quite often that more desirable study programme is medicine, so students consider possibility to study for a semester at Faculty of Chemistry as a possibility to improve their competences and prepare themselves for more successful studies in another study programme. According state funding policy in the first semester of studies student can terminate his studies without financial consequences. Students who are not sure about their choice of study programme, take this opportunity and terminate studies.

Table 17. Information about dropout numbers

Legend: SF – state funding P – paying by themselves

Year of admission	Number of admitted students	Dropout numbers						
		1st year of studies	2nd year of studies	3rd year of studies	4th year of studies	Year of graduation	Total	Dropout percentage
2015	SF: 24	4				2019		
	P: 2	1						
Total	26	5					5	19.23
2014	SF: 26	1	4			2018		
	P: 2		1					
Total	28	1	5				6	21.42
2013	SF: 28	4	2			2017		
	P: 3							
Total	31	4	2				6	19,35
2012	SF: 24	4	1			2016		
	P: 1							
Total	25	4	1				5	20
2011	20	2	1		2	2015		
	0							
Total	20	2	1		2		5	25
Total for all period	**SF: 122**	**15**	**8**		**2**		**25**	**20.5%**
	P: 8	**1**	**1**				**2**	**28.6%**
	SF + P 130	**16**	**9**		**2**		**27**	**20.8%**

Table 18. Dropout reasons

	Year of study	Year of admission					Total
		2015	2014	2013	2012	2011	
Due to low academic results	I	1					**1**
	II		1				**1**
	III						
	IV					**2**	**2**
Due to personal reasons	I	4	1	4	**4**	**2**	**15**
	II		4	2	**1**	**1**	**8**
	III						
	IV						

5.3. Organization of study process and academic support

81. Information about studies and consultations are given by Study directorate (at level of University), by members of dean's office (coordinator of studies, vice-deans), teachers and representatives of Student Union. Students may ask questions on special consultation website www.klausk.vu.lt . Those questions are answered by members of Study directorate or faculty.

82. Information concerning organization of studies, study mobility, financial support, timetables (next semester timetables are announced two months before the end of current semester) are presented in webpage of faculty www.chf.vu.lt and informational system of Vilnius university (password protected).

83. Students who failed to pass exam have possibility to take it one more time at the beginning of the next semester (free of charge). If they fail again, they have to take this course next year (when this course is delivered again). For rehearsal of the course students have to pay. In the case when the academic debts exceed a limit of 15 credits, the student is removed from the list of students, and may recover his student status only after he eliminates all academic debts while undertaking the studies as a course attender. Students of the final year may be allowed to eliminate their academic debts not later than until the beginning of the last examination session, i.e., they are provided an opportunity to complete the studies in the same academic year. In the case when students do not agree with the procedure of examination or the assessment of their performance, they have a right to appeal in writing to the Appeal commission.

84. Students who encounter health problems may take a break up to two years. Maternity leave can be provided up to 3 years. Also students may take 1-year break if they have some other personal problems.

85. Student Union take very active care about student's wellbeing, transferring student traditions from generation to generation, organizing free time. Seeking smooth integration of the first year students into University's life, Student Union organizes "Freshmen's camp" before the beginning of academic year, appoints so called curator (student from higher course) for each first year academic group of student's. Curator consults students about life in the University, helps to solve arising problems.

5.4. Student's support: scholarships, dormitories

86. Part of the students (about 12-15%) gets scholarships based on the academic performance. Scholarships are of two kinds: simple (57 €) and increased (95 €). Students from deprived backgrounds may be granted a social scholarship. Those are distributed through the Students' Union. Best students can seek some special scholarships (Thermo Fisher Scientific, Martyno Yčo, Eileen and Vincent Kadis, Gražina Romualda Klimavičius, and some other). Some financial support is provided for students' events, sports equipment, etc. States Study Foundation provides special loans for students. Information about these loans are given in the webpage of the University.

87. Students whose living place is not Vilnius, may get dormitory. Students from deprived families and students with disabilities may get discount for their living in dormitory.

88. University's Health and Sport's Centre provides possibility to attend various sports classes, to participate in wellness programmes. At the Center of Psychological Innovations and Research students may get professional psychological consultation.

5.5. Student's scientific and artistic activities

89. Vilnius University, in cooperation with Kaunas Technological University and Klaipėda University, organizes annual conferences for chemistry and chemical technology students where students present their research and discus in sections.

90. A part of Students' Union is Chemistry students' scientific society that unites students who are interested in popularizing chemistry science and its ideas to the general public. Members of this society visit various schools, present our faculty and the science of chemistry to them, organize excursions to our university laboratories.

91. In the faculty we have section of Association for Promotion of the Olympiads in Natural Sciences. Members of this association participate in organizing committee (organizing free time during Olympiads) and in scientific committee (preparing theoretical and practical tasks, grading of participant's exams).

92. Faculty of Chemistry together with Centre of Informal Youth Education organizes extramural chemistry school for secondary school students. Students of Faculty participate in organizing activities and in teaching process of this school. University students have possibility to read lectures, lead seminars and laboratory works for secondary school students.

93. Student Union organizes several events for faculty members. Those are celebration of matriculation of freshmens, freshmen camp, parade on occasion of opening academic year, celebration of chemistry days, celebration of Student Union birthday. Student Union publishes their newspaper "Acetonas" (https://issuu.com/csklp/docs).

94. In Vilnius University there are several artistic collectives for students (choruses, orchestras, theaters, folk's groups and others). Those are coordinated by University's Center of Culture (http://www.kultura.vu.lt/)

95. Sports activities are coordinated by Sports and Health Centre (http://www.ssc.vu.lt/). This Center has three sports bases in different places of Vilnius where students may train.

5.6. Student mobility

96. Student mobility (Erasmus studies, Erasmus internship and other) is coordinated by Section of International Programs and Studies Department of Vilnius University. In faculty vice-dean for academic affairs is also responsible for student mobility. Number of students participating in mobility programmes is limited by number of scholarships. Every semester Faculty gets 3-5 scholarships for Erasmus studies and approximately 8-12 scholarships for Erasmus practice. List of Erasmus agreements is presented in Appendix 6. Possibilities to go for Erasmus studies are limited by number or Erasmus scholarships (those are distributed proportionally to number of students in faculties). All allocated scholarships are exploited. Funds for Erasmus practice are higher and Faculty students are very active in this field. Because some faculties are not able to exploit all allocated scholarships, our students are able to get unproportionally high number of scholarships for Erasmus practice (Appendix 8).

5.7. Assessment of students

97. Academic achievements of students are assessed in accordance with the *Procedure for the assessment of student achievements:* (*http://www.vu.lt/site_files/SD/Studentams/Studiju_pasiekimu_vertinimo_Tvarka_12.21.pdf*) that defines the general principles for the assessment of academic achievements of degree students and attenders, responsibilities of persons participating in the assessment, their rights and duties. All information concerning assessment is given in University webpage: http://www.vu.lt/studijos/studentams/egzaminu-sesija .

98. The assessment of the achievements in studying a course is planned and performed by the lecturer of the subject in accordance with the information provided in the description of the course. Contents of the course, requirements and time table are presented by lecturer during the first lecture.

99. A cumulative assessment scheme is applied in most courses. Assessment of the control work and colloquies makes up 30-40% of the final evaluation. Laboratory work performance is worth approximately 10% of the final mark. The weighting of the final exam amounts to 50-60% of the final mark. Concrete principles of assessment of students' achievements are described in the description of a specific course.

100. Students' honest studying is ensured by continuous oral defense of laboratory works, pedagogical staff observes students' work in laboratory. Observation is conducted during colloquies and examinations to prevent cheating. Campaigns against cheating were organized in cooperation with the Students' Union during which students' representatives observed examinations. To verify the independence of the written assignments, a plagiarism check programme operates within the University information system, which compares the written paper with other students' papers registered within the system.

5.8. Monitoring of career of graduates

101. Vilnius University, together with other Lithuanian higher education institutions in 2014 launched special informational system for monitoring career of graduates (webpage www.karjera.lt). This system receives information from various official sources (including social insurance) and from surveys of graduates. Statistical information about employability and studies of graduates is accessible for authorized users only. Students, graduates and employers are invited to register in career monitoring system and to use it as a place for looking and offering jobs and practice places. Also they are asked to answer periodical questionnaires. Information about further studies and employability of first cycle Chemistry graduates (after 6 and 36 months after graduation) are presented in table 20.

Table 19. Percentages of graduates that are continuing studies and employed

Year of graduation	2015	
Number of months after graduation	6	36
Continue studying, %	69.23%	
Employed, %	69.23%	
Employed and continue studying, %	46.15%	

5.9. Strengths and weakness of the programme:

Strengths:

102. Admission of students to the programme is competitive and based on grades in secondary school maturity exam and annual scores. The admission rules are consistent with the nature of the studies and skills required from the students.

103. The study programme employs various teaching and learning methods (lectures, tutorials/seminars, laboratory work, projects).

104. In tutorials and seminars teacher works with groups up to 25 students, in laboratory – with groups up to 12-13 students. For preparation of Bachelor thesis each student has its personal supervisor.

105. Students are encouraged to join research groups since the second year of education.

106. Students are encouraged to participate in exchange programme.

107. Students are able to join students' organization.

108. Students are able to get scholarships based on their academic results or social scholarships.

109. This programme enables students to acquire enough knowledge and skills for future career and studies in Master's programmes in Lithuanian or foreign universities.

110. In most courses cumulative assessment system is applied. Students are assessed during semester and in final exam. Students may appeal to special commission if they do not agree with final assessment.

111. The informational system for monitoring career of graduates was launched.

Weaknesses of the programme:

112. High drop-out rate during first two years of studies.

113. Low level of using e-learning possibilities.

Actions for improvement:

114. Faculty is preparing for participation in pilot project of organization of Freshmen integration week. The purpose of this week is to familiarize students with all possibilities that is offered by the University and the Faculty, to motivate students for purposive studies.

115. Since autumn 2016 special module of introductory Physics will be included into Introductory studies course.

116. To find possibilities motivate teachers to use e-learning.

6. The Management of the Programme

6.1. Quality assurance

117. One of the strategic goals of our University is formation of study quality culture. The Studies department prepared *Quality Manual* (http://skvis.vu.lt/pub/book/qme/topic/10298445) where detail descriptions of responsibilities of all study process participants are presented "*VU Study Program Regulations"* and "*VU Regulations of Studies"* obligate Study Programme Committee to monitor quality of studies and to initiate changes when those are necessary. Committee of Study programme consists from university teachers and representatives of Student Union and social partners. Committee operates according "*Study Program Committee Regulations*" and is responsible to Faculty Council.

6.2. Study programme management

118. Study program is managed by Study Programme Committee. Members of this Committee are R. Raudonis, A. Katelnikovas, R. Skaudžius, A. Brukštus, L. Tamašauskaitė-Tamošiūnaitė (senjor research fellow in Centre of Physical and Technological Sciences), I. Paklonskaitė (student). The Study Programme Committee is responsible for design of Curriculum and monitoring responses of university teachers, students, graduates and employers about study programme. Changes in the Curriculum are suggested by Study Program Committee and confirmed by Faculty Council. The course unit descriptions at first are approved by corresponding department (e.g. Organic chemistry by Department of organic chemistry) and then confirmed by Study Programme Committee. The heads of departments are responsible for the quality and implementation of the courses related to the profile of the department.

The implementation of the study programme is administered by the Dean's Office – the Dean, Vice Dean of Academic Affairs and the Coordinator of studies. The matters related with administration of the programme are discussed during weekly meetings at the Dean's Office.

6.3. Informational system of studies

119. A plan of study is designated for every newly enrolled student group with the University information system. Under this plan the information system generates examination rolls, sends messages to students and faculty members about the planned events related with studies (deadlines for selection of electives, examination dates, etc.). The student can log in into the system and find out what his/her plan of studies is, check the assessment grades, enroll into the elective courses. Overall, the plan should not change till the completion of the whole cycle of Bachelor studies. Correction in the programme must be made before a new admission. However, if the Study Programme Committee takes a decision to alter an ongoing programme, a reasoned request is submitted to the Directorate of Studies of Vilnius University to obtain permission to change the plan of studies.

6.4. Feedback

120. The Faculty has the Student Union, each academic group has an elected leader, representatives of the Student Union are members of the Faculty Council, the Study Programme Committee and the Appeals Commission. Once per semester Student Union representatives and Faculty administration organize a meeting where various problems are discussed.

121. At the end of the semester students are offered an e-questionnaire, in which they are asked: 1) to assess satisfaction with the studies in general; 2) to assess the content of each course and the teacher's skills. Questionnaires are prepared by VU Quality Management Centre. The results of the survey (Appendix 11) are analyzed by administration, teacher and chairmen of Programme Study Committee. Results about satisfaction with the studies in general are posted on intranet. Regulations of acquisition of feedback posted on webpage: http://www.vu.lt/site_files/SD/SK/SP_dalyviu_GR_tvarka.pdf .

6.5. Social partners

122. Social partners take part in the development of the study programme in several ways, as follows: 1) indicating the problems of the programme during the official meetings, such as conferences, seminars, the so-called science days at the enterprises; 2) discussing the content of the programme and the constitutive courses during informal meetings; 3) joining the SPC; 4) participating in Thesis Examination Committee (mostly as a chairman of a committee); 5) as a lecturers of some courses 6) accepting students to take a practice and writing assessment after practice period.

6.6. Strengths and weakness of the programme:

Strengths:

123. Design of the study programme is in hands of SPC. For implementation of study programme is responsible Deans office and Heads of departments. The responsibilities are described in the University documents.

124. Feedback from students is collected: by using the on-line surveys organized by Vilnius University after each semester (in the survey students express their opinion on studies in general and about individual

teachers); by organizing meetings of students' representatives and administration (in the middle of each semester).

125. According on-line surveys in general students are satisfied with the studies at the Faculty.

Social partners participate in management of the programme as a members of Thesis examination committee, practice supervisors, SPC members, as e lecturers of some courses, in activities of Alumni organization.