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MINISTER OF EDUCATION, SCIENCE AND SPORT OF THE REPUBLIC OF LITHUANIA

ORDER
ON APPROVAL OF THE DESCRIPTOR OF THE STUDY FIELD OF CHEMISTRY

17 November 2020 No. V-1780
Vilnius

In accordance with Paragraph 11 of Article 53 of the Law on Higher Education and Research of the Republic of Lithuania:

1. I approve the Descriptor of the Study Field of Chemistry (enclosed).

2. I determine that the higher education institutions have to adjust their study programmes to the Descriptor of the Study Field of Chemistry approved by Clause 1 hereby until 01 September 2021.

3. I recognize Order No. V-808 of the Minister of Education and Science of the Republic of Lithuania of 23 July 2015 “On Approval of the Descriptor of the Study Field of Chemistry” as invalid.

Minister of Education, Science and Sport at interim Algirdas Monkevičius

APPROVED
by Order No. V-1780 of the Minister of
Education, Science and Sport of the Republic
of Lithuania of 17 November 2020

DESCRIPTOR OF THE STUDY FIELD OF CHEMISTRY

CHAPTER I
GENERAL PROVISIONS

1. The Descriptor of the Study Field of Chemistry (hereinafter – Descriptor) regulates the special requirements for the study programmes in the study field of chemistry (C01). The Descriptor regulates the study field of chemistry in the scope not covered by the General Requirements for the Studies approved by Order No. V-1168 of the Minister of Education and Science of the Republic of Lithuania of 30 December 2016 "On approval of the General Requirements for the Studies."

2. The Descriptor was prepared in consideration of the main standards and accreditation criteria for the programmes granting the degrees of Eurobachelor and Euromaster of the European Chemistry Thematic Network Association (ECTN) (*Tuning Educational Structures in Europe: Reference Points for the Design and Delivery of Degree Programmes in Chemistry*).

3. The Descriptor's requirements shall be applied for college and university studies of the first cycle and the university studies of the second cycle in the field of chemistry conducted as full-time or part-time studies. The Descriptor provides general guidelines that help to express better the learning outcomes of the programme, yet it does not serve as a specification of detailed content of the study programme or subjects.

4. Upon completion of the studies in the field of chemistry, the bachelor's /master's degree in physical sciences that is in conformity with the sixth/seventh level of the Lithuanian Qualifications Framework and the European Qualifications Framework for lifelong learning, and first/second cycles of the Framework for Qualifications of the European Higher Education Area attested by the diploma of bachelor's/ master's degree in physical sciences and diploma supplement issued by the higher education institution.

5. Degree programmes in the field of Chemistry may be offered as combined (double-major) study programmes or interdisciplinary study programmes, delivered jointly with study fields belonging to the groups of study fields in physical sciences, mathematics, informatics, life sciences, engineering sciences, technological sciences, health sciences, and agricultural sciences.
Supplemented with a subparagraph:
Nr. V-1293, 2021-07-16, published TAR 2021-07-16, legal act code 2021-16049

6. The Descriptor does not establish any specific admission requirements for applicants to first-cycle study programmes. Admission to second-cycle study programmes shall be open to persons who:

6.1. have obtained a Bachelor's degree in a study field belonging to the groups of study fields in physical sciences, engineering sciences, technological sciences, life sciences, health sciences, veterinary sciences, or agricultural sciences, and have completed the number of credits in Chemistry study field modules (courses) prescribed by the higher education institution, or have completed supplementary studies in the Chemistry study field of the scope and content determined by the higher education institution;

6.2. have obtained a Professional Bachelor's degree in a study field belonging to the groups of study fields in physical sciences, engineering sciences, technological sciences, life sciences, health sciences, veterinary sciences, or agricultural sciences, have completed the number of credits in Chemistry study field modules (courses) prescribed by the higher education institution, and have

completed supplementary studies in the Chemistry study field of the scope and content determined by the higher education institution.

Supplemented with a subparagraph:
Nr. V-1293, 2021-07-16, published TAR 2021-07-16, legal act code 2021-16049

CHAPTER II
CONCEPT AND SCOPE OF THE STUDY FIELD

7. Chemistry is a science that is analysing systematically the structure and features of substance on the level of atoms and molecules.

8. Chemistry unites mathematics and physics with life and applied sciences.

9. Chemistry is divided into four fundamental components:

9.1. organic chemistry that analyses structure, composition, features and synthesis of carbon-containing compounds and their derivatives;

9.2. inorganic chemistry that analyses all other substances – inorganic and organometallic compounds;

9.3. physical chemistry that describes chemical expressions on the basis of the laws of modern physics and uses its terms;

9.4. analytical chemistry that identifies components of natural and synthetical substances, analyses their release and quantitative determination.

10. The studies of chemistry cover the following main branches: applied chemistry, inorganic chemistry, structural chemistry, environmental chemistry, medical chemistry, organic chemistry, physical chemistry, colloidal chemistry, analytical chemistry, polymer chemistry, pharmaceutical chemistry, and chemistry of nano-compounds. The study modules of applied character (e.g., environmental chemistry, chemistry of substances, medical chemistry) or the modules that cover several branches and analyse the relations of chemistry with other subjects (e.g., biochemistry, chemical biology, chemical physics) may be included into the study programmes.

11. The programme of practical training prepared by the higher education institution with the employer or stakeholder has to be included into the study programme of chemistry of the first cycle. It should consist of the chemical project carried out in the enterprise and specialised, project-related studies.

12. The specialists of chemistry must be ready not to restrict themselves to the knowledge acquired during the studies and to continue lifelong learning independently.

CHAPTER III
GENERAL AND SPECIAL LEARNING OUTCOMES

13. The fundamental learning outcomes aimed in the study field of chemistry are presented in this chapter. They should be applied to any study programme of this study field, yet they do not serve as a specification of detailed content of the study programme or subjects.

14. The learning outcomes of the first cycle of studies (professional bachelor):

14.1. knowledge and its application:

14.1.1. to be able to explain chemical expressions on the basis of theories and facts of main chemical areas;

14.1.2. to be able to apply theoretical fundamentals and methods of qualitative and quantitative chemical analysis for chemical researches;

14.1.3. to be able to apply knowledge about key technological processes of chemical and biotechnological industry in practice;

14.1.4. to be able to apply knowledge of mathematics, statistics, physics and information technologies to process results of chemical analysis;

14.2. research skills:

14.2.1. to be able to plan course of chemical analysis and to manage material resources;

14.2.2. to be able to carry out the research according to the properly selected method of analysis;

14.2.3. to be able to process and assess the research results statistically and to document them;

14.3. special abilities:

14.3.1. to be able to work safely with chemical substances, standard laboratory equipment and devices;

14.3.2. to be able to choose the necessary substances and means and to prepare samples for analysis;

14.3.3. to be able to solve practical chemical problems according to the acquired chemical knowledge and practical skills;

14.3.4. to be able to carry out reliably chemical qualitative and quantitative analysis;

14.4. social abilities:

14.4.1. to be able to communicate in correct Lithuanian and foreign language (orally and in writing);

14.4.2. to be able to present the research results in writing or orally to the audience of specialists and non-specialists;

14.4.3. to demonstrate social responsibility for own work results and their impact on organisation and society;

14.5. personal abilities:

14.5.1. to be able to plan and organise individual activities and studies;

14.5.2. to be able to work independently, responsibly and accurately;

14.5.3. to be able to evaluate new situations and make appropriate decisions;

14.5.4. to be able to communicate and cooperate in order to achieve common goals;

14.5.5. to be able to evaluate new situations and to make appropriate decisions.

15. The learning outcomes of the first cycle of studies (bachelor):

15.1. knowledge and its application:

15.1.1. to be able to describe chemical expressions on the basis of theories and facts of various chemical areas;

15.1.2. to be able to apply chemical knowledge to solve routine qualitative and quantitative problems;

15.1.3. to be able to collect, evaluate and interpret chemical information and data;

15.1.4. to be able to apply knowledge of mathematics, statistics, physics and information technologies for numerical description and modelling of chemical expressions;

15.2. research skills:

15.2.1. to be able to formulate purpose and tasks of the research work;

15.2.2. to be able to find and analyse scientific and informational chemical literature;

15.2.3. to be able to select suitable methodology for research work;

15.2.4. to be able to apply theoretical knowledge of various chemical areas for researches, to analyse and evaluate the research results;

15.2.5. to be able to summarise the results of chemical research and to formulate the conclusions;

15.3. special abilities:

15.3.1. to be able to use and maintain standard laboratory equipment and devices;

15.3.2. to be able to act safely in the chemical laboratory according to the requirements of occupational safety and health;

15.3.3. to be able to choose a suitable methodology for synthesis and analysis of chemical compounds and to use safety data sheets;

15.3.4. to be able to interpret the data of laboratory observations and measurements;

15.3.5. to be able to observe and measure chemical changes and to document them systematically and reliably;

15.3.6. to be able to formulate a problem of practical work, to project the course of work, and to control its performance;

15.4. social abilities:

15.4.1. to be able to convey the results of chemical experiment or research in writing or orally to the audience of specialists and non-specialists;

15.4.2. to be able to communicate in correct Lithuanian and foreign language (orally and in writing);

15.4.3. to be able to organise and ensure safe work in chemical laboratories and chemical companies;

15.5. personal abilities:

15.5.1. to be able to plan and organise individual work and studies;

15.5.2. to be able to adjust to new conditions;

15.5.3. to be able to expand competences of own professional activities;

15.5.4. to be able to work independently, responsibly and accurately.

16. The learning outcomes of the second cycle of studies (master):

16.1. knowledge and its application:

16.1.1. to demonstrate knowledge and understanding of theories, concepts, principles and facts of specialised chemistry;

16.1.2. to be able to integrate knowledge of various chemical areas into solution of newly arising problems;

16.1.3. to be able to interpret the latest achievements, theories and ideas in the science of chemistry, to assess them critically, and to apply for research work;

16.2. research skills:

16.2.1. to be able to formulate purpose and tasks of the scientific research work;

16.2.2. to be able to find, analyse, and assess critically scientific and informational chemical literature;

16.2.3. to be able to plan and conduct an experiment independently, to assess critically the procedures and results of the experiment (scientific research);

16.2.4. to be able to process, summarise and interpret the data of scientific research, to apply the computer programmes (information and communication technologies), and to formulate conclusions;

16.2.5. to be able to select methodology for research work when newly arising problems are solved;

16.2.6. to be able to assess accuracy limits of experimental data and to take them into consideration when further research is planned;

16.3. special abilities:

16.3.1. to be able to perform non-standard and/or complex laboratory procedures, to use the equipment for synthesis and analysis of substances;

16.3.2. to be able to work safely with hazardous chemical substances, taking requirements of environmental protection into consideration;

16.3.3. to be able to formulate a problem of practical work, to plan, to project the course of work, and to control its performance;

16.3.4. to be able to make innovative decisions and to evaluate social consequences;

16.4. social abilities:

16.4.1. to be able to present the results of scientific research in writing or orally to the audience of specialists and non-specialists;

16.4.2. to be able to coordinate the project activities;

16.4.3. to be able to communicate, cooperate, and motivate people in pursuit of common goals;

16.4.4. to be able to work in an interdisciplinary group;

16.5. personal abilities:

16.5.1. to be able to think creatively and to act on own initiative;

16.5.2. to be able to think systemically and analytically;

16.5.3. to be able to work in international and multicultural environment.

CHAPTER IV
TEACHING, LEARNING AND ASSESSMENT

17. The teaching, learning and assessment activities have to be organised in such a way so that the students would be able to achieve effectively the learning outcomes provided in the study programme of the field of chemistry.

18. The applied learning methods have to be defined clearly, reviewed and improved regularly, with regard to the changing needs of the labour market, the latest achievements of the science of chemistry, and requirements of modern didactics. It is recommended to search for examples of good practice of development and improvement of the study programmes in the field of chemistry in the documents of the European Chemistry Thematic Network Association (ECTN). The teaching and learning strategy have to be developed in such a way that the students would be able to obtain relevant professional knowledge, abilities and practical skills necessary for work in chemistry-related areas. The teaching content has to be updated and improved regularly. The new knowledge and teaching methods in compliance with the concept of lifelong learning and philosophy of student-oriented education have to be integrated into the study process. The formation of appropriate practical work of students in chemical laboratories has to be included into the studies.

19. The university teachers have to know and understand the didactic concept of the study programme, to apply various teaching methods, and to endeavour at optimal use of the available material resources. A choice of the set of teaching methodology depends on the form of studies (full-time or part-time), purpose of the subject's learning, and the aimed learning outcomes. The same teaching and learning methods may be applied in different cycles of studies; however, the volume and complexity of tasks must differ. Applied methods are the following: lectures, laboratory exercises, individual consultations, seminars (teaching in small groups), workshop, demonstrative exercises, professional practical training (recommended in an industrial company or in another research and higher education institution), individual or group projects, remote teaching via virtual teaching environment, field trips, case analyses, papers, search, analysis and generalization of the needed information, reading of books and articles, preparation and presentation of reports, etc.

20. In the beginning of each semester, the university teachers have to introduce thorough curriculum, goals of the subject, their relations to generic goals of the study programme, expected learning outcomes, expected learning load, assessment procedure and criteria of learning achievements (influence of the examination and interim tests on final grade, examination terms, etc.) to the students.

21. The assessment system of studies has to ensure constant feedback to the students about their learning achievements and validity of evaluation of performed works. The assessment methods have to be not only generalisable, but also formative and diagnostic.

22. The university teachers have to be familiar with various assessment methods, methodical aspects and role of their application, when the students are acquiring knowledge and skills related to qualification in the field of chemistry. The university teacher reserves the right to choose the most appropriate assessment methods, depending on the size of the group of students, goals of assessment and subject, expected learning results, and other factors. When university teachers are assessing the learning achievements, they have to follow the principles of objectivity, clarity, impartiality, mutual respect and benevolence.

23. The procedures applied to assess the students' achievements have to be based on clear pre-formulated criteria that have been presented to the students and that enable to reflect correctly and reliably the level of knowledge, abilities and practical skills achieved by the student in the course of studies. The assessment criteria show whether the student's performance quality is in compliance with the established requirements. The achieved learning results are graded according to the ten-point grading system. Various assessment methods of learning achievements may be applied: written or oral examination, final work and its defence, solution of exercises, oral and

stand-based presentations, reports on individual or team work, report of practical training, colloquiums, tests (when questions of closed and/or open type are asked), written works (review of literature, essay), etc.

24. The final work (project), its defence and assessment summarise general and special abilities that are obtained by the student and that satisfy qualification requirements for the degrees of professional bachelor, bachelor or master.

CHAPTER V
REQUIREMENTS FOR IMPLEMENTATION OF STUDY PROGRAMMES

25. General requirements for teachers of the study programmes in the field of chemistry and content of the programmes:

25.1. at least 10 percent of the subjects of the college studies in the field of chemistry have to be taught by scientists. More than a half of the teachers of the college studies must have at least 3 years of practical experience in the field of the taught subject;

25.2. at least half of the subjects of the university studies of the first cycle in the field of chemistry have to be taught by scientists;

25.3. at least 80 percent of the teachers in the master's studies must have an academic degree. Other teachers may be practicians, who have acquired the professional work experience of at least 3 years in the recent 7 years in the field, the subjects whereof are taught. At least 20 percent of the subjects in the field of chemistry have to be taught by professors;

25.4. the competence of the university teachers shall be assessed according to their experience, ability to communicate fluently in at least one foreign language used for international cooperation (English, German, French, etc.), interest and enthusiasm in development of more effective teaching methods, scientific level, recognition in professional, scientific and other societies, participation in refresher programmes, professional perception and personal interest in the students' research and independent works, etc.;

25.5. the university teachers must spare time for scientific researches, development of new technologies, learning of scientific and technological novelties, and their teaching;

25.6. each institution conducting the study programme shall decide, how to distribute the credits of particular subjects or modules; however, at least 90 credits of all the chemistry study programmes of the first cycle have to be attributed to the studies of analytical chemistry, inorganic chemistry, organic chemistry, physical chemistry, biochemistry, physics and mathematics. In addition, the studies of at least three narrower branches of chemistry have to be provided for university study programmes, and one branch – for college study programmes (for example, chemistry of polymers, chemical technologies, chemometrics);

25.7. the list of compulsory subjects or modules is not established for the study programmes of chemistry of the second cycle. With regard to the specifics of the institution conducting the study programme, these programmes may be meant to get the students prepared for practical work or PhD studies;

25.8. the study programme has to be improved and updated continuously. It has to reflect the changes in the science and field of studies. The persons in charge of the programme's implementation have to make sure that innovative and relevant topics are included into the programme, that the needs and recommendations of enterprises susceptible to chemical knowledge, and needs and recommendations of the State and society are taken into consideration. The relevance of the study programme shall be reviewed and assessed regularly by all the interested parties;

25.9. the students have to be motivated and informed properly about the particularity of future work, essence and character of their studies;

25.10. in order to introduce the students to applicability of the studied subjects and needs of labour market, practical examples and situations have to be presented in the course of studies;

25.11. with regard to practical training of students, it is recommended to enter into contracts with companies, institutions and organisations conducting chemical activities, and research

institutes that would undertake to provide work places for students or that would create a possibility to perform practical training;

25.12. the studies of all the cycles shall end in final work (project);

25.13. final work (project) of professional bachelor has to reveal the student's ability to analyse the practical work cases and it has to be based on knowledge and skills acquired in the course of studies. The final work (project) serves for the student to show his or her level of knowledge and understanding, ability to analyse the selected topic, to assess previous works in the field of studies performed by other persons, to describe own practical research work, and to formulate reasoned conclusions according to the requirements approved by the higher education institution;

25.14. the final work (project) of the university studies of the first cycle has to be based on individual applied researches, application of knowledge or it has to be prepared as a project that manifests the skills complying with the programme's goals. The final work (project) serves for the student of the first cycle to show his or her level of knowledge and understanding, ability to analyse the selected topic, to assess previous works in the field of studies performed by other persons, to carry out researches in the field of studies independently, to describe own research work, and to formulate clearly and in the reasoned way the conclusions according to the requirements approved by the university;

25.15. the final work (project) of the second cycle has to be based on individual scientific or applied researches, application of knowledge or it has to be prepared as a project that manifests the skills complying with the programme's goals. The final work (project) serves for the student of the second cycle to show his or her level of knowledge and understanding, ability to analyse the selected topic, to assess previous works in the respective field of studies performed by other persons, to carry out researches in that field independently, to describe own research work, and to formulate clearly and in the reasoned way the conclusions and recommendations according to the requirements approved by the university;

25.16. the assessment commission of the final work (project) shall be formed from competent specialists of the study field – scientists, professional practicians and representatives of probable employers. The commission's chairman cannot come from the higher education institution, which study programme is being completed.

26. General requirements for special material resources of the studies:

26.1. the lecture halls have to satisfy the requirements of hygiene and work safety;

26.2. the lecture halls must have modern audio and video equipment and demonstration tools;

26.3. the laboratories have to satisfy the requirements of hygiene and work safety and they have to be marked by the code of fire class;

26.4. the laboratory equipment and devices have to be appropriate to teach the student to apply modern methods of chemical analysis and synthesis. While performing the laboratory works, the students shall use this equipment to do the works, to learn to use the testing devices, to analyse and interpret the received experimental results. Depending on the subject's curriculum, each student must have an opportunity to use especially expensive or very large equipment (for example, nuclear magnetic resonance, electron paramagnetic resonance, mass, X-ray, electronic spectrometers, etc.) directly or with the help of operating personnel;

26.5. if different university teachers are reading theoretical lectures of the subject and supervising laboratory works, they must be familiar with the theoretical course, laboratory works and exercises taught by the colleagues;

26.6. the library and its reading room have to satisfy the hygienic and ergonomic requirements. The spaces for team (group) work and discussions of the students may be arranged;

26.7. the number of textbooks and other teaching aids of each subject available in the libraries must satisfy the students' needs, while the electronic information sources must be easily accessible to all participants of the study process;

26.8. sufficient number of work places, computers and appropriate software has to be present in the libraries' reading rooms (Internet connection, catalogues of literature, search engines, connection with databases of bigger libraries).