APPROVED BY

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Education and Science of the
Republic of Lithuania of 23 July 2015

DESCRIPTOR OF THE STUDY FIELD OF CHEMISTRY

CHAPTER 1

GENERAL PROVISIONS

1. The Descriptor of the study field of Chemistry (hereinafter referred to as the "Descriptor") shall govern the special requirements applied to the study programmes of the study field of Chemistry.

2. The Descriptor has been prepared in accordance with the Law on Higher Education and Research of the Republic of Lithuania taking into account Resolution No 535 of the Government of the Republic of Lithuania of 4 May 2010 "On the Approval of the Descriptor of the Lithuanian Qualifications Framework", Order No V-2212 of the Minister of Education and Science of the Republic of Lithuania of 21 November 2011 "On the Approval of the Descriptor of Study Cycles", Order No V-501 of the Minister of Education and Science of the Republic of Lithuania of 9 April 2010 "On the Approval of the Descriptor of General Requirements for Degree-Awarding First Cycle and Integrated Study Programmes", Order No V-826 of the Minister of Education and Science of the Republic of Lithuania of 3 June 2010 "On the Approval of the Descriptor of General Requirements for Master's Study Programmes", Order No V-2463 of the Minister of Education and Science of the Republic of Lithuania of 15 December 2011 "On the Approval of Recommendations for Developing the Descriptor of a Study Field or Study Fields", and main standards and accreditation criteria developed by European Chemistry Thematic Network (ECTN) for the two cycles qualification in chemistry, the Eurobachelor® and the Euromaster® (http://ectn-assoc.cpe.fr/chemistry-eurolabels).

3. This descriptor of chemistry study field applies to the first cycle college of higher education and university study programmes and the second cycle university study programmes. This Descriptor provides general guidelines for better definition of learning outcomes of the programme; it should be noted that this Descriptor is not a detailed specification of the contents of the study programme or course units.

4. Purpose of this Descriptor:

4.1. Provide help to higher education institutions in development, execution, and evaluation of programmes in chemistry study field;

4.2. Notify the students and the employers about attained knowledge and abilities;

4.3. Provide focus to the experts who evaluate programmes in chemistry study field.

5. The field of study of chemistry is a branch of physical science. The field of study of chemistry includes the following branches: applied chemistry, inorganic chemistry, structural chemistry, environmental chemistry, medicinal chemistry, organic chemistry, physical chemistry, analytical chemistry, and polymer chemistry.

6. The following degree is obtained upon completion of chemistry studies:

6.1. Study programme at a college of higher education: a professional bachelor qualification (academic) degree in chemistry or a professional bachelor qualification (academic) degree, a diploma certifying the attained qualification (academic) degree and a diploma supplement are issued;

6.2. First cycle university programme at a college of higher education: a bachelor qualification (academic) degree in chemistry or a bachelor qualification (academic) degree, a diploma certifying the attained qualification (academic) degree and a diploma supplement are issued;

6.3. Second cycle university programme at a college of higher education: a master qualification (academic) degree in chemistry or a master qualification (academic) degree, a diploma certifying the attained qualification (academic) degree and a diploma supplement are issued.

7. Chemistry can be a minor study programme taken with the major first cycle study programme.

8. Chemistry studies can be organised as full-time and/or part-time studies. General requirements for acceptance to these studies are the following:

8.1. Persons with minimum secondary education are accepted to first cycle chemistry study programmes on a basis of a competition according to their learning outcomes, the results of entrance examination or other criteria set by the higher education institution. The list of competitive subjects by their respective fields of study and the principles of determining the competition grade, the minimum entry grade, and other criteria is prepared by the higher education institution subject to evaluation by the student representative body; this list must be published no later than 2 years before the start of the relevant school year;

8.2. Recommended candidates for second cycle studies are persons who have minimum bachelor or professional bachelor qualification (academic) degree and meet the requirements established by the university. The learning outcomes attained during first cycle studies must ensure the ability to study chemistry master's study programmes. The readiness for the studies can be achieved in bridging studies.

9. The qualification (academic) degrees of professional bachelor or bachelor that are awarded correspond to the sixth level of the Lithuanian Qualifications Framework and the European Qualifications Framework for Lifelong Learning as well as the first cycle of the Framework for Qualifications of the European Higher Education Area; the master qualification (academic) degree corresponds to the seventh level of the Lithuanian Qualifications Framework and the European Qualifications Framework for Lifelong Learning as well as the second cycle of the Framework for Qualifications of the European Higher Education Area.

CHAPTER 2

CONCEPT AND SCOPE OF THE STUDY FIELD

10. Chemistry is the science that systematically studies the composition, properties, and behaviour of matter at the atomic and molecular level.

11. Chemistry connects mathematics and physics with life and applied sciences.

12. Chemistry has four main branches:

12.1. Organic chemistry is the study of the structure, composition, properties, and synthesis of compounds and derivatives that contain carbon;

12.2. Inorganic chemistry is the study of all remaining substances: inorganic and organometallic compounds;

12.3. Physical chemistry involves the use of conceptions of modern physics and its laws to describe chemical phenomena;

12.4. Analytical chemistry is the analysis of natural and synthetic substances with the purpose of determining and separation of their constituents. It also involves quantitative analysis.

13. The scope of chemistry studies includes all main branches of chemistry. There is an equal focus on both the studies itself and their scope. The approach to the development of teaching programmes can be thematic by including multi-branch disciplines that study the points of contact between chemistry and other disciplines (e.g. chemical biology or chemical physics) and also considers applied aspects (e.g. environmental chemistry, material chemistry, and medicinal chemistry).

14. The chemistry study programme should include a biochemistry course as well as a practical training (internship) programme developed together by the institution of higher education and the employer that would include a chemistry project to be performed at the company and specialised project-related studies.

15. Chemistry professionals should not limit themselves with the knowledge gained during their studies and be ready for life-long independent learning.

CHAPTER 3

GENERAL AND SPECIAL LEARNING OUTCOMES

16. This Chapter describes the target fundamental learning outcomes of chemistry studies applicable to any programme in this field of study; it should be noted that this is not a detailed specification of the contents of the study programme or course units.

17. First cycle (professional bachelor) learning outcomes:

17.1. Knowledge and its application:

17.1.1. Main aspects of chemistry terminology, nomenclature, conventions, and units;

17.1.2. Characteristics of main states of matter and theories describing these states;

17.1.3. Principles and application of quantum mechanics, description of the structure and properties of atomic and molecular structures;

17.1.4. Relation between atoms and molecules that make up the substance, also the relation between the properties of the whole substance;

17.1.5. The structure of elements and compounds and its main examination methods.

17.1.6. Typical properties of elements groups of the periodical table of elements and their compounds;

17.1.7. Main types and characteristics of chemical reactions;

17.1.8. Basics of chemical thermodynamics and chemical kinetics;

17.1.9. Nature and properties of inorganic and organic compounds;

17.1.10. Properties of functional groups of organic molecules;

17.1.11. Properties of aliphatic, aromatic, heterocyclic, and organometallic compounds;

17.1.12. Main methods of inorganic and organic synthesis;

17.1.13. Methods and theoretical foundation of qualitative and quantitative chemical analysis;

17.1.14. Natural and synthetic macromolecular compounds and their properties;

17.1.15. Essential biochemical processes, the structure and chemical properties of biomolecules;

17.1.16. Knowledge about key technological processes applied in chemical industry;

17.1.17. Knowledge about electrochemical processes: corrosion of metals and accumulation of energy;

17.1.18. Application of basic mathematics and physics for solution of problems in chemistry.

17.2. Practical skills:

17.2.1. Ability to formulate the goal and objectives of investigation;

17.2.2. Ability to find and analyse scientific and informational literature in the field of Chemistry;

17.2.3. Ability to prepare the methodology of an investigation;

17.2.4. Ability to apply theoretical knowledge in various fields of chemistry in investigation, the analysis and assessment of results;

17.2.5. Ability to generalise the results and formulate conclusions of chemical investigation;

17.2.6. Ability to perform a technological experiment in production environment and assess the experimental data.

17.3. Special abilities:

17.3.1. Ability to use and maintain the standard laboratory equipment and devices;

17.3.2. Ability to follow work safety requirements to ensure safe behaviour in the chemistry laboratory;

17.3.3. Ability to handle chemical substances in a safe manner;

17.3.4. Ability to solve practical chemistry problem by applying chemistry knowledge and practical skills;

17.3.5. Ability to select a proper methodology for synthesis or analysis of chemical compounds;

17.3.6. Ability to interpret data obtained from laboratory observations and measurements;

17.3.7. Ability to monitor and measure chemical properties of quantitative and qualitative nature, chemical variations, also ability to document them in a systematic and reliable manner;

17.3.8. Ability to formulate problems of practical activities, plan and design the progress of the activity, and control its performance;

17.3.9. Ability to assess quality and safety of raw materials, semi products, and finished products;

17.3.10. Ability to plan the technology process;

17.3.11. Ability to manage and control the available material resources;

17.3.12. Understanding of technology standards of product manufacture and the procedures of development and evaluation of such standards.

17.4. Social abilities:

17.4.1. Ability to present the results of a chemical experiment or research both orally and through the written word for specialist and non-specialist audience;

17.4.2. Ability to co-ordinate project activities;

17.4.3. Ability to communicate both orally and through the written word in proper Lithuanian and foreign languages;

17.4.4. Ability to interact and collaborate with the others and motivate them in order to reach common goals;

17.4.5. Ability to organise and assure a safe work in the chemistry laboratory and at the chemistry companies;

17.4.6. Ability to work in an interdisciplinary team.

17.5. Personal abilities:

17.5.1. Ability to plan and organise independent work and learning;

17.5.2. Ability to act upon and adapt to new conditions;

17.5.3. Ability to broaden one's professional abilities;

17.5.4. Ability to work independently, responsibly and thoroughly;

17.5.5. Ability to feel moral responsibility for the outcome of one's work and its effect on the collective and the society.

18. First cycle (bachelor) learning outcomes:

18.1. Knowledge and its application:

18.1.1. Main aspects of chemistry terminology, nomenclature, conventions, and units;

18.1.2. Characteristics of main states of matter and theories describing these states;

18.1.3. Principles and application of quantum mechanics, description of the structure and properties of atomic and molecular structures;

18.1.4. Relation between the properties atoms and molecules that make up the substance and the properties of the whole substance.

18.1.5. The structure of elements and compounds and its main examination methods;

18.1.6. Typical properties of elements groups of the periodical table of elements and their compounds;

18.1.7. Main types and characteristics of chemical reactions;

18.1.8. The laws of thermodynamics and their application in chemistry;

18.1.9. Basics of chemical kinetics;

18.1.10. Nature and properties of inorganic and organic compounds;

18.1.11. Properties of functional groups of organic molecules;

18.1.12. Properties of aliphatic, aromatic, heterocyclic, and organometallic compounds;

18.1.13. Main methods of inorganic and organic synthesis;

18.1.14. Methods and theoretical foundation of qualitative and quantitative chemical analysis;

18.1.15. Natural and synthetic macromolecular compounds and their properties;

18.1.16. Essential biochemical processes, the structure and chemical properties of biomolecules.

18.1.17. Knowledge about key technological processes applied in chemical industry;

18.1.18. Knowledge about electrochemical processes: corrosion of metals and accumulation of energy.

18.1.19. Application of basic mathematics and physics for solution of problems in chemistry.

18.2. Practical skills:

18.2.1. Ability to formulate the goal and objectives of investigation;

18.2.2. Ability to find and analyse scientific and informational literature in the field of Chemistry;

18.2.3. Ability to prepare the methodology of investigation;

18.2.4. Ability to apply theoretical knowledge in various fields of chemistry in investigation, the analysis and assessment of results;

18.2.5. Ability to generalise the results and formulate conclusions of a chemical investigation.

18.3. Special abilities:

18.3.1. Ability to use and maintain the standard laboratory equipment and devices;

18.3.2. Ability to follow work safety requirements to ensure safe behaviour in the chemistry laboratory;

18.3.3. Ability to handle chemical substances in a safe manner;

18.3.4. Ability to solve practical chemistry problem by applying chemistry knowledge and practical skills;

18.3.5. Ability to select a proper methodology for synthesis or analysis of chemical compounds;

18.3.6. Ability to interpret data obtained from laboratory observations and measurements;

18.3.7. Ability to monitor and measure chemical properties of quantitative and qualitative nature, chemical variations, also ability to document them in a systematic and reliable manner;

18.3.8. Ability to formulate problems of practical activities, plan and design the progress of the activity, and control its performance;

18.3.9. Ability to make innovative decisions and evaluate social consequences.

18.4. Social abilities:

18.4.1. Ability to present the results of a chemical experiment or research both orally and through the written word for specialist and non-specialist audience;

18.4.2. Ability to co-ordinate project activities;

18.4.3. Ability to communicate both orally and through the written word in proper Lithuanian and foreign languages;

18.4.4. Ability to interact and collaborate with the others and motivate them in order to reach common goals;

18.4.5. Ability to organise and assure a safe work in the chemistry laboratory and at the chemistry companies;

18.4.6. Ability to work in an interdisciplinary team.

18.5. Personal abilities:

18.5.1. Ability to plan and organise independent work and learning;

18.5.2. Ability to act upon and adapt to new conditions;

18.5.3. Ability to broaden one's professional abilities;

18.5.4. Ability to work independently, responsibly and thoroughly;

18.5.5. Ability to feel moral responsibility for the outcome of one's work and its effect on the collective and the society.

19. Second cycle (master) learning outcomes:

19.1. Knowledge and its application:

19.1.1. Knowledge and understanding of theories, concepts, principles, and facts from specialised fields of chemistry;

19.1.2. Ability to integrate knowledge from various fields of chemistry to solve unknown problems;

19.1.3. Understanding of the newest achievements in the science of chemistry, its theories, ideas, and principles, their critical assessment and application in research.

19.2. Ability to perform research:

19.2.1. Ability to formulate the goal and objectives of scientific research work;

19.2.2. Ability to find, analyse and critically assess scientific and informational literature in the field of Chemistry;

19.2.3. Ability to critically assess theoretical chemistry knowledge and research methods;

19.2.4. Ability to independently plan and perform experiments and critically assess the procedures and outcomes of the experiment/scientific research;

19.2.5. Ability to process and interpret scientific research data with computer software (information and communication technologies);

19.2.6. Ability to prepare the methodology of a research work to solve unknown problems.

19.2.7. Ability to generalise the results and formulate conclusions of a chemistry research;

19.2.8. Ability to understand the precision limits of experimental data and take it into account in planning of further research.

19.3. Special abilities:

19.3.1. Ability to perform non-standard (complex) laboratory procedures and use the equipment for synthesis and analysis of substances;

19.3.2. Ability to follow work safety requirements to ensure safe behaviour in the chemistry laboratory;

19.3.3. Ability to handle chemical substances in a safe manner;

19.3.4. Ability to solve practical chemistry problem by applying chemistry knowledge and practical skills;

19.3.5. Ability to select a proper methodology for synthesis or analysis of chemical compounds;

19.3.6. Ability to interpret data obtained from laboratory observations and measurements;

19.3.7. Ability to monitor and measure chemical properties of quantitative and qualitative nature, chemical variations, also ability to document them in a systematic and reliable manner;

19.3.8. Ability to formulate problems of practical activities, plan and design the progress of the activity, and control its performance;

19.3.9. Ability to make innovative decisions and evaluate social consequences.

19.4. Social abilities:

19.4.1. Ability to present the results of a scientific research both orally and through the written word for specialist and non-specialist audience;

19.4.2. Ability to co-ordinate project activities;

19.4.3. Ability to communicate both orally and through the written word in proper Lithuanian and foreign languages;

19.4.4. Ability to organise and assure a safe work in the chemistry laboratory and at the chemistry companies;

19.4.5. Ability to interact and collaborate with the others and motivate them in order to reach common goals;

19.4.6. Ability to work in an interdisciplinary team.

19.5. Personal abilities:

19.5.1. Ability to plan and organise independent work and learning;

19.5.2. Ability to act upon and adapt to new conditions;

19.5.3. Ability to broaden one's professional abilities;

19.5.4. Ability to work independently, responsibly and thoroughly;

19.5.5. Ability to feel moral responsibility for the outcome of one's work and its effect on the collective and the society;

19.5.6. Ability for creative thinking and ability to take initiative;

19.5.7. Ability for systematic and analytic thinking;

19.5.8. Ability to work in an international environment.

CHAPTER 4

TEACHING, LEARNING AND ASSESSMENT

20. The organisation of teaching, studying, and assessment activities must enable the students to efficiently achieve the learning outcomes defined in the chemistry study programme.

21. The teaching and studying methods that will be applied should be clearly defined and regularly revised and improved in line with the changes in labour market requirements, the newest achievements of the chemistry science, and the requirements of modern didactics. The recommended place to search for good practice examples of chemistry study programme development and improvement is the documents by European Chemistry Thematic Network (ECTN) (ectn-assoc.cpe.fr/network/index.htm). The teaching and studying strategy should be developed in the way enabling the students to gain relevant subject knowledge, abilities, and practical skills necessary for work in chemistry-related fields. The teaching content should be continuously updated and improved by integrating into the study process new knowledge and teaching methods aligned with the concept of life-long learning. The studies must include proper development of student skills of practical work in a chemistry laboratory.

22. The teachers must know and understand the didactic concept of their study programme, apply various teaching methods and strive for optimal use of available material resources. The choice of the teaching methodology set depends on the mode of studies (full-time or part-time) and the teacher's opinion regarding specific studying purposes and abilities to be developed within an individual subject. Same teaching and studying methods with different scope and complexity of tasks can be applied in different cycles of study:

22.1. Lectures

22.2. Laboratory activities

22.3. Individual counselling

22.4. Seminars (teaching in small groups)

22.5. Practice classes

22.6. Demonstration activities

22.7. Vocational practical training (recommended location is an industry company or another research and higher education institution)

22.8. Individual or team projects

22.9. Teaching via the Internet with a virtual teaching environment

22.10. Field trips

22.11. Case studies

22.12. Writing of summaries and essays

22.13. Search for and summarising of required information, reading of books and articles

22.14. Preparation of oral presentations

23. At the beginning of each semester the teachers must introduce the students to the detailed programme of the study subject, its purposes and their relationship with the general purposes of the study programme, expected learning outcomes, estimated learning load, the procedure for and criteria of assessment of learning achievements (the impact of the exam and intermediate examinations to the final grade, terms of examinations, etc.).

24. The study assessment system must provide a continuous feedback to the students about their studying achievements and the validity of assessment of their work. The assessment methods should not be limited to just summative assessment but also include formative and diagnostic assessment. Summative assessment allows measuring student achievements upon completing the subject, semester, course, or study programme. Formative and diagnostic assessment allows continuous monitoring of transition towards the target outcome and identifying difficulties, encourages the analysis of achievements and collaboration with the teachers in the process of making decisions regarding methods of assessment of learning outcomes, amount and scope of tasks, and assessment criteria.

25. The teachers should be knowledgeable about different methods of assessment, methodology aspects of their application, and their role as the students gain knowledge and skills related to the qualification to be reached in the field of chemistry. The teacher has the right to choose methods of assessment that are most suitable according to the size of the student group, the purposes of assessment and education in the subject being taught, expected learning outcomes, and other factors. In their assessment of studying achievements the teachers should follow the principles of objectivity, clarity, impartiality, mutual respects, and goodwill.

26. The procedures used for the assessment of studying achievements must be based on clearly defined criteria enabling correct and reliable reflection of the level of knowledge, abilities, and practical skills achieved by the student during the period of studies. The assessment criteria show if the quality of the student's performance comply with the set requirements. Learning outcomes are assessed using a ten-grade criterion-referenced grading system. Different methods of assessment of studying achievements can be used:

26.1. Written or oral examination;

26.2. Thesis and its defence;

26.3. Laboratory reports and defence;

26.4. Problem-solving exercises;

26.5. Oral presentations and displays of posters;

26.6. Individual or team project report;

26.7. Practical training report;

26.8. Colloquium.

26.9. Test papers with closed and/or open questions;

26.10. Written papers (literature reviews, essays, etc.).

27. The final thesis (project), its defence and evaluation summarises general and special abilities attained by the student against professional bachelor, bachelor, or master qualification requirements.

CHAPTER 5

REQUIREMENTS FOR THE IMPLEMENTATION OF STUDY PROGRAMMES

28. General requirements to the teachers teaching chemistry study programmes and the content of such programmes:

28.1. At least 10 per cent of course units in chemistry study programmes taught at colleges of higher educations must be taught by scientists. More than half of teachers in the study programme must have at least 3 years of hands-on experience in the relevant subject area;

28.2. At least half of course units in first cycle chemistry study programmes taught at universities must be taught by scientists;

28.3. At least 80 per cent of all course units in second cycle chemistry study programmes (or at least 60 per cent if the study programme focuses on practical training) must be taught by scientists at least 60 per cent of whom (or at least 40 per cent if the study programme focuses on practical training) must be engaged in scientific activity that matches the course units they teach. If the study programme focuses on practical training then to 40 per cent of teachers teaching the course units can be practitioners who have in the last 7 years accumulated at least 3-year professional experience that matches the applied course units taught by them. The professional experience specified in this paragraph is mandatory to the teachers of applied course units marked in the programme description. At least 20 per cent of course units in chemistry study field must be taught by teachers in professorial positions;

28.4. The foundation of any study programme is competent and qualified teachers. The ability of the teachers is assessed by their experience; the ability to communicate freely in at least one foreign language used in international collaboration (English, German, or French); their interest in and enthusiasm towards designing more efficient teaching methods; scientific level; recognition in professional, scientific, and other communities; involvement in qualification improvement programmes; professional insight; personal interest in scientific and independent activities by the students;

28.5. The contact teaching workload of a teacher should make up no more than 25 per cent of his/her overall workload. The teacher should have time for scientific research activities, development of new technologies, study of scientific and technology innovations and teach them;

28.6. The teacher must be able to properly advice the students regarding their study plans and career opportunities, encourage students' academic mobility;

28.7. The teacher must know and understand the criteria for study programme accreditation;

28.8. Each institution executing the study programme makes its own decision regarding the allocation of credits for specific course units or modules, however all first cycle chemistry study programmes must have at least 90 credits allocated for the studies of analytic chemistry, inorganic chemistry, organic chemistry, physical chemistry, biochemistry, physics, and mathematics. Study chemistry programmes taught at universities must also include the studies of at least three and those taught at colleges of higher education must include the studies of at least one more specific branch of chemistry (e.g. polymer chemistry, chemical technology, chemometrics, etc.);

28.9. There is no list of compulsory course units or modules for second cycle chemistry study programmes. These programmes can be focused on practical activities or preparation for PhD studies according to the specifics of the institution executing the study programme;

28.10. The study programme must be continuously improved and updated. It should reflect the changes in science and the field of study. The executors of the programme should ensure inclusion of newly emerging topics to expose the students to the innovations while they are still studying to encourage insight into and anticipation of the perspectives for development of their study field. Upon completion of the programme the students should be capable of further development of their special abilities related to the chemistry field of study;

28.11. The students must be properly motivated and informed about the essence and the nature of their studies in the context of their future occupation;

28.12. During the studies practical examples and situations should be presented to the students to familiarise them with the application opportunities of their course units, interest of labour market in them, and the opportunities for satisfaction of their needs;

28.13. It is recommended to conclude agreements with companies, institutions, organisations, or research institutes engaged in chemistry activities so that they will hire the students or accept them for practical training;

28.14. Studies of all cycles must be finished with the final thesis (project);

28.15. The final thesis (project) by a professional bachelor must demonstrate the student's ability to analyse work practice cases. The final thesis (project) must be based on knowledge and abilities attained during the studies and demonstrate the abilities corresponding to the purpose of the programme. The final thesis (project) should show the level of the student knowledge and understanding, his/her ability to analyse the selected topics, assess previous works in this study field (or branch), describe his/her own practical research activities, formulate clear and substantiated conclusions in compliance with the requirements approved by the institution of higher education;

28.16. The final thesis (project) of the first cycle university study must be based on autonomous applied research, application of knowledge, or be a project demonstrating the abilities corresponding to the purpose of the programme. In his/her final thesis (project) the bachelor should demonstrated the level of his/her s knowledge and understanding, the ability to analyse the selected topics, assess previous works in this study field (or branch), autonomously perform research in the study field (or branch), describe his/her own research activities, formulate clear and substantiated conclusions and recommendations in compliance with the requirements approved by the university;

28.17. The final thesis (project) of the second cycle studies must be based on autonomous scientific or applied research, application of knowledge, or be a project demonstrating the abilities corresponding to the purpose of the programme. In his/her final thesis (project) the master should demonstrated the level of his/her s knowledge and understanding, the ability to analyse the selected topics, assess previous works in the relevant study field (or branch), autonomously perform research in this study field (or branch), describe his/her own research activities, formulate clear and substantiated conclusions in compliance with the requirements approved by the university;

28.18. The final thesis (project) evaluation commission must be formed from competent specialists in the study field: scientists, professional practitioners, representatives of potential employers. The chairman of the commission must not be from the same higher education institution the study programme of which is being completed.

29. General requirements for material basis of studies:

29.1. The classrooms must comply with hygiene and occupational safety requirements;

29.2. The classrooms must have modern audio and video equipment and presentation tools;

29.3. The laboratories must comply with hygiene and occupational safety requirements and be marked with fire hazard class code;

29.4. The level of laboratory equipment and apparatus must be sufficient to allow the students to learn the application of modern methods of chemical analysis and synthesis. In the course of laboratory practice each student must use this equipment to perform his/her tasks and learn to use research devices, analyse and interpret the experimental results. It is not necessary for each laboratory to have highly expensive and large-size equipment such as nuclear magnetic resonance, electron paramagnetic resonance, mass, X-ray, or electronic spectrometers or similar equipment, but each student must have the opportunity to use such equipment, directly or with the help of service staff, as needed in the programme of the course unit;

29.5. If different teachers give theoretical lectures and supervise laboratory activities each teacher should be aware of the theoretical course or laboratory activities or exercises given by his/her colleague;

29.6. The reading room at the library must comply with the hygiene requirements, have a good sound insulation, comfortable chairs and tables. It may also have a discussion room, e.g. round table or similar;

29.7. The number of copies of textbooks or lecture synopses available in the library must correspond with the needs of the students; the electronic sources of information must be made freely available to all participants in the study process;

29.8. There must be a sufficient number of computers and proper software (the Internet connection, catalogues of publications, search systems, connection to the databases of larger libraries) available.

CHAPTER 6

DESCRIPTOR OF LEVELS OF ACHIEVED LEARNING OUTCOMES

30. The learning outcomes attained by the students are classified in to three achievement levels: excellent, typical, and threshold.

30.1. Excellent achievement level:

30.1.1. Demonstration of profound understanding of concepts included in the study programme, the use of amount of information much larger than given during the studies;

30.1.2. Quick, fluent, and precise performance of routine calculations, explanations, interpretations, and analyses. Fast adaptation of know-how and practical skills to new situation to solve new problems. Critical approach to the problems and their solutions. Fast and assured gathering of new knowledge;

30.1.3. Demonstration of excellent experimental skills according to the study programme, exhaustive analysis and assessment of experimental results;

30.1.4. Demonstration of excellent general abilities.

30.2. Typical achievement level:

30.2.1. Demonstration of good understanding of concepts included in the study programme, the use of information given during the studies;

30.2.2. Precise performance of routine calculations according to a known algorithm, explanations, interpretations, and analyses. Easy and assured gathering of new knowledge;

30.2.3. Demonstration of abilities to perform experiments in a precise and reliable manner;

30.2.4. Demonstration of good general abilities;

30.2.5. After the graduate gets occupational experience he/she becomes a good practitioner capable of demonstrating good expert knowledge. The career perspectives also include research, development of innovations, and control of technologies; significant managerial responsibilities and further career as a higher-level executive can be expected.

30.3. Threshold achievement level:

30.3.1. Demonstration of basic understanding of concepts included in the study programme and application of knowledge;

30.3.2. Essentially correct performance of routine calculations according to a known algorithm, explanations, interpretations, and analyses;

30.3.3. The student performs standard experimental tasks correctly but might not be able to establish the significance of all results from the first try, might need help in explanation and analysis of the results;

30.3.4. Demonstration of basic general abilities;

30.3.5. The graduate at this level will be suitable for the technical or general control (assistant) position. After attaining necessary occupational experience such a graduate may become a good practitioner in a specific field where knowledge and substance know-how is critical but regular application of fundamental knowledge is not required.

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