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

ORDER
ON APPROVAL OF THE DESCRIPTOR OF THE GROUP OF STUDY FIELDS OF MATHEMATICAL SCIENCES

18 November 2020 No. V-1787
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 Group of Study Fields of Mathematical Sciences (enclosed).

2. I determine that the higher education institutions have to adjust their study programmes to the Descriptor of the Group of Study Fields of Mathematical Sciences approved by Clause 1 hereby until 01 October 2021.

3. I recognize Order No. V-813 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 Mathematics” as invalid.

Minister of Education, Science and Sport at interim Algirdas Monkevičius

APPROVED
by Order No. V-1787 of the Minister of Education, Science and Sport of the Republic of Lithuania of 18 November 2020

DESCRIPTOR OF THE GROUP OF STUDY FIELDS OF MATHEMATICAL SCIENCES

CHAPTER I
GENERAL PROVISIONS

1. The Descriptor of the Group of Study Fields of Mathematical Sciences (hereinafter – Descriptor) regulates the special requirements for the study programmes in the study fields of mathematics (A01), applied mathematics (A02) and statistics (A03) that belong to the group of study fields of mathematical sciences (A). The Descriptor regulates the studies in the listed fields 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 shall be applied for university studies of the first and second cycles, regardless of the form of studies.

3. Upon completion of the studies of mathematics/ applied mathematics/ statistics, the bachelor's /master's degree in mathematical sciences that is in conformity with the sixth/seventh level of the Lithuanian Qualifications Framework and the European Qualifications Framework for lifelong learning, attested by the diploma of bachelor's/ master's degree and diploma supplement are awarded.

4. The studies of mathematics/ applied mathematics/ statistics may be conducted at universities only. They may be organised as full-time and/or part-time studies.

5. There are no special requirements established in the Descriptor for the persons, who want to be admitted to the study programmes of the first cycle.

6. The persons, who have completed the university studies of the first cycle in the relevant field or have completed the university studies of the first cycle in other fields and who have been prepared for the studies of the second cycle, may be admitted to the studies of the second cycle of mathematics/ applied mathematics/ statistics. The preparation for studies may be acquired through the bridging courses or professional activities in the procedure established by higher education institution.

7. The study programmes of all cycles in the fields of mathematics/ applied mathematics/ statistics have to develop:

7.1. mathematical competencies – abilities to understand, assess and use mathematics everywhere where it plays or may play certain role;

7.2. abstract logical thinking, wide erudition;

7.3. need to take interest in mathematics and need to promote mathematical literacy;

7.4. ability to preserve and raise professional competence through lifelong learning.

CHAPTER II
CONCEPTION AND SCOPE OF THE STUDIES OF MATHEMATICAL SCIENCES

FIRST SECTION
GENERAL RULES

8. The study programmes of the group of study fields of mathematical sciences (hereinafter – group of fields of mathematical sciences) may have elements of all three fields or they may be focused on one of them. The differences in the study programmes depend on the choice of particular fields, depth and extent of the studied mathematical subjects.

9. The study programmes may have specialisations intended to:

9.1. deepen specific knowledge and skills in the group of fields of mathematical sciences or in one of the fields (for example, numerical analysis, stochastic analysis, operations research, optimisation theory, geometry, number theory, topology, discrete mathematics, other specialisations);

9.2. to acquire and develop interfield (interdisciplinary) competencies (for example, finances and insurance, engineering mathematics, data analysis, econometry, biometrics, mathematical biology, mathematical economics, logistics, mathematical modelling of information, manufacturing or business systems, and other specialisations).

10. The variety of specialisations in the programme depends on the lecturers' scientific interests and directions of science research developed at university.

11. Mathematics serves as a foundation not only for natural and technological sciences, but also for the areas of intellectual activities, where abstract thinking and model formation are needed. The mathematical skills help to understand better philosophy and psychology, while the abstractiveness of its objects trains the human imagination and perception of harmony.

SECOND SECTION
STUDY FIELD OF MATHEMATICS

12. Mathematics is a science about numbers, structures, spaces, forms, limits and other abstract concepts intended to know the surrounding world.

13. The mathematics research is a search for new mathematical knowledge – investigation of new mathematical structures and establishment of new links between the mathematical objects.

14. The mathematical studies are learning of mathematical activities and assimilation of its outcomes. The mathematical activity is understood as cognition of the most common regularities and investigation of the abstract concepts used to understand the real world. Its outcomes are mathematical concepts and their research methods (axioms, definitions, proofs, etc.).

15. The study programmes in the field of mathematics have to be focused on such selected fundamental research areas of mathematics as algebra, functional analysis, combinatorics, number theory, dynamic systems, optimisation theory, stochastic analysis, topology, etc.

16. It is recommended to teach main mathematical courses in the first year of studies: mathematical analysis (theory of functions of one or several variables), linear algebra and geometry.

17. The basic knowledge of various mathematical areas are given while teaching such subjects as algebraic structures, theory of algorithms and mathematical logic, differential and analytical geometry, differential and integral equations, theory of functions of complex variable and harmonic analysis, history of mathematics and philosophy of mathematics, numerical methods, calculus of variations and mathematical modelling, theory of probability and mathematical statistics, topology, measure theory, functional analysis, etc.

18. The special courses of study programmes may be formed from the selected mathematical research areas, including combinatorics, number theory, algebra, algebraic geometry, measure and integral theory, theory of functions of real and complex variable, theory of differential equations, functional analysis, integral equations, dynamic systems, optimisation theory, geometry, differential geometry, topology, theory of probability and stochastic analysis, statistics, numerical methods, etc.

THIRD SECTION
STUDY FIELD OF APPLIED MATHEMATICS

19. Applied mathematics is a part of the science of mathematics that covers those its sections which mathematical knowledge is widely applied to solve real problems. It develops the mathematical methods and models intended to solve the problems of functioning, development and management of human activities and complex systems. The research of applied mathematics include such areas of mathematics as numerical analysis, operations research, system theory, differential equations, discrete mathematics and algorithm theory, dynamic systems, financial and insurance mathematics, mathematical aspects of life, natural and social sciences, mathematical aspects of modern information technologies, etc.

20. The studies in the study field of applied mathematics cover learning of the mathematical methods and models and their application in selected areas. They may be used for deeper and/or wider mathematical studies (for example, numerical analysis, optimisation, operations research, data science, system theory, information security, etc.) or for studies of their application (energy industry, information systems, life and natural sciences, engineering and technologies, medicine, biology, genetics, environmental protection, sociology, climatology, finances, insurance, etc.).

21. The differences in the study programmes of applied mathematics depend on the application areas, to which the study programme is oriented.

22. The basic subjects of the programme have to include mathematical analysis, linear algebra, theory of probabilityand mathematical modelling. Other basic mathematical subjects are selected depending on the purpose of the programme.

23. It is recommended to study the subjects of algorithm formation, programming and other computer science subjects that are needed to learn the principles of operation and use of the mathematical software, to stress the abilities to create and implement the mathematical models, to research especially complex systems and processes.

24. It is recommended to study the subjects of the chosen mathematical areas intended to acquire interdisciplinary knowledge and skills in the study programmes of the first cycle in the field of applied mathematics.

FOURTH SECTION
STUDY FIELD OF STATISTICS

25. Statistics examines quantitative aspects of natural phenomena and society and qualitative content of these phenomena. The statistical practice covers data collection, aggregation and interpretation, planning of statistical experiments with the features of uncertainty and variability, statistical research and generalisation of their results.

26. The object of the statistical studies is theory and practice of data collection, processing and visualisation, and analysis and interpretation of results.

27. The studied subjects have to include mathematical analysis, linear algebra, theory of probability, statistics (mathematical statistics, applied statistics and statistical methods). The subjects may include mathematical modelling, data visualisation, random processes, multidimensional statistical analysis, experiment planning, sample theory, statistical modelling, etc.

28. The subjects of the chosen specialisation in statistics have to be reflected clearly in the study programmes (for example, planning of statistical experiment for specialisation of applied statistics, measure theory for specialisation of mathematical statistics).

29. The fundamentals of informatics are acquired in the course of studies. The focus is on abilities to create and manage databases, to programme in the programming language suitable for statistics, and to work with specialised statistical or mathematical software.

30. The study programmes of the first cycle in the field of statistics must also include subjects from at least one of such other fields as public policy, economics, psychology, sociology,

agriculture, engineering, medicine, genetics and other subjects devoted to obtain interdisciplinary knowledge and abilities.

FIFTH SECTION
CAREER OPPORTUNITIES OF THE GRADUATES OF MATHEMATICAL SCIENCES

31. The career opportunities of the graduates are formed by the studied mathematical fields / specialisation, achieved level of academic outcomes, and personal interests, to which mathematical skills are fitted.

32. Some popular careers include engineering, banking, insurance, scientific research (mathematical and interdisciplinary); operations research; statistical researches; general business and management areas; information technologies; career in public sector; career teacher of school of mathematics or instructor of mathematics in high education institution, etc.

33. The graduates may obtain in the following positions: mathematician, analyst, consulting analyst, process manager, business analyst, data analyst, data scientist, statistician, information analyst, financial analyst, insurance analyst, actuary, operation analyst, operation scientist, mathematical modelling jobs, artificial intellingence specialist, quality analyst, qualitative research analyst, risk assessment analyst, investment analyst, modelling engineer, supply chain analyst, instructor in higher education institution teacher of , school mathematics, etc.

SIXTH SECTION
MATHEMATICAL STUDIES IN OTHER STUDY FIELDS

34. Separate modules (subjects) of mathematics, applied mathematics and statistics included in the study programmes of other study fields have:

34.1. to train the abilities to understand, assess and use mathematics within such context of the study field, where it plays or may play certain role;

34.2. to provide knowledge and to train the abilities necessary to apply mathematical models for solution of the problems in the study field;

34.3. to provide knowledge and to train the abilities necessary for work in the areas of the studies field related to statistics.

35. It is important in the subjects (modules) of mathematics to teach the fundamentals of function theory, algebra and geometry.

36. Various methods of mathematical modelling linked to the studied field are taught in the subjects (modules) of applied mathematics.

37. It is important to teach theoretical fundamentals of statistics – theory of probability and mathematical statistics – in the subjects (modules) of statistics.

CHAPTER III
GENERAL AND SPECIAL LEARNING OUTCOMES

38. The fundamental learning outcomes of the study fields of mathematics, applied mathematics and statistics are presented in this chapter; however, they do not serve as a specification of exhaustive content of the study programme or subjects. The learning outcomes are transformed in to learning outcomes of particular study programmes, forming the content and process of studies.

39. The following social and personal abilities constitute general learning outcomes of the studies of the first and second cycles of mathematics, applied mathematics and statistics:

39.1. the abilities attributed to the first cycle of studies:

39.1.1. to present the problems, tasks and solutions in the studied field in writing or orally to the audience of specialists and non-specialists;

39.1.2. to assess critically own and others' performance results;

39.1.3. to act in compliance with academic and professional ethics;

39.1.4. to plan and organise with independent work and learning, understanding the importance of lifelog learning;

39.1.5. to analyse the self-study literature in the respective study field;

39.1.6. to assess critically own profession, knowledge and values;

39.2. the abilities attributed to the second cycle of studies:

39.2.1.to communicate professionally on the topics of mathematics and its application with the specialists of own or other fields, and to present the results of own work;

39.2.2. to act in compliance with academic and professional ethics;

39.2.3. to plan and organise activities, to evaluate possible alternatives, and to make independent decisions;

39.2.4. to analyse the latest scientific information;

39.2.5. to reflect own professional growth, with understanding the importance of lifelog learning;

39.2.6. to work in interdisciplinary teams, to generate ideas, to integrate the knowledge and skills at hand;

39.2.7. to take critically the impact of own activities and their results on society and environment, and to assume moral responsibility for work results.

40. Special learning outcomes of the studies of the first and second cycles of mathematics, applied mathematics and statistics consist of special abilities, knowledge and ability to apply them, as well as ability to carry out research.

41. Upon completion of the studies of the first cycle in the field of mathematics, the following shall be achieved together with other special learning outcomes:

41.1. special abilities:

41.1.1. to understand mathematical proofs;

41.1.2. to model mathematically phenomena, processes and situations;

41.1.3. to communicate in the language of mathematics;

41.2. knowledge and its application:

41.2.1. to have knowledge of main mathematical fields and to be able to use it to solve the mathematical problems;

41.2.2. to understand main mathematical concepts, principles, theories and results;

41.2.3. to have knowledge in the selected branch of mathematics and to be able to apply it for solution of practical and/or theoretical problems;

41.3. research skills:

41.3.1. to analyse mathematical literature, to collect data from the specified sources, to process and analyse the obtained information;

41.3.2. to analyse structure and features of the mathematical models and to assess possibilities of their application;

41.3.3. to identify, formulate, specify and solve theoretical and practical mathematical problems of different types.

42. Upon completion of the studies of the second cycle in the field of mathematics, the following shall be achieved together with other learning outcomes:

42.1. special abilities:

42.1.1. to abstract information of various areas and to describe it in the language of mathematics;

42.1.2. to transform heuristic arguments to mathematical proofs;

42.1.3. to examine, understand and master new mathematical methods;

42.2. knowledge and its application:

42.2.1. to have deeper and/or wider mathematical knowledge and to be able to apply it in new non-standard settings;

42.2.2. to have knowledge about modern scientific research methods and to be able to apply it;

42.2.3. to have the latest knowledge about results and tendencies in the selected branch of mathematics and to be able to apply it for solution of problems;

42.3. research skills:

42.3.1. to find, select and understand the scientific mathematical literature and to apply the scientific research knowledge for solution of practical problems;

42.3.2. to create mathematical models of the real world;

42.3.3. to initiate, prepare, implement and present the research problems, to interpret the received results, to formulate and substantiate the conclusions, to assess the prepared reports and documents.

43. Upon completion of the studies of the first cycle in the field of applied mathematics, the following shall be achieved together with other special learning outcomes:

43.1. special abilities:

43.1.1. to formulate the problems of applied branches of mathematics' application in the language of mathematics and to select the known mathematical methods to solve them;

43.1.2. to think mathematically, to communicate in the language of mathematics;

43.1.3. to create mathematical models to solve real problems and to interpret their results;

43.1.4. to create algorithms and programmes, to use mathematical software to implement and research the mathematical models;

43.2. knowledge and its application:

43.2.1. to have knowledge of main mathematical fields and to be able to use it to solve the mathematical problems;

43.2.2. to have knowledge about principles of mathematical modelling and to be able to use it to model real phenomena, processes and situations;

43.2.3. to have knowledge of algorithm formation, programming and mathematical software and to be able to apply it for realisation of the models and solution of system modelling and research tasks;

43.2.4. to have knowledge of functioning of the systems and processes in the selected areas of mathematics' application and to be able to apply it for formation of the mathematical models;

43.3. research skills:

43.3.1. to analyse literature, to collect data from the specified sources, to process and analyse the obtained information;

43.3.2. to analyse structure and features of the mathematical models and to assess their application possibilities;

43.3.3. to create mathematical models within the specified context, to analyse and identify the objects of application areas (phenomena, situations, processes) within the mathematical modelling context.

44. Upon completion of the studies of the second cycle in the field of applied mathematics, the following shall be achieved together with other learning outcomes:

44.1. special abilities:

44.1.1. to understand scientific literature on applications of mathematics;

44.1.2. to identify the problems of mathematics' application and to describe the systems of the application areas and their processes using mathematical relations;

44.1.3. to think analytically and to form algorithms and computer programmes to implement the mathematical models;

44.2. knowledge and its application:

44.2.1. to have deeper and/or wider mathematical knowledge and to be able to apply it to solve problems of applied mathematics;

44.2.2. to have knowledge about modern scientific research methods and to be able to apply it within the interdisciplinary context or to apply it creatively in the unknown setting;

44.2.3. to recognise the information of the latest tendencies in the selected branch of mathematics' application and to be able to apply it for creation of mathematical models of the systems;

44.2.4. to have more thorough knowledge of mathematical modelling needed to create and implement the models for complex systems in case of limited computing resources;

44.3. research skills:

44.3.1. to select and understand the scientific literature on application of mathematics;

44.3.2. to create and analyse mathematical models of the real world;

44.3.3. to select, evaluate and integrate the latest knowledge in different areas and various mathematical modelling methods;

44.3.4. to carry out the projects and to make the research results public.

45. Upon completion of the studies of the first cycle in the field of statistics, the following shall be achieved together with other special learning outcomes:

45.1. special abilities:

45.1.1. to communicate in the language of mathematics, to operate the classical mathematical concepts, and to solve the statistical problems using the mathematical tools;

45.1.2. to understand statistical texts, to use the statistical terms correctly, and to solve the practical statistical problems using the acquired knowledge and practical skills;

45.1.3. to plan statistical research, to collect data, and to apply statistical data analysis methods;

45.2. knowledge and its application:

45.2.1. to have knowledge of mathematical fundamentals (mathematical analysis, linear algebra, theory of probability, etc.) and to be able to apply it for solution of statistical problems;

45.2.2. to have knowledge of theoretical basics of mathematical statistics and statistical data analysis and to be able to use it for the statistician's work;

45.2.3. to have informatics fundamentals and to be able to apply it in the work with statistical or mathematical software;

45.2.4. to have basic knowledge in at least one application area of statistics (economics, sociology, engineering, etc.) and to be able to apply it;

45.3. research skills:

45.3.1. to find and analyse literature, to collect data from the specified sources, to process and analyse the obtained information;

45.3.2. to prepare reports on statistical data analysis, to interpret the results of statistical analysis, to formulate the conclusions, and to apply the known presentation methods of statistical information;

45.3.3. to model phenomena, processes and situations, using the statistical measures.

46. Upon completion of the studies of the second cycle in the field of statistics, the following shall be achieved together with other special learning outcomes:

46.1. special abilities:

46.1.1. to analyse complex systems and processes, by integrating knowledge in different areas;

46.1.2. to compare and assess critically the results of statistical modelling;

46.1.3. to understand scientific statistical literature and to use the scientific research knowledge to solve the theoretical and practical statistical problems;

46.2. knowledge and its application:

46.2.1. to have deeper knowledge about mathematical methods applied in statistics and to be able to apply it for solution of scientific research problems;

46.2.2. to have deeper knowledge of mathematical statistics and to be able to apply it to solve theoretical and practical statistical problems;

46.2.3. to have deeper knowledge in the selected application area of statistics or knowledge about statistical data analysis and to be able to apply it creatively in unknown setting or within the interdisciplinary context;

46.3. research skills:

46.3.1. to plan and carry out statistical research in unknown setting or within the interdisciplinary context;

46.3.2. to apply specialised data collection and management methods, while performing research in unknown setting or within the interdisciplinary context;

46.3.3. to prepare reports on statistical research.

CHAPTER IV
TEACHING, LEARNING AND ASSESSMENT

47. Teaching has to be based on fundamental knowledge and the latest achievements of the science. The teaching and learning methods have to expose the importance of logical thinking, mathematical literacy, and to provide the necessary knowledge to achieve the goals of the study programme.

48. The subjects of the study programme have to be taught consistently and have to be compatible with the aimed outcomes in consideration.

49. The teaching content has to be updated and improved regularly, by integrating the latest information and study methods that are in conformity with the lifelong learning into the process of studies.

50. With regard to the aimed learning outcomes of the subject (module), different learning and teaching methods are chosen, for example, lectures of various types, workshops, problem-based teaching, discussion, seminars, laboratory works, independent work, project-baced works, final work (bachelor or master thesis), consultations, learning in virtual learning environment, case analyses, modelling and imitation, research-based teaching, cognitive and teaching internship, teaching according to individual curriculum, and other methods.

51. The same teaching and learning methods may be applied in different cycles of studies; however, the complexity of tasks must differ. It is recommended to give some particular tasks and detailed plan of an independent work to the students of the first cycle. The students of the second cycle may suggest the topics for their project-based works, to generate the implementation ideas, to search for information independently, and it is recommended to base the teaching of subjects on the scientific achievements.

52. The learning outcomes are assessed in accordance with the procedure approved by the higher education institution. It established the assessment principles of the study achievements of the first and second cycles, organisation procedure, responsibility, rights and duties of the persons participating in the assessment process. The assessment procedure of the learning outcomes of certain module (subject) has to be provided in its descriptor.

53. The assessment of students' achievements has to be based on clear assessment criteria linked to the learning outcomes of the study programme and the subject (module). The assessment strategy has to assure achievement of the aimed learning outcomes of the students, whereas mastering of theory and skills of its practical application should be assessed in parallel. The assessment has to assure objective determination of achievements.

54. In order to improve effectiveness of the process of studies and teaching quality, the students should be granted a possibility to convey a feedback to the instructor and to discuss various aspects of studies of certain subject (module) with the teachers.

55. When the higher education institution is establishing an assessment procedure, it has to grant a possibility for the instructor to choose assessment methods. The assessment methods are chosen with regard to the aimed cognition level (to know, understand, apply, analyse or assess). It is recommended to apply various assessment methods of the achievements: colloquium, test, solving standard or problemic tasks, report and defence of the laboratory works, report and defence of individual or team project, oral presentation, oral survey of individuals or groups, testing, tasks done by computer, report and defence of practical training, defence of final work, oral or written examination of closed or opened book, examination in the form of test, etc.

56. It is recommended to provide in the assessment procedure that the instructors should give information to the students about their performed works, substantiation of assessment, and suggestions how to achieve higher level of learning outcomes. The students should receive timely information about their works together with constructive comments based on clear assessment criteria.

57. The assessment strategy of the achievements has to be consolidated in the documents. In the beginning of each semester, the university instructors have to introduce the students to assessment of learning outcomes, thorough curriculum of the study programme, goals, expected learning outcomes, the assessment procedure of the learning outcomes of particular subject, the criteria and structure of the assessment, constituents of final evaluation, examination terms, influence of interim tests on the final grade, procedure of continuous tests, etc.

58. The assessment procedure, the assessment system and the assessment criteria have to be reasoned, reliable, clear and useful for achievement of the learning goals. When the instructor is assessing the students' achievements, the teacher has to observe the principles of objectivity, impartiality, transparency, mutual respect and good will.

CHAPTER V
REQUIREMENTS FOR IMPLEMENTATION OF STUDY PROGRAMMES

59. The study programme should be implemented by competent and qualified instructors, who are performing scientific research, who are able to apply advanced teaching methods, who are improving their qualification, who know the particularity of the graduates' future work, and who are able to help the students to get ready for future professional or academic activities.

60. The competence and qualification of the instructors shall be assessed according to their scientific, pedagogical and practical experience, on the basis of criteria and qualification requirements established by universities.

61. At least 50 percent of the subjects in the study fields of mathematics and statistics of the first cycle should be taught by scientists, who have a doctoral degree in mathematics. At least 50 percent of the subjects in the study field of applied mathematics of the first cycle should be taught by scientists, at least half of whom must have a doctoral degree in mathematics.

62. In order to ensure successful implementation of the study programme, the following material resources are needed:

62.1. the number of lecture halls, computer classes, laboratories, other teaching premises and places in them, their arrangement and layout have to be in compliance with the studying needs and hygiene requirements. They must have modern audio and video equipment and demonstration aids;

62.2. the qualitative operation of computers and their networks, and Internet accesses have to be suitable for practical activities of the students and for formation of their skills;

62.3. with regard to the infrastructure of information technologies, the software of mathematics, applied mathematics and/or statistics has to be available;

62.4. the teaching material and sources of literature have to be available in the libraries and/or virtual environment, and in the information bases; the number of textbooks, books, journals and other literature if the subjects taught in the fields if mathematics, applied mathematics, statistics and informatics has to meet the students' needs;

62.5. the sufficient number of computers and suitable software and information equipment must be available in the libraries (literature catalogues, search engines, Internet connection, connection with databases of bigger libraries, access to the databases of full-text scientific publications and other information sources at the disposal of universities).

63. The study programme of the first cycle ends in the defence of the graduate's final work (project) that amounts to at least 15 study credits.

64. The study programme of the second cycle ends in the master thesis and its defence. It should be equal to at least 30 study credits.

65. The final works (projects) of the first cycle have to be based on independent applied and/or theoretical research, application of knowledge, or they have to be prepared as the projects that reflect the abilities conforming to the programme's goals. The person completing the studies of the first cycle should use the final work (project) to manifest the appropriate level of knowledge and understanding, ability to discuss the selected topic, to present earlier works of other persons in the chosen field, to present the solutions of selected problems, and to demonstrate the ability to learn independently.

66. The person completing the studies of the second cycle should use the final work (project) to demonstrate the ability to analyse independently the selected topic, to convey and assess earlier works of other persons in the chosen field, to make decisions or to give original ideas, to perform research and to interpret their results, and to describe own research work according to the requirements approved by the university.

67. The assessment commission of the final work (project) has to consist of competent scientists. It is recommended to include stakeholders into the defence commissions. At least one member of the commission has to be from another scientific and higher education institution than the one conducting the study programme.

68. The professional practical training has to be an integral compulsory component of the study field of mathematics. Its volume in the university study programmes of the first cycle should amount to at least 15 study credits.

69. The practical training shall be organised in accordance with the descriptor prepared by the higher education institution for organisation of professional practical training. It has to define the requirements of practical training, particular tasks, expected results, system of achievements' assessment, support to the student in the course of practical training, and the criteria that help to establish and assess the skills of appropriate level acquired by the student in the course of practical training.

70. It is recommended to spend at least 15 percent of the practical training time on the individual and/or group consultations given by the instructor appointed by the university. The recommended format of practice is final practical training, where the performed tasks are directly related to the final work (project).

71. The practical training supervisors in the company, institution, entity or organisation have to be involved into the process of improvement of content of tasks for practical training and organisation of practical training.

72. The tasks of practical training are selected with regard to the direction of professionalism growth, by linking the student's academic preparation with the competencies of practical activities.

73. The higher education institution may offer a list of possible practical training places, with whom the cooperation contracts have been concluded. The student may find a place for practical training himself/herself, having coordinated this with the higher education institution. When the

institution for practical training is chosen, a trilateral agreement shall be entered into by the student, the higher education institution and place of practical training.

74. The instructors of subjects/modules in the study fields of mathematics, applied mathematics and statistics included into a different study field should be the persons, who have at least the master's degree in the mathematical sciences, and whose scientific and/or professional interests are linked to respective study field.

CHAPTER VI
TEACHING OF MATHEMATICS

75. This chapter establishes special requirements for the study programmes that prepare teachers of school mathematics.

76. Teaching mathematics is the practice of teaching and learning of mathematics at schools of all types and levels. The preparation of teachers of school mathematics is based on the research of school mathematics, which is a part of the science of mathematics. The research of school mathematics is divided into fundamental and applied according to the aims:

76.1. understanding of fundamental problems of mathematical thinking and teaching/learning of mathematics;

76.2. application of mathematical understanding while investigating the present teaching tools and creating new tools used to improve teaching of mathematics (textbooks, educational and study programmes, programmes of teacher preparation, etc.).

77. The teachers of school mathematics must have solid grounds of mathematics, be able to share their knowledge in various ways, and be able to communicate effectively with pupils, teachers and colleagues in order to pursue the common goals – to grant education to young people.

78. The teachers of school mathematics are prepared in the university study programmes of 240 credits of the first cycle. These programmes may be:

78.1. the study programme awarding the bachelor's degree in mathematics and integrating the following two modules: the module of pedagogical studies awarding the pedagogue's qualification, and the module of mathematics teaching of at least 30 credits;

78.2. the study programme awarding the bachelor's degree in educational sciences and the pedagogue's qualification that integrates at least 120 credits of the subjects in the study fields of mathematical sciences, including the module of mathematics teaching.

79. The module of mathematics teaching is a set of subjects that helps to develop the competencies needed for the qualification the teachers of school of mathematics. It shall consist of subjects of at least 30 study credits that are needed for didactic transformation of mathematics (content school mathematics, psychology of mathematics thinking, history of mathematics, mathematical philosophy, etc.).

80. Upon completion of the study programme of the first cycle preparing teachers of school mathematics, the following shall be achieved together with other learning outcomes:

80.1. special abilities:

80.1.1. ability to apply knowledge of mathematical didactics and teaching of school mathematics considering individual differences between the learners, and ability to communicate in the mathematical language;

80.1.2. ability to apply various means in the teaching process that would increase variety of activities used to learn mathematics, and accessibility to learning;

80.2. knowledge and its application:

80.2.1. deeper and expanded knowledge content of school mathematics, psychology of mathematics thinking, history of mathematics, and mathematical philosophy;

80.2.2. knowledge about modern tendencies of mathematics teaching and ability to apply it for improvement of the quality of teaching process;

80.2.3. specialised knowledge of information technologies (IT) and its adaption to convey the teaching content;

80.3. research skills:

80.3.1. ability to analyse the pupils' achievements, to formulate the teaching tasks, and to apply the mathematical and statistical methods in research of education sciences and pedagogical activity;

80.3.2. ability the construct the mathematics teaching context with regard to the learners' needs, teaching goals, ability to analyse the teaching methods, ways, strategies and forms, as well as mathematical school literature;

80.4. social and personal abilities:

80.4.1. ability to apply modern methods and strategies of assessment and self-evaluation of the pupils' achievements, and to assume responsibility for the performance results;

80.4.2. ability to communicate and cooperate with the parties interested in education (pupils' parents, teachers, local community), and ability to comply with the academic ethics.

81. The pedagogical practical training performed at school should be supervised by the school teacher of mathematics, who has at least the category of a teacher-supervisor.

82. The career opportunities for teachers of school of mathematics have to be related to continuous improvement of their mathematical qualification.