APPROVED BY
Order No. V-948 of the Minister
of Education, Science and Sport
of the Republic of Lithuania of 5 May 2023

DESCRIPTOR OF THE GROUP OF STUDY FIELDS OF ENGINEERING SCIENCES

CHAPTER I
GENERAL PROVISIONS

1. The Descriptor of the group of study fields of Engineering Sciences (hereinafter referred to as 'the Descriptor') regulates the specific requirements for study programmes in the group of study fields of Engineering Sciences (E). The Descriptor regulates studies in the study fields of Engineering Sciences (referred to as 'fields of Engineering Sciences') in the scope not covered by the General Requirements for the Provision of Studies approved by Order No. V-1168 of the Minister of Education, Science and Sport of the Republic of Lithuania of 30 December 2016 *On Approval of Description of General Requirements for the Provision of Studies*.

2. The Description takes into account the recommendations of the European Accreditation Standard for Engineering Education Programmes *(EUR-ACE® Framework Standards and Guidelines* (http://www.enaee.eu/)).

3. The Descriptor applies to short qualification studies (hereinafter referred to as 'the short studies'), college and university first and second cycle study programmes, as well as to study programmes in the field of Aeronautical Engineering which may be conducted as integrated studies, carried out in the full-time or the part-time study form.

4. The volume of the short studies can be either 90 or 120 study credits.

5. Graduates of the short studies acquire a qualification corresponding to Level 5 of the *Lithuanian Qualifications Framework* and the *European Qualifications Framework for Lifelong Learning* (EQF-LLL), which is evidenced by a study certificate issued by a higher education institution entitling them to engage in a professional activity and/or to pursue further studies according to a collegiate or a university undergraduate study programme.

6. Upon completion of studies in Engineering Sciences, a Professional Bachelor's/Bachelor's/Master's qualification degree corresponding to the Sixth/Seventh Level of the *Lithuanian Qualifications Framework* and the *European Qualifications Framework for Lifelong Learning*, and the First/Second Level of the *European Qualifications Framework* in the *European Higher Education Area* is awarded, as attested by the Professional Bachelor's/Bachelor's/Master's diploma and the diploma supplement issued by the higher education institution.

7. Studies in the study fields of Engineering Sciences may be conducted as two-field, interdisciplinary or joint first cycle study programmes, and as interdisciplinary and joint second cycle study programmes, provided that the intended learning outcomes satisfy the provisions of the Regulations and provide new knowledge and career opportunities.

8. There are no specific requirements established in the Descriptor for admission to study programmes.

9. Holders of a Professional Bachelor's qualification degree who apply to second cycle university study programmes must complete additional university bridging courses.

10. The main objective of the study programmes in the group of study fields of Engineering Sciences is to provide students with the knowledge and skills to the highest possible level, in line with the learning outcomes of their chosen study field, and to prepare them for their future academic and professional careers.

CHAPTER II
CONCEPT AND SCOPE OF STUDY FIELDS

11. Engineering is the purposeful activity of developing tools, instruments and systems for using natural resources and natural phenomena to meet human needs. Engineering is systematic work based on knowledge gained from research and practical experience, intended to develop new or improve already existing materials, technologies, products, devices, equipment, processes, services, to design their implementation, and to plan and organise production by using information technology.

12. Engineering Sciences have direct links with technological sciences and with information technologies enabling the production of technological and technical information and documentation in the digital form, and the management of processes and data flows, as well as with mathematics, physics and chemistry, biology, ecology and business management.

13. The knowledge, skills and competences provided to graduates of study programmes in the group of study fields of Engineering Sciences must be recognised and explicit. They must be in line with the labour market needs. The following are the main typical occupational fields of engineering:

13.1. Engineering technologist (Level VIII specialists). The activities of the professions in this group include: management of individual legal entities and establishment of new legal entities; identification of problem areas in the sector and formulation of possible solutions; participation in working groups at the national level representing the interests of the engineering industry; provision of recommendations to policy and legislative makers in the field of engineering regulating the provision of industrial services in this field;

13.2. Engineering technologist (Level VII specialists). The scope of activities of this group of occupations includes: organisation, management and control of product manufacturing and human resources (planning of resources for the production of industrial products; management of the technological process of production; training of employees); optimisation and improvement of the product production process (keeping and controlling records of product manufacturing; analysis and optimisation of the production process; introduction of innovative technological and methodological solutions in production);

13.3. Engineering technologist (Level VI specialists). The scope activities of this group of occupation includes: determining the need for materials according to the company’s profile, placing orders with the supply department; knowledge of quality standards; analysis of materials safety data sheets, completion of the record book, checking of quality certificates; drawing up and enforcing warehousing regulations; implementation of the requirements of inventories in the production departments; knowledge of the principles of the operation of production technical equipment; the areas include: planning, management and control of resources on the basis of accounting, logistics and technical documentation; assessment and planning of the technical capabilities and production capacity of production equipment; design and management of the production process; solution of engineering problems in the technological production process; knowledge and application of production planning software; knowledge and application of the requirements for the preparation and completion of technical documentation; assessment of the impact of indirect quality costs on the company’s results and initiation of measures to reduce them; analysis of technical requirements and documentation; provision of proposals for improving production performance, automation and robotic processes; preparation of production plans and implementation of requirements for their timely execution; preparation and implementation of a production strategy; forecast of the tools and equipment required for production, material costs, number of employees, production efficiency and other factors affecting production efficiency; analysis of and solutions to problems arising in production;

13.4. Technician, specialist (Level V specialists). The scope of activities of this group of occupations includes: knowledge of production processes according to the company’s business

profile, selection of ways and means of solving technical problems in production, troubleshooting of problems in the technological process, installation of production equipment, management and training of low-skilled workers, planning and distribution of production tasks, supervision of the production process, quality control of production, evaluation of production results, completion of production documentation, and provision of suggestions for improving production processes.

14. The concept and scope of the different study fields of Engineering Sciences are as follows:

14.1. Safety Engineering (E01) is designed to analyse, evaluate and manage emergency-related processes, identify threats and hazards (natural, technogenic, criminal) and develop complex preventive systems, assess and manage the risks of process applications, ensure and control safety through passive and active safety measures, select and use safety equipment and techniques, address critical safety issues of major importance for the protection of people and property, and predict and assess the impact of human factors on safety management;

14.2. Bioengineering (E02) is an interdisciplinary scientific and practical field of engineering which develops an understanding of key contemporary issues at the interface of engineering, biological and medical sciences, with the aim of training professionals who possess the knowledge and skills to improve the quality of health services through the application of engineering science methods, innovative technologies and interdisciplinary research. Bioengineering aims to investigate and develop biomedical engineering, electronics and mechatronics and biomechanical technologies and the application of engineering principles and methods to solve problems in medicine and biology, as well as to develop tools, instruments and systems to meet human and societal needs through the efficient use of natural resources, and to assess and manage the risks posed by materials and phenomena;

14.3. Environmental Engineering (E03) is an interdisciplinary scientific and practical field of engineering which aims to develop tools, instruments and systems to meet human and societal needs through the efficient use of natural resources, and the assessment and management of the risks posed by materials and phenomena. It applies the principles of technology and engineering science to the development, planning, design, and engineering of technological devices, instruments and systems to improve the quality of life, whether from a technological, technical, safety, environmental, economic, managerial or any other perspective. During their studies in the study field of Environmental Engineering, students are set to acquire higher education qualifications which, together with practical experience, provide a sound basis for professional engineering practice;

14.4. Measurement Engineering (E04) is an interdisciplinary, targeted field of science and measurement activities covering the principles of measurement, analysis and interpretation of results, interchangeability and standardisation of all processes in engineering fields, including the measurement and refinement of the shape and size of all or part of land, measurements of the gravitational field, spatial measurements of natural, physical (relief, hydrography, vegetation), anthropogenic and other objects on the surface of the earth, determination of the coordinates of these objects and representation of these objects on maps by means of geographic information systems. The principles of Engineering Science are applied in planning (spatial planning), design (land formation and redevelopment projects, design works at construction sites, industrial facilities), cadastral data of real estate, control of construction processes (measurements of buildings, structures and engineering network objects), various transactions involving management of objects (buying, selling, renting), equipment, processes, services, etc.;

14.5. The concept and scope of Civil Engineering (E05) are as follows:

14.5.1. Civil Engineering is the purposeful activity of designing, developing and using equipment, tools and systems which make efficient and safe use of natural resources and natural phenomena to meet the needs of the built environment for human habitation, work and recreation. These engineering activities are systematic activities based on scientific research and knowledge gained from practical experience, the purpose of which is to develop new or substantially improve already existing building materials, building structures, construction technologies, to design, plan, organise, manage and control construction and the related business processes. Civil Engineering

includes residential and non-residential buildings, special and hydraulic structures, communications and engineering networks. The study field covers geotechnical engineering, geodesy and geoinformatics, transport structural engineering; structural engineering, construction materials engineering, hydraulic and water engineering, structural engineering systems, urban engineering;

14.5.2. individuals who have completed their studies and obtained the qualification of a civil engineer, in order to take up the position of a manager of the main areas of technical activities in the construction of extraordinary and non-extraordinary structures in the Republic of Lithuania, must obtain qualification certificates. The institutions performing the certification and recognition of the right to hold the position of the head of the main areas of technical activities in the construction of extraordinary and non-extraordinary buildings shall be guided by the Technical Construction Regulation of the Republic of Lithuania STR 1.02.01:2017 *Description of the Procedure for the Certification of Construction Participants and Recognition of Their Right* approved by Order No. D1-880 of the Minister of Environment of the Republic of Lithuania of 12 December 2016 *On Approval of the Technical Construction Regulation STR 1.02.01:2017 'Description of the Procedure for the Certification of Construction Participants and Recognition of Their Right'* and may establish requirements for the certification of civil engineers. The certification of civil engineers must be based on the learning outcomes of the study programmes, and changes in certification must be coordinated by the national authorities with all higher education institutions offering Civil Engineering studies;

14.6. Mechanical Engineering (E06) is a systematic activity based on the knowledge gained from research and practical experience, the aim of which is to develop new or substantially improve the currently existing mechanical systems or mechanical subsystems in integrated engineering systems, to put them into operation and to maintain their performance by technical means, and to evaluate them from technological, technical, safety, environmental, economic, managerial, or other perspectives. Throughout their studies in the study field of Mechanical Engineering, individuals must acquire a higher education qualification which, together with practical experience, provides a sound basis for a career as an engineer;

14.7. Marine Engineering (E07) is a focused activity aimed at the development, operation, improvement and maintenance of self-propelled and non-self-propelled waterborne vehicles, their propulsion and on-board systems, Civil Engineering structures and installations and means of meeting human needs through the sustainable use of marine and marine environmental resources. The study field of Marine Engineering covers the areas of ship engineering, ship power plant engineering, offshore engineering, and port engineering;

14.8. Electrical Engineering (E08) is a focused activity aimed at the design, research and efficient and safe use of electrical equipment and systems for the generation, supply and consumption of electricity and for economically and environmentally sustainable operations. Electrical Engineering covers a wide range of electrical and power equipment and systems, automation, robotics, control and communication devices and systems;

14.9. Electronic Engineering (E09) is a focused activity aimed at the development, efficient and safe use of electronic devices and systems for the safe, efficient, comfortable, economically and environmentally sustainable activities of people. Electronic Engineering covers a wide range of electronic devices and mechatronic/electronic systems, telecommunications, control and automation equipment and systems, microwave devices, optoelectronic and computer technology, analogue and digital electronics design, and device manufacturing and programming processes;

14.10. Production Engineering (E10) is the scientific and practical activity of an engineer, the purpose of which is to ensure the correct technical functioning of all equipment and to devise new methods and means of production using known and new or substantially improved materials, technologies, equipment, processes, products, services, and to prepare for their introduction, plan and organise the production processes. During their studies in Production Engineering, students are set to acquire higher education qualifications which, together with practical experience, provide a sound basis for professional production-based engineering practice.

14.11. Chemical Engineering (E11) is the focused activity of designing, developing, improving and adapting processes and products to meet human needs. These activities include the

design, management, control, research, economic evaluation and management of production processes. During their studies in this study field, students are set to acquire higher education qualifications which, together with practical experience, provide a sound basis for professional engineering practice;

14.12. Transport Engineering (E12) is an interdisciplinary scientific and practical field of engineering which involves the purposeful development or improvement of transport facilities and their efficient, safe and environmentally sound operation to meet the needs of human transport and the transport of goods, using natural resources in a sustainable manner. Transport Engineering research subjects include road transport, rail transport, transport infrastructure construction and maintenance machinery, mobile process equipment, pipeline transport, military engineering equipment;

14.13. Energy Engineering (E13) is a focused activity aimed at developing tools, instruments and systems for using natural resources and natural phenomena to meet the energy needs of humanity, ensure comfort, increase energy efficiency and reduce negative environmental impacts. These engineering activities are systematic activities based on knowledge gained from research and practical experience, used to develop new or improve existing materials, technologies, products, devices, equipment, processes, services, to design their implementation, and to plan and organise production by using information technology. This work includes modelling and analysis of renewable and non-renewable energy production, conversion, supply, consumption in the industrial, building and transport sectors, solving engineering problems of indoor microclimate, and design and management of energy installations and systems for high energy efficiency, environmental friendliness, cost-effectiveness, quality and reliability;

14.14. Aeronautical Engineering (E14) is a focused activity aimed at developing tools, instruments and systems for the usage of natural resources and natural phenomena to meet human needs. Aeronautical Engineering covers the components of the air transport system, including aircraft, flight control equipment and systems, maintenance, and interaction between system components.

CHAPTER III
GENERAL AND SPECIAL LEARNING OUTCOMES

15. This chapter presents the fundamental learning outcomes of studies of Engineering Sciences applicable to all the study fields within the group of Engineering Sciences, but they do not constitute a specification of the detailed curriculum of the study programme or study subjects.

16. The following knowledge and skills must be acquired upon completion of short studies:

16.1. Knowledge and its application. A person must:

16.1.1. possess a general knowledge background in mathematics, physical and/or technological sciences which would enable them to understand and describe the processes involved in their chosen field of study in Engineering Sciences;

16.1.2. have an understanding of the fundamental concepts and content of the chosen field of study of Engineering Sciences;

16.1.3. acquire fundamental and up-to-date knowledge of the chosen field of study of engineering sciences that is applicable in practice;

16.1.4. be familiar with the principles of digital manufacturing, cloud manufacturing processes, the Internet of Things, business management systems and augmented reality;

16.2. Special skills (engineering analysis and design). A person must:

16.2.1. be able to understand and interpret the results of their chosen field of study in Engineering Sciences;

16.2.2. be able to solve engineering problems by selecting the appropriate methods, experimental and production equipment;

16.2.3. understand design methodologies and apply specialised software for process and data management, implementation of processes and product manufacturing in accordance with specified technical, economic and environmental requirements in the chosen field of Engineering Sciences;

16.3. Research skills and practical activities. A person must:

16.3.1. be able to locate, organise and interpret information relevant to the studies of the chosen field of Engineering Sciences;

16.3.2. be familiar with the general regulations on the use of work equipment, have the skills to work with equipment used in the chosen field of study in Engineering Sciences; be able to cooperate with specialists in other professional activities;

16.4. Personal skills (decision-making, lifelong learning, cooperation and teamwork). A person must:

16.4.1. be able to communicate with the engineering community and the general public in correct Lithuanian and at least one foreign language;

16.4.2. understand the impact of engineering decisions on society and the environment, observe professional ethics and standards of engineering practice, and understand responsibility for the results of engineering activities;

16.4.3. be familiar with the basic aspects of project delivery and management at the level of engineering performance;

16.4.4. be aware of the importance of and prepare for individual lifelong learning.

17. The following knowledge and skills must be acquired upon completion of college studies:

17.1. Knowledge and its application. A person must:

17.1.1. possess general knowledge of mathematics and natural sciences enabling them to understand and describe the processes involved in their chosen study field of Engineering Sciences;

17.1.2. have knowledge and understanding of the key concepts and content of the chosen study field of Engineering Sciences, or of the study field that is related to the chosen study field of Engineering Sciences;

17.1.3. acquire fundamental and up-to-date knowledge of the chosen study field of Engineering Sciences, or of the study field that is related to the chosen study field of Engineering Sciences, that can be applied in practice;

17.1.4. be familiar with the principles of digital manufacturing, cloud manufacturing processes, the Internet of Things, business management systems and augmented reality;

17.2. Special (engineering analysis and design) abilities. A person must:

17.2.1. be able to analyse the processes and products of the chosen study field of Engineering Sciences, and understand and interpret the results obtained;

17.2.2. be able to solve engineering problems by selecting the appropriate methods, experimental and production equipment;

17.2.3. understand design methodologies, and be able to use specialised software for process analysis and data management to design processes and products of the chosen study field of Engineering Sciences in accordance with specified technical, economic and environmental requirements;

17.3. Research skills and practical activities. A person must:

17.3.1. be able to find, organise and interpret information relevant to the study of their chosen study field of Engineering Sciences;

17.3.2. be able to carry out experiments to solve engineering problems, analyse the results and draw conclusions;

17.3.3. have experience of work with equipment used in their chosen study field of Engineering Sciences;

17.3.4. be able to solve practical problems in their chosen study field of Engineering Sciences;

17.3.5. be able to participate in working groups to implement projects in their chosen study field of Engineering Sciences, while taking into account the principles of the circular economy, artificial intelligence, digitalisation of industry, ethical, environmental, commercial, organisational, occupational health and safety considerations and the development of the sustainability concept;

17.3.6. be able to work collaboratively with professionals in other professional activities;

17.4. Personal skills (decision-making, lifelong learning, cooperation and teamwork). A person must:

17.4.1. be able to solve engineering problems individually and as part of a team;

17.4.2. be able to communicate with the engineering community and the general public in correct Lithuanian and at least one foreign language;

17.4.3. understand the impact of engineering decisions on society and the environment, observe professional ethics and standards of engineering practice, and understand responsibility for the results of engineering activities;

17.4.4. have the knowledge of key aspects of project delivery and management at the engineering level;

17.4.5. understand the importance of individual lifelong learning and prepare for it.

18. The following additional knowledge and skills must be acquired upon completion of college studies in the study field of Measurement Engineering:

18.1. Knowledge and its application. A person must:

18.1.1. possess basic Measurement Engineering knowledge of geodetic and cadastral measuring techniques and tools, basic cartography (mapping, plan making), basic real estate formation and the use of geographic information systems for data processing. This knowledge will be needed for practical work on land, construction and industrial sites;

18.2. Special (engineering analysis and design) abilities. A person must:

18.2.1. be able to apply analytical and standard modelling methods to solve qualitative and quantitative engineering problems in the study field of Measurement Engineering;

18.2.2. be able to apply the work processes of the study field of Measurement Engineering, use modern measurement tools and optimally organise and perform work according to the defined requirements in a variety of objects and engineering fields.

19. A graduate of college studies of Production Engineering must be able to implement production projects (of new products, services, etc.) while taking into account the principles of the circular economy, artificial intelligence, the digitalisation of industry, ethical, environmental, commercial, organisational, occupational health and safety considerations, and the development of the sustainability concept.

20. The following additional knowledge and skills must be acquired upon completion of college studies in the study field of Transport Engineering:

20.1. Knowledge and its application. A person must:

20.1.1. possess knowledge and understanding of the general principles and laws of mathematics, natural sciences, mechanics, materials science, electronics and information technology, at least to the level required to achieve the learning outcomes of the Transport Engineering study field;

20.1.2. possess fundamental and up-to-date knowledge of Transport Engineering, including vehicle and machine structures, principles of operation and performance, and structural and performance materials;

20.1.3. understand the multidisciplinary nature of Transport Engineering sciences and the potential to apply knowledge from other sciences to engineering solutions and technologies;

20.1.4. be able to apply process and product design methods in the study field of Transport Engineering in accordance with the defined requirements while using scientific achievements in the fields of control, electrification, automation of vehicles, machinery and their systems.

21. A person who has completed a first cycle college study programme in Marine Engineering and acquired the theoretical and practical knowledge and skills necessary to obtain a certificate of competency as a watch-keeper or electro-mechanic for engine-powered ships with an

engine power of 750 kW or more must be able to operate and maintain marine machinery, ship's electromechanical, electronic and control equipment, and carry out operational management and supervision of people on board at the operational and management level, while using a variety of tools and techniques, by taking into account the ship's viability and the health and safety of people, the environment, the principles of artificial intelligence, and the digitalisation of industry.

22. A person who has completed first cycle university studies must have acquired the following knowledge and skills:

22.1. Knowledge and its application. A person must:

22.1.1. possess general knowledge of mathematics and physical and/or technological sciences, natural sciences enabling them to understand and describe the processes involved in their chosen study field of Engineering Sciences;

22.1.2. acquire coherently linked knowledge to design, model and simulate processes in their chosen study field of Engineering Sciences;

22.1.3. acquire fundamental knowledge of the measurement and control of processes in their chosen study field of Engineering Sciences;

22.1.4. be able to explain the interdisciplinary context of their chosen study field of Engineering Sciences;

22.1.5. be familiar with the principles of digital manufacturing, cloud manufacturing processes, the Internet of Things, business management systems, and augmented reality;

22.2. Special (engineering analysis and design) abilities. A person must:

22.2.1. be able to analyse the processes and products of the chosen study field of Engineering Sciences, evaluate analysis methods and interpret results;

22.2.2. be able to identify, formulate and apply fundamental principles to holistically solve problems in their chosen study field of Engineering Sciences;

22.2.3. be able to appropriately select and apply process and product modelling and optimisation methods of the chosen study field of Engineering Sciences;

22.2.4. be able to apply digital technology-based design and data management methodologies of the chosen study field of Engineering Sciences;

22.2.5. be able to design or develop processes and products in the chosen study field of Engineering Sciences in accordance with the specified technical, economic and environmental requirements;

22.3. Research skills and practical activities. A person must:

22.3.1. be able to locate the relevant professional and scientific information in databases and other information sources, systematise, interpret, draw conclusions and apply them in their studies and/or practical activities;

22.3.2. be able to creatively solve problems of their chosen study field of Engineering Sciences by using the latest scientific material, laboratory analytical and process research methods and equipment;

22.3.3. be able to carry out experiments, interpret results and draw conclusions in the chosen study field of Engineering Sciences by using the given methodology;

22.3.4. be able to work effectively in research teams and describe and present the results of their work;

22.3.5. be able to assess the impact on human health and the environment before undertaking engineering activities;

22.3.6. be able to identify and apply the environmental impacts of engineering decisions and their relationship to economic consequences, engineering standards and responsibilities;

22.3.7. be able to design and implement projects in their chosen study field of Engineering Sciences, while taking into account the principles of circular economy, artificial intelligence, digitalisation of industry, ethical, environmental, commercial, organisational, occupational health and safety considerations, and the development of the sustainability concept;

22.4. Personal skills (decision-making, lifelong learning, cooperation and teamwork). A person must:

22.4.1. be able to work effectively independently and as part of a team with professionals from other professional backgrounds and at other levels of qualification;

22.4.2. be able to communicate with the national and international engineering community and the general public in correct Lithuanian and at least one foreign language;

22.4.3. holistically understand the impact of engineering decisions on society and the environment, the norms of professional ethics and technological engineering practices, and the responsibility for the consequences of engineering practices;

22.4.4. understand various project management and business aspects (risk and change management, production scale effect, etc.), as well as the links between technological solutions and their economic and social implications;

22.4.5. understand the importance of individual lifelong learning and prepare for it.

23. A person who has completed first cycle university studies in the field of Measurement Engineering must have acquired the following knowledge and skills:

23.1. Special (engineering analysis and design) abilities. A person must:

23.1.1. be able to appropriately select and apply methods of analysis, modelling and optimisation of measurement processes and data not only in the field of geodesy and cartography, but also in production and industry;

23.1.2. be able to design or develop processes and products in the study field of Measurement Engineering in accordance with the established technical, economic and environmental requirements defined by legislation.

24. A graduate of second cycle university studies in Civil Engineering must comply with the standards and safety rules for the civil engineering practice.

25. The following additional knowledge and skills must be acquired upon completion of first cycle university studies in Marine Engineering:

25.1. A graduate must be able to compose, develop, operate and maintain engineering equipment while using a variety of tools and techniques;

25.2. A graduate must be able to design and implement projects in the study field of Marine Engineering, while taking into account the principles of circular economy, artificial intelligence, digitalisation of industry, ethical, environmental, commercial, organisational, occupational health and safety considerations and the development of the sustainability concept.

26. The following additional knowledge and skills must be acquired upon completion of first cycle university studies in Production Engineering:

26.1. A graduate must possess the knowledge and understanding of the laws and regularities of mathematics, mechanics, materials science, information technology, mechatronics and robotics, at least to the level required to achieve the learning outcomes of the study field of Production Engineering;

26.2. A graduate must be able to solve problems in the field of Production Engineering by using laboratory analytical and process research equipment.

27. The following additional knowledge and skills must be acquired upon completion of first cycle university studies in Transport Engineering:

27.1. Knowledge and its application. A person must:

27.1.1. possess the knowledge and understanding of the fundamentals and laws of mathematics, physical and/or technological sciences, mechanics, materials science, electronics and information technology at least at the level required to achieve the learning outcomes set out for the study field of Transport Engineering;

27.1.2. acquire state-of-the-art, coherently integrated knowledge of Transport Engineering, enabling the development of new and major improvements to existing Transport Engineering facilities and their individual systems in accordance with the specified technical, economic and environmental requirements;

27.2. Special (engineering analysis and design) abilities. A person must:

27.2.1. be able to solve problems of design, control, electrification, automation and operation of transport engineering objects and their systems by applying theoretical analytical and numerical methods, by using laboratory, computer and other research equipment;

27.2.2. be able to carry out experiments, process and interpret the results according to the given methodology.

28. The following additional knowledge and skills must be acquired upon completion of first cycle university studies in Bioengineering:

28.1. Knowledge and its application. A person must:

28.1.1. know and understand the regularities and laws of mathematics and other sciences (physics, chemistry, biology) relevant to the specifics of Bioengineering at least at the level required to achieve the learning outcomes set out for the study field of Bioengineering;

28.1.2. know and understand the broader interdisciplinary (multidisciplinary) context of Bioengineering, and be able to apply methods and processes from other disciplines;

28.2. Special (engineering analysis and design) abilities. A person must:

28.2.1. be able to identify, formulate and solve engineering problems in the field of Bioengineering studies; select and apply the appropriate methods from established analytical, computational and experimental techniques, and correctly interpret the results of analysis;

28.2.2. be able to develop and design complex products (devices, equipment, etc.), processes and systems in the field of Bioengineering studies in accordance with the defined requirements, and select and apply the appropriate design methodologies;

28.3. Research skills and practical activities. A person must:

28.3.1. be able to solve Bioengineering problems by using laboratory analytical and process research equipment;

28.3.2. have the skills necessary to work with the laboratory and/or workshop equipment used in the field and branches of Bioengineering studies; be able to plan and carry out experimental studies, to interpret the data obtained, and draw conclusions.

29. The following knowledge and skills must be acquired upon completion of second cycle studies:

29.1. Knowledge and its application. A person must:

29.1.1. possess sound knowledge and ability to creatively apply modern knowledge of mathematics and natural sciences necessary for the research and development of new products or processes and for the achievement of the learning outcomes in the chosen study field of Engineering Sciences;

29.1.2. be familiar with and be able to fully appreciate the latest developments in the chosen study field of Engineering Sciences;

29.1.3. possess the knowledge of digital manufacturing principles, cloud manufacturing processes, the Internet of Things and augmented reality capabilities and business management systems;

29.2. Special (engineering analysis and design) abilities. A person must:

29.2.1. be able to deal with problems that are unusual, not strictly defined, and/or incomprehensively specified;

29.2.2. be able to identify, analyse and solve problems arising in their chosen study field of Engineering Sciences in an integrated manner, by using the latest research;

29.2.3. be able to apply complex methods, methodologies and tools requiring up-to-date scientific knowledge to solve problems in their chosen study field of Engineering Sciences;

29.2.4. be able to apply new process monitoring and data management methodologies and technologies to the development of new products, devices, processes or methods;

29.2.5. be able to adopt socially responsible, natural resource-efficient and energy-efficient technological solutions when being faced with multiple, technically undefined and uncharacterised problems;

29.3. Research skills and practical activities. A person must:

29.3.1. be able to identify, locate and evaluate professional and scientific information in databases and other information sources relevant to engineering work;

29.3.2. be able to plan and carry out analytical, modelling and experimental studies, critically evaluate their findings, and draw conclusions;

29.3.3. be able to investigate the applicability of new methods and approaches to problem-solving in their chosen study field of Engineering Sciences;

29.3.4. be able to integrate knowledge and practical skills from different fields of study to address the next generation of engineering challenges dealt with by the industry;

29.3.5. be able to select engineering equipment and software, systematise the results obtained and draw conclusions by identifying the best methods and applying the latest scientific literature;

29.3.6. have the knowledge of and ability to apply in practice the principles of circular economy, artificial intelligence, digitalisation of industry, and the ethical, environmental and commercial requirements and responsibilities of engineering activities;

29.4. Personal skills (decision-making, lifelong learning, cooperation and teamwork). A person must:

29.4.1. be able to work effectively independently and as part of a team, and to be a/the leader in a team that may include people from different professional backgrounds and skill levels;

29.4.2. be able to communicate fluently and professionally with the engineering community and the general public, both nationally and internationally, in correct Lithuanian and at least one foreign language;

29.4.3. be able to represent Engineering Sciences at national and international scientific events;

29.4.4. professionally understand the impact of engineering decisions on society and the environment, observe professional ethics and the norms of technological engineering practice, and understand the responsibility for engineering activities;

29.4.5. have the knowledge at the leadership level of project management and business aspects (risk and change management, production scale effect, etc.), as well as understand the links between technological solutions and their economic and social implications;

29.4.6. understand the importance of individual lifelong learning and continuous improvement.

30. The following additional knowledge and skills must be acquired upon completion of second cycle studies in Measurement Engineering:

30.1. Research skills and practical activities. A person must:

30.1.1. be able to investigate the applicability of new methods and approaches to the study of Measurement Engineering sciences, problem-solving methods and techniques in surveying, cartography and other interdisciplinary engineering fields;

30.1.2. have a thorough understanding of the methods and methodologies used and their limitations, and be able to select engineering equipment and software to solve engineering problems.

31. The following additional knowledge and skills must be acquired upon completion of second cycle studies in Civil Engineering:

31.1. Special (engineering analysis and design) abilities. A person must:

31.1.1. be able to analyse new and complex Civil Engineering products, processes and systems in a broader or interdisciplinary context, to select and apply the most appropriate and relevant methods from established or new and advanced analytical, computational and experimental methods, and to interpret the results of the analysis correctly;

31.1.2. be able to conceptualise on Civil Engineering products, processes and systems;

31.2. Research skills and practical activities. A person must:

31.2.1. comply with the standards and safety rules of the Civil Engineering practice;

31.2.2. possess the knowledge of the materials, equipment and tools used in Civil Engineering, engineering technology processes and limitations of their applicability;

31.2.3. have profound understanding of the methods and methodologies used and their limitations, and be able to select the appropriate engineering equipment and software;

31.2.4. have the knowledge of the principles of circular economy, artificial intelligence, the digitalisation of industry, and the ethical, environmental and commercial requirements and responsibilities of engineering.

32. The following additional knowledge and skills must be acquired upon completion of second cycle studies in Production Engineering:

32.1. A graduate must possess and be able to creatively apply modern knowledge of mathematics, mechanics, materials science, information technology, which is necessary for researching tasks in the study field of Production Engineering studies and developing new products or processes at the level required to achieve the learning outcomes;

32.2. A graduate must be able to develop and apply new processes, materials, equipment and/or organise and execute production projects from the generation of an idea to the introduction of a product/service to the market.

33. The following additional knowledge and skills must be acquired upon completion of second cycle studies in Transport Engineering:

33.1. A graduate must know and be able to creatively apply modern knowledge of mathematics, physical and/or technological sciences, mechanics, materials science and information technology necessary for the research of tasks in the study field of Transport Engineering and for the development of new products or processes, at least at the level required to achieve the learning outcomes set out for the study field of Transport Engineering;

33.2. Special (engineering analysis and design) abilities. A person must:

33.2.1. be able to solve unusual, poorly-defined and incompletely characterised problems in the development, investigation and design of Transport Engineering objects and systems;

33.2.2. be able to use their knowledge and understanding when dealing with transport engineering problems, as well as apply theoretical models and research methods, including mathematical analysis, numerical modelling, optimisation and experimental research methods;

33.2.3. be able to apply their knowledge and understanding of the design, development, operation and research of transport facilities and systems to solve non-standard problems, including those related to other fields of science and engineering study.

CHAPTER IV
TEACHING, LEARNING AND ASSESSMENT

34. Study methods must be effective and varied (case study, collaborative learning, group work, debate, diary, discussion, design-based thinking, film making, group project, idea mapping, individual project, challenge-based learning, concept mapping, consultative seminars, cooperative learning, workshops, guest lectures, laboratory work, modelling, lecture, experiential learning, problem-based learning, designing, reflective learning, seminar, simulation, observation, blog, research-based learning, problem solving, role-playing, etc.), the tasks of independent work must be linked to the study outcomes of the study programme and to the solving of the existing problems and must motivate the students; the time of the students and the teachers and the material resources must be used rationally (including libraries, laboratories, equipment and others), and the digital technologies of communication and information retrieval must be applied effectively.

35. The idea of lifelong learning must be promoted in the study process. The study process should be based on the design and problem-solving of real and currently existing systems, while its basis should be formed by an integrated application of interdisciplinary knowledge, including digital manufacturing principles, cloud manufacturing processes, the Internet of Things and augmented reality capabilities and business management systems. Students must be trained and encouraged to take responsibility for their own learning. The study programme, its curriculum and didactic system must motivate students to also use other possible resources and sources for their studies, and teachers must introduce innovations into the study process.

36. The limits of teachers' competences:

36.1. Teachers must be familiar with and understand the didactic concept of the study programme, their competence must meet the requirements of the study programme, and they must be able to construct the curriculum of a subject (module), basing it on the study programme of study to which the subject (module) belongs. They must base their lessons and tasks given to the students on the latest research, the concept of sustainability, circular economy, artificial intelligence and the digitalisation of production, have an understanding of the links between the study subject (module) and the fields of study of physical and/or technological, life sciences and mathematics and computer science, and an interdisciplinary approach to problem solving, be able to improve the content of teaching and studying, choose effective, student-oriented study methods and methods of assessing student achievements, develop more effective study methods, make recommendations to study programme developers for programme improvement, and be familiar with the requirements for accreditation of study fields;

36.2. Teachers, supervisors and examiners of study programmes in the field of Marine Engineering leading to the acquisition of the theoretical and practical knowledge and skills required for the certificate of competency as a watch-keeper or an electro-mechanic on board engine-powered ships with an engine power of 750 kW or more must be appropriately qualified and fulfil certain competence requirements for the training of seafarers and for activities carried out on board and/or ashore as laid down in the *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers* (1978).

37. The following methods and forms of study are recommended: traditional and interactive lectures, laboratory work, tasks for finding and summarizing information, case studies, problem analysis and solving exercises, individual and group projects, report presentation kits, as well as consultations and lecture videos and process animations if part of the studies is carried out remotely. The same methods may be applied to studies of different cycles, but, in the second cycle of study, their application must be based on more profound understanding of the content, more complex tasks, research work, expression of student autonomy and the like.

38. Studies, especially second cycle studies, must include research work, focus on industrial application and the development of transversal skills, and emphasize personal skills. Great attention must be paid to work dealing with the application of digital manufacturing principles, the implementation of cloud manufacturing processes, the Internet of Things, business management systems, and augmented reality. The didactic framework of the study programme must both encourage and create the prerequisites for the application of analytical, practical and transversal skills. It is recommended that this be implemented with the final thesis that is to be prepared during the final semester of studies, but it is up to each higher education institution and the study programme developers to decide how to take this into account for a given study programme.

39. It is recommended that students carry out their internship at an industrial enterprise or another research and study institution (at least 2/3 of the study credits), and, if it has the laboratories necessary for training (at most 2/3 of the study credits), the internship may be carried out in the same research and study institution. The internship must be organised in accordance with the higher education institution's description of the procedures for organising the internship, which must specify the requirements of the internship, the principles for the design of specific internship tasks and the system for assessing performance (including the methods and criteria for assessing the skills acquired by the student), and the support to be provided to the student during the period of internship. Additional internship requirements for study programmes in the group of study fields of Engineering Sciences are as follows:

39.1. In Marine Engineering study programmes which provide theoretical and practical knowledge and skills necessary to obtain a certificate of competency as a watch-keeper or an electro-mechanic for engine-powered vessels with an engine power of 750 kW or more, practical skills are taught and assessed through simulators, by selecting the simulator tasks and linking them as closely as possible to the tasks performed on board and the established procedures;

39.2. In the training of civil engineers, it is necessary to include teachers with practical experience (in design, construction technology and organisation, maintenance and expertise) who are involved in the study process and in the activities of construction companies;

39.3. During the course of study programmes in the field of Aeronautical Engineering which provide theoretical and practical knowledge and skills necessary for obtaining a professional licence, certificate of competency or their confirmation, practical skills are developed and evaluated by using real aircraft and/or simulators and other equipment required by the relevant legislation. When choosing tasks for students, teachers must take into account the relevant legislation in the field.

40. Short studies should be based on the application of knowledge and skills in practice and the development of general social and personal skills acquired through practical activities (internships, field trips, etc.).

41. Teachers can choose from a wide range of assessment methods, such as exams, colloquiums, computer-based testing, problem-solving analysis, reports, presentations, papers, laboratory reports, reports on coursework and final papers (defences), internship reports, project reports, learning records, self-assessment, peer assessment. Teachers must be aware of the methodological aspects of their application and be encouraged to explore new integrated assessment methods. Teachers have the right to choose the most appropriate assessment methods, while taking into account the size of the group of students, the assessment and educational objectives of the subject, the expected learning outcomes and other factors.

42. In assessing student performance, teachers must be guided by the principles of objectivity, clarity, impartiality, mutual respect, and goodwill. All the knowledge and skills described in the learning outcomes must be assessed in a way that would demonstrate that students possess this knowledge and skills. Students must receive timely feedback on the work they have done or projects they have prepared. Their assessment should be based on clear criteria and accompanied with constructive comments.

43. The assessment of student knowledge and skills must be clearly documented, reliable, and based on clearly formulated and predetermined criteria, while taking into account the conditions under which the work is to be carried out and the resources available, and allowing the higher education institution to be satisfied that the students completing the study programme have achieved the intended learning outcomes. Students must be given opportunities to participate in decisions regarding the ways and criteria for assessing the learning outcomes achieved, the quantity and volume of assignments.

CHAPTER V
REQUIREMENTS FOR THE IMPLEMENTATION OF STUDIES

44. The study programme must meet the requirements for study programmes set out in the Descriptor and other legal acts, be relevant, conform to the level of science and the study field, be constantly improved and updated, reflect the achievements of the scientific directions associated with the study field. Study programme implementers must ensure that the study programme includes the latest developments in the engineering industry and in Engineering Science, enabling students to achieve study results that meet the needs of the labour market, and topics that introduce students to innovations and prospects for the development of the study field while they are still studying.

45. The purpose of the study programme must be clear, and the results of the studies must be achievable, by reflecting the distinctiveness, specificity and scope of the programme, but, at the same time, it must also include the learning outcomes set out in the Descriptor. The structure of the study programme must correspond to the specifics of the study fields of Technological Studies, include concepts of design, drawing up of the specification, implementation of technological activities, development and maintenance, industrial digitization, and sustainable development.

46. Students must be provided with academic, psychological, social and financial support. The procedures and forms of support are governed by the higher education institution’s legislation on studies. Academic support for students is available in the following ways:

46.1. The administration must ensure that students have access to the advice they need;

46.2. Academic and administrative staff must encourage, motivate and engage students in academic and research activities;

46.3. Access must be provided to career counselling and support from an academic adviser;

46.4. The conditions must be suitable for students with special needs to be able to study;

46.5. Students must be able to organise cultural events on the premises of the higher education institution, and to set up and participate in student organisations or clubs.

47. The basis of study programmes shall be competent and qualified teachers. They need to know the subject matter, build on research results, understand the links and connections with other fields of study and research, and the possibilities of interdisciplinarity. Instructors who are licensed by the relevant competent authorities shall be used to achieve the specific objectives of study programme or subject (module) in the field of Aeronautical Engineering. The following general requirements apply to teachers, practitioners, and the quality implementation of the study programme:

47.1. Teaching at all study cycles is open to persons holding at least a Master's degree or equivalent higher education qualification;

47.2. At least half of the academic staff teaching in the relevant study field of Engineering Studies must hold a Master's degree or equivalent higher education qualification in that field of engineering studies;

47.3. Internship supervisors must have at least a Bachelor's degree and 3-year professional experience in the engineering sector, or a Master's degree and 1-year professional experience in the engineering sector, or a PhD degree. In colleges, students' practical activities (practical work, training, student internships, etc.) may be supervised by a person holding a Bachelor's or a Professional Bachelor's degree or higher;

47.4. All teachers of subjects in the study field must relate the subject matter to the problems of the relevant field of engineering studies, and illustrate their theoretical knowledge with examples of activities in that field;

47.5. Researchers teaching first cycle college study programmes must carry out research in the relevant field of engineering studies, publish their results in scientific publications and participate in national and international scientific and practical events. Teachers who have accrued extensive practical experience in the subject(s) they teach must renew their practical experience at least every five years by means of a two-month training or placement in a traineeship or refresher course, and, in the case of study programmes for the training of specialists in state-regulated professions, by means of work experience of an appropriate qualification related to the study subject they teach;

47.6. Researchers teaching first cycle study programmes at university must conduct research in the relevant field of engineering studies, publish their results in scientific journals and participate in national and international scientific events, and teachers of state-regulated specialities must have relevant work experience in a subject related to the qualification they teach. At least 10 per cent of the subjects (modules) in the second study cycle must be taught by professors. Where training and assessment of competence is carried out by using simulators, teachers must be adequately trained in simulator-based training and have practical experience of training and assessing students in the use and operation of the specific type of simulator;

47.7. Researchers teaching second cycle university study programmes possessing a Master's degree or a PhD degree must conduct research in the relevant field of engineering studies, publish their results in scientific journals, and participate in national and international scientific events. Teachers of state-regulated specialities must have accrued relevant work experience in the study subject they teach. At least 20 per cent of the subjects (modules) in the second study cycle must be taught by professors. Where training and assessment of competence is carried out by using simulators, trainers must be adequately trained in simulator-based training and have practical experience of training and assessing students in the use and operation of the specific type of simulator.

48. The Assessment Board for the evaluation of publicly defended final works (projects) must be composed of competent researchers in the study field, i.e., scholars, practising professionals, and representatives of stakeholders from various institutions.

49. The material and methodological facilities must be closely related to the study programme and meet the following minimum requirements:

49.1. Laboratories appropriate for the chosen study field of Engineering Sciences are essential for studies, and they must be equipped with both analytical and process research equipment. Analytical equipment is essential for product development and quality assurance studies, and, for that, bench-top equipment is used when investigating various processes;

49.2. The number, arrangement and layout of classrooms, laboratories, other study and independent work spaces, and the number of workstations in them must be appropriate to the needs of the studies and meet the requirements of occupational safety and hygiene. In order to assess the cost of technological systems and the rapid change of technology, it is recommended for higher education institutions to conclude cooperation or utilisation agreements with companies which can provide students with access to technological processes and equipment and allow them to acquire skills in working with such equipment;

49.3. The work of technical and administrative services must create favourable conditions for the development of students' practical skills and the individualization of the study programme;

49.4. Teaching materials and literature sources must be available in a library and/or electronic environment. Students must be given access to the software necessary to acquire practical skills during contact classes and when carrying out tasks independently.

50. For short studies, an internship in real-life work environment must make up at least one-third of the study programme.

51. Internships are an integral and compulsory part of first and second cycle studies. It must ensure that the practical skills set out in the study programme are achieved.

52. The second cycle of studies may include professional or scientific internship, depending on the nature of the study programme.

53. The process of internship must provide the conditions for practical learning by linking professional activity, education, and personal development.

54. Cooperation with the social partners is recommended when organising internships:

54.1. supervisors nominated by social partners are involved in the process of improving the content and organisation of internship tasks;

54.2. the higher education institution organises (if necessary) training for internship supervisors to ensure quality cooperation between the higher education institution and the enterprise or institution where the internship takes place and the integrity of the development of theory and practice;

54.3. the higher education institution must have internship agreements with domestic and/or foreign industrial companies with modern technological facilities and internship placements. If the higher education institution has the necessary technological or technical equipment and highly qualified staff to operate it, some or all of the professional internship can be carried out at the higher education institution.

55. Continuous improvement of studies is carried out through regular assessment of the labour market needs, surveys of students, graduates, employers, employees, and social partners.

_____