

Major learning outcomes	Description of learning outcomes Upon completion of his or her first-cycle studies in Technical Physics the graduate:	Reference to major learning outcomes in the area of physical sciences
KNOWLEDGE		
1) general knowledge (not directly related to engineering)		
K_W01	Knows mathematical methods essential for describing basic physical laws and solving problems related to technical physics including: basic concepts of differential and integral calculus, linear algebra and analytical geometry, statistics and numerical methods	Has knowledge of mathematics, physics, chemistry and other field-related areas useful for formulating and solving simple problems associated with the scope of his or her field of study T1A_W01
K_W02	Has basic knowledge of selected branches of chemistry essential for understanding basic physicochemical and technological processes	Has knowledge of mathematics, physics, chemistry and other field-related areas useful for formulating and solving simple problems associated with the scope of his or her field of study T1A_W01
		Has basic knowledge of fields of studies associated with his or her field of study T1A_W02
K_W03	Has well-established theoretical basic knowledge of experimental physics including mechanics, thermodynamics, fluid mechanics, electricity, magnetism and electromagnetism	Has well-established theoretical basic knowledge of key issues related to the scope of his or her field of study T1A_W03
K_W04	Knows and understands the basic structure of a quantum description and interpretation of physical phenomena	Has knowledge of mathematics, physics, chemistry and other field-related areas useful for formulating and solving simple problems associated with the scope of his or her field of study T1A_W01
		Has well-established theoretical basic knowledge of key issues related to the scope of his or her field of study T1A_W03
2) basic engineering knowledge		
K_W05	Knows selected computer-aided calculation and engineering design programs	Has basic knowledge of fields of studies associated with his or her field of study T1A_W02
		Knows basic methods, techniques, tools and materials used to solve simple engineering problems related to his or her field of study T1A_W07
K_W06	Knows principles of engineering graphics and technical drawing, also using CAD programs	Has basic knowledge of fields of studies associated with his or her field of study T1A_W02
		Knows basic methods, techniques, tools and materials used to solve simple engineering problems related to his or her field of study T1A_W07
K_W07	Has basic knowledge of technical	Has knowledge of mathematics, physics,

	mechanics, strength of materials and general principles of engineering constructions	chemistry and other field-related areas useful for formulating and solving simple problems associated with the scope of his or her field of study T1A_W01
		Has basic knowledge of fields of studies associated with his or her field of study T1A_W02
		Has basic knowledge of the lifespan of devices, facilities and technical systems T1A_W06
K_W08	Has basic knowledge of electrical power engineering, electronics, optics and automatic control enabling him or her to understand operation principles of measurement instruments and research equipment	Has basic knowledge of fields of studies associated with his or her field of study T1A_W02
		Has well-established theoretical basic knowledge of key issues related to the scope of his or her field of study T1A_W03
		Knows basic methods, techniques, tools and materials used to solve simple engineering problems related to his or her field of study T1A_W07
K_W09	Has basic knowledge of metrology, knows and understands methods of measuring physical quantities and analysing results of such measurement	Has well-established theoretical basic knowledge of key issues related to the scope of his or her field of study T1A_W03
		Knows basic methods, techniques, tools and materials used to solve simple engineering problems related to his or her field of study T1A_W07
K_W10	Knows and understands the process of developing and manufacturing simple mechanical, electronic and optical devices	Has basic knowledge of fields of studies associated with his or her field of study T1A_W02
		Has well-established theoretical basic knowledge of key issues related to the scope of his or her field of study T1A_W03
		Has detailed knowledge of selected issues related to his or her field of studies T1A_W04
		Knows basic methods, techniques, tools and materials used to solve simple engineering problems related to his or her field of study T1A_W07
3) knowledge closely related to solving engineering tasks		
K_W11	Has well-established and theoretical knowledge of the structure and function of nano- and micro-world objects	Has knowledge of mathematics, physics, chemistry and other field-related areas useful for formulating and solving simple problems associated with the scope of the field of study T1A_W01
		Has well-established theoretical basic knowledge of key issues related to the scope of his or her field of study T1A_W03
K_W12	Has detailed knowledge related to selected problems of analysing the functional materials and processes at the nanoscale	Has basic knowledge of fields of studies associated with his or her field of study T1A_W02

		Has detailed knowledge of selected issues related to his or her field of study T1A_W04
		Knows basic methods, techniques, tools and materials used to solve simple engineering problems related to his or her field of study T1A_W07
K_W13	Knows the current state of and is versed in the latest development trends in the area of nanotechnology, optoelectronics, bioelectronics, quantum engineering and computer simulations of physical processes	Has well-established theoretical basic knowledge of key issues related to the scope of his or her field of study T1A_W03
		Has basic knowledge of development trends in the area of science and scientific disciplines relevant to his or her field of study T1A_W05
K_W14	Is versed in high vacuum and low temperature techniques used to analyse mechanisms of physical, chemical and technological processes	Has detailed knowledge of selected issues related to his or her field of studies T1A_W04
		Has basic knowledge of development trends in the area of science and scientific disciplines relevant to his or her field of study T1A_W05
		Has basic knowledge of the lifespan of devices, facilities and technical systems T1A_W06
		Knows basic methods, techniques, tools and materials used to solve simple engineering problems related to his or her field of study T1A_W07
K_W15	Has basic knowledge of the operation and lifespan of measurement and research instruments and technical systems	Has basic knowledge of the lifespan of devices, facilities and technical systems T1A_W06
K_W16	Has basic knowledge essential for understanding social, economic, legal and nontechnical aspects of engineering, including radiological protection and environmental physics	Has basic knowledge essential for understanding social, economic, legal and nontechnical aspects of engineering T1A_W08
K_W17	Has elementary knowledge concerning the organisation, management and running a business as well as quality management	Has basic knowledge concerning management, including quality management, and running a business T1A_W09
		Knows general principles of creating and developing forms of individual entrepreneurship using knowledge of scientific branches and disciplines relevant to his or her field of study T1A_W11
K_W18	Knows basic economics terminology	Has basic knowledge essential for understanding social, economic, legal and nontechnical aspects of engineering T1A_W08
K_W19	Has basic knowledge of standards, patents and copyright law; knows and understands basic terminology and principles relating to protecting industrial and intellectual	Has basic knowledge essential for understanding social, economic, legal and nontechnical aspects of engineering T1A_W08

	property	Knows and understands basic terminology and principles related to industrial and intellectual property protection; is able to use patent information resources T1A_W10
K_W20	Has basic knowledge of technology transfer in relation to nanotechnology, computer simulation and research equipment	Knows and understands basic terminology and principles related to industrial and intellectual property protection; is able to use patent information resources T1A_W10
SKILLS		
1) general skills (not directly related to engineering)		
K_U01	Is able to use knowledge she or he has acquired to describe processes, create models, write down algorithms in the area of technical physics; is able to use analytical methods to formulate and solve problems in the area of measuring physical quantities	Is able to use information and communication techniques relevant to engineering tasks T1A_U07
		Is able to use analytical, simulation and experimental methods to formulate and solve engineering problems T1A_U09
K_U02	Is able to extract information from the literature, databases and other sources, interpret it and draw conclusions, formulate and justify opinions	Is able to extract information from the literature, databases and other properly selected sources, also in English or another foreign language of international communication in the area of his or her field of study, is able to integrate obtained information, interpret it, draw conclusions and formulate and justify opinions T1A_U01
		Has language skills at B2 level related to scientific branches and disciplines relevant to his or her field of study, in accordance with requirements set for level B2 Common European Framework of Reference for Languages T1A_U06
K_U03	Is able to plan and arrange self-education process	Is able to plan and arrange self-education process T1A_U05
K_U04	Is able to prepare and give an oral presentation in Polish and in a foreign language and a well-documented treatise regarding specific problems related to technical physics	Is able to extract information from the literature, databases and other properly selected sources, also in English or another foreign language of international communication in the area of his or her field of study, is able to integrate obtained information, interpret it, draw conclusions and formulate and justify opinions T1A_U01
		Is able to communicate using various techniques in professional and other contexts T1A_U02
		Is able to prepare a well-documented treatise of problems related to his or her field of study in Polish and a foreign language recognised as primary for scientific branches and disciplines relevant to his or her field of study T1A_U03

		Is able to prepare and deliver an oral presentation in Polish and a foreign language concerning detailed issues related to his or her field of study T1A_U04
		Has language skills at B2 level related to scientific branches and disciplines relevant to his or her field of study, in accordance with requirements set for level B2 Common European Framework of Reference for Languages T1A_U06
K_U05	Is able to work both individually and in a team, manage his or her time, undertake and fulfil his or her commitments	Is able to plan and arrange self-education process T1A_U05
K_U06	Is able to prepare a schedule of technical and experimental activities and manage their implementation carried both on his or her own or as a team	Is able to communicate using various techniques in professional and other contexts T1A_U02
		Is able to plan and carry out experiments, including computer measurements and simulations, interpret results he or she has obtained and draw conclusions T1A_U08
		Is able to discern the system and nontechnical aspects when formulating and solving engineering problems T1A_U10
		Is prepared for working in an industrial environment and knows safety rules related to that work T1A_U11
		Is able to carry out initial economic analysis of undertaken engineering activities T1A_U12
2) basic engineering skills		
K_U07	Is able to draw and measure basic elements of engineering structures	Is able to use analytical, simulation and experimental methods to formulate and solve engineering problems T1A_U09
		Is able to identify and formulate a specification of simple practical engineering problems relevant to his or her field of study and choose and use the appropriate method and tools T1A_U14
		is able to evaluate usefulness of routine methods and tools for solving a simple engineering problem relevant for his or her field of engineering, and choose and use the appropriate method and tools T1A_U15
K_U08	Is able to carry out simple calculations for strength of engineering structure elements	Is able to use analytical, simulation and experimental methods to formulate and solve engineering problems T1A_U09
		Is able to identify and formulate a specification of simple practical engineering problems relevant to his or her field of study and choose and use the appropriate method and tools T1A_U14
		is able to evaluate usefulness of routine methods and tools for solving a simple

		engineering problem relevant to his or her field of engineering, and choose and use the appropriate method and tools T1A_U15
K_U09	Is able to make correct use of standard analytical tools, including numerical and calculation ones, to solve detailed physical and technical problems; is able to make a critical evaluation of results of such analysis	Is able to use information and communication technologies to carry out engineering tasks T1A_U07
		Is able to plan and carry out experiments, including computer measurements and simulations, interpret results he or she has obtained and draw conclusions T1A_U08
		Is able to use analytical, simulation and experimental methods to formulate and solve engineering problems T1A_U09
		Is able to identify and formulate a specification of simple practical engineering problems relevant to his or her field of study and choose and use the appropriate method and tools T1A_U14
		is able to evaluate usefulness of routine methods and tools for solving a simple engineering problem relevant to his or her field of engineering, and choose and use the appropriate method and tools T1A_U15
K_U10	Is able to use selected computer aided design programs; is able to design selected elements and simple mechanical, electronic and measurement equipment structures	Is able to use information and communication technologies to carry out engineering tasks T1A_U07
		Is able to use analytical, simulation and experimental methods to formulate and solve engineering problems T1A_U09
		Is able to identify and formulate a specification of simple practical engineering problems relevant to his or her field of study and choose and use the appropriate method and tools T1A_U14
		Is able to evaluate usefulness of routine methods and tools for solving a simple engineering problem relevant to his or her field of engineering, and choose and use the appropriate method and tools T1A_U15
K_U11	Is able to use a foreign language to communicate, read and understand specialist texts related to technical physics, containing elements of technical language	Has language skills at B2 level related to scientific branches and disciplines relevant to his or her field of study, in accordance with requirements set for level B2 Common European Framework of Reference for Languages T1A_U06
		Is able to use information and communication technologies to carry out engineering tasks T1A_U07
K_U12	Knows the principles of job organisation; obeys health and safety regulations	Is able to plan and carry out experiments, including computer measurements and simulations, interpret results he or she has obtained and draw conclusions T1A_U08
		Is prepared for working in an industrial

		environment and knows safety rules related to that work T1A_U11
K_U13	Is able to carry out initial economic analysis of undertaken engineering activities and assess their labour intensity	Is able to discern the system and nontechnical aspects when formulating and solving engineering problems T1A_U10
		Is able to carry out initial economic analysis of undertaken engineering activities T1A_U12
3) skills closely related to solving engineering tasks		
K_U14	Is able to identify a technical problem and propose a scheme of its analysis and/or its solution detailing its essential physicochemical aspects	Is able to carry out critical analysis of the way in which existing technical solutions, especially devices, facilities, systems, processes and services function, and evaluate them, particularly in relation to his or her field of study T1A_U13
		Is able to identify and formulate a specification of simple practical engineering problems relevant to his or her field of study and choose and use the appropriate method and tools T1A_U14
		is able to evaluate usefulness of routine methods and tools for solving a simple engineering problem relevant to his or her field of engineering, and choose and use the appropriate method and tools T1A_U15
K_U15	Is able to operate standard experimental infrastructure equipment: mechanical, electrical, cryogenic, vacuum, pressure, laser, radiological devices; is able to correctly define requirements concerning the infrastructure in technical language and in accordance with health and safety rules	Is able to plan and carry out experiments, including computer measurements and simulations, interpret results he or she has obtained and draw conclusions T1A_U08
		Is prepared for working in an industrial environment and knows safety rules related to that work T1A_U11
		Is able to evaluate usefulness of routine methods and tools for solving a simple engineering problem relevant to his or her field of engineering, and choose and use the appropriate method and tools T1A_U15
K_U16	Is able to develop and use software controlling simple measurement systems using standard devices and modules	Is able to carry out critical analysis of the way in which existing technical solutions, especially devices, facilities, systems, processes and services function, and evaluate them, particularly in relation to his or her field of study T1A_U13
		Is able to identify and formulate a specification of simple practical engineering problems relevant to his or her field of study and choose and use the appropriate method and tools T1A_U14
		is able to evaluate usefulness of routine methods and tools for solving a simple engineering problem relevant to his or her

		field of engineering, and choose and use the appropriate method and tools T1A_U15
		Is able to design and develop a simple device, facility, system or process relevant to his or her field of study using appropriate methods, techniques and tools, according to provided specification T1A_U16
K_U17	Is able to plan and carry out standard measurement, analyse and record results of research concerning classic and quantum physical phenomena at the macro-, micro- and nanoscale; is able to identify and assess the importance of basic factors disturbing a measurement	Is able to use information and communication technologies to carry out engineering tasks T1A_U07
		Is able to plan and carry out experiments, including computer measurements and simulations, interpret results he or she has obtained and draw conclusions T1A_U08
		Is able to use analytical, simulation and experimental methods to formulate and solve engineering problems T1A_U09
		Is able to evaluate usefulness of routine methods and tools for solving a simple engineering problem relevant to his or her field of engineering, and choose and use the appropriate method and tools T1A_U15
K_U18	Is able to select materials which have appropriate physicochemical and structure properties for laboratory and engineering uses	Is able to extract information from the literature, databases and other properly selected sources, also in English or another foreign language of international communication in the area of his or her field of study, is able to integrate obtained information, interpret it, draw conclusions and formulate and justify opinions T1A_U01
		Is able to carry out critical analysis of the way in which existing technical solutions, especially devices, facilities, systems, processes and services function, and evaluate them, particularly in relation to his or her field of study T1A_U13
		Is able to evaluate usefulness of routine methods and tools for solving a simple engineering problem relevant to his or her field of engineering, and choose and use the appropriate method and tools T1A_U15
K_U19	Is able to carry out computer modelling and simulations of basic physical phenomena and technical processes using standard software	Is able to plan and carry out experiments, including computer measurements and simulations, interpret results he or she has obtained and draw conclusions T1A_U08
		Is able to use analytical, simulation and experimental methods to formulate and solve engineering problems T1A_U09
K_U20	Is able to configure basic measurement systems, technical and research diagnosis systems from functional modules and components	Is able to carry out critical analysis of the way in which existing technical solutions, especially devices, facilities, systems, processes and services function, and

		evaluate them, particularly in relation to his or her field of study T1A_U13
		Is able to identify and formulate a specification of simple practical engineering problems relevant to his or her field of study and choose and use the appropriate method and tools T1A_U14
		Is able to evaluate usefulness of routine methods and tools for solving a simple engineering problem relevant to his or her field of engineering, and choose and use the appropriate method and tools T1A_U15
		Is able to design and develop a simple device, facility, system or process relevant to his or her field of study using appropriate methods, techniques and tools, according to provided specification T1A_U16
K_U21	Is able to prepare a technical specification of basic measurement systems, research systems and technical diagnosis systems based on phenomena related to various branches of physics, using standard computer-aided design tools	Is able to use information and communication technologies to carry out engineering tasks T1A_U07
		Is able to identify and formulate a specification of simple practical engineering problems relevant to his or her field of study and choose and use the appropriate method and tools T1A_U14
		Is able to evaluate usefulness of routine methods and tools for solving a simple engineering problem relevant to his or her field of engineering, and choose and use the appropriate method and tools T1A_U15
K_U22	Is able to express achievements in physics described in the literature in technical language	Is able to extract information from the literature, databases and other properly selected sources, also in English or another foreign language of international communication in the area of his or her field of study, is able to integrate obtained information, interpret it, draw conclusions and formulate and justify opinions T1A_U01
K_U23	Is able to discern the social, economic and legal aspects when formulating and solving engineering problems	Is able to discern the system and nontechnical aspects when formulating and solving engineering problems T1A_U10
K_U24	Is able to use databases that use standard software	Is able to use information and communication technologies to carry out engineering tasks T1A_U07
ATTITUDES		
K_K01	Is able to work responsibly on task assigned to him or her both on his or her own and as part of a team, assuming various roles	Is able to cooperate and work in a team, assuming various roles T1A_K03
		Is able to identify priorities correctly in order to carry out a task defined by him or her or others T1A_K04

		Is able to properly identify and settle dilemmas related to the job he or she does T1A_K05
K_K02	Follows the rules of professional ethics, is responsible for the reliability of results obtained in his or her work and their interpretation, and the assessment of work done by others	Is aware of the importance of and understands nontechnical aspects and results of engineering, including its environmental impact, and responsibility for the decisions taken in relation to this T1A_K02
		Is able to properly identify and settle dilemmas related to the job he or she does T1A_K05
K_K03	Understands the need of and opportunities for continuous self-improvement (first- and second-cycle studies, postgraduate studies) – raising his or her professional, personal and social competences	Understands the need of life-long learning; is able to inspire and organise other people's learning process T1A_K01
K_K04	Is aware of the need of taking care of his or her health and physical fitness	Understands the need of life-long learning; is able to inspire and organise other people's learning process T1A_K01
K_K05	Is responsible for his or her own safety at work and that of his or her team	Is able to cooperate and work in a team, assuming various roles T1A_K03
		Is able to identify priorities correctly in order to carry out a task defined by him or her or others T1A_U04
		Is able to properly identify and settle dilemmas related to the job he or she does T1A_U05
K_K06	Is aware of the importance of and understands nontechnical aspects and results of engineering, including its environmental impact, and responsibility for the decisions taken in relation to this	Is aware of the importance of and understands nontechnical aspects and results of engineering, including its environmental impact, and responsibility for the decisions taken in relation to this T1A_K02
K_K07	Is able to identify priorities correctly in order to carry out a task defined by him or her or others; is aware of the importance of behaving in a professional manner; is aware of responsibility for jointly realised tasks associated with teamwork	Is able to identify priorities correctly in order to carry out a task defined by him or her or others T1A_K04
		Is able to cooperate and work in a team, assuming various roles T1A_K03
K_K08	Is able to think and act in a creative and entrepreneurial manner	Is able to think and act in a creative and entrepreneurial manner T1A_K06
K_K09	Is aware of the social role of technical university graduates, and especially understands the need of informing the society about new developments, information and opinions in the field of technical physics and other aspects of engineering	Understands the need of life-long learning; is able to inspire and organise other people's learning process T1A_K01
		Is aware of the social role of technical university graduates, and especially understands the need of informing the society (especially through mass-media) about new developments, information and opinions in the field of technology and other

		aspects of engineering; attempts to present the information and opinions in a commonly understandable manner T1A_K07
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