1. General characteristics of the studies

Name of the field of study (major)	**Physics**
Level of education (first-cycle studies / second-cycle studies / long-cycle master's degree studies)	first-cycle studies
Education profile (general academic/practical)	general academic
Form of studies full-time/part-time	full-time
Indication of the fields of science and scientific disciplines or fields of art and artistic disciplines to which the learning outcomes apply (including the leading discipline) and determining the percentage of the number of ECTS points for the respective disciplines in the number of ECTS points necessary to obtain qualifications corresponding to the level of education	field of exact and natural sciences discipline: physical sciences, 100% ECTS
Indication of the professional title awarded to graduates	licencjat
Information about the scientific category held by the basic organizational unit of the University	Faculty of Physics and Astronomy category B+

2. Indicating the connection between the field of study and the mission of the University and its development strategy

The education of students in the field of Physics is directly related to the mission and development strategy of the University and the faculty, and in particular it refers to the activities listed below.

Entry in the Statutes of the University of Zielona Góra:
§ 4
1. The basic directions of the University's activities are: conducting scientific research in the field of humanities, social sciences, art, economics, technology, mathematics and natural sciences; educating students and doctoral students and popularising science, art and culture.
2. Education, upbringing and popularising science, art and culture are particularly reflected in: 1) strengthening respect for truth and conscientious work as well as fostering an atmosphere of kindness in the academic environment, 2) training staff capable of independent scientific work and teaching, as well as artistic and economic activity, 3) supplementing the general and specialist knowledge of people with professional titles and performing practical professions, 4) developing and popularising the national culture and technical progress, 5) shaping the personality of students in the spirit of respect for human rights, democracy and patriotism characterized by responsibility for the society and the state, 6) caring for the health and physical development of students, 7) cooperating with other institutions in spreading

knowledge in the society and in other projects for the benefit of the regional community.
3. The University remains faithful to academic traditions and customs, relies on them in situations not regulated by law, and fulfils its goals and tasks with respect for human dignity.
4. The University is guided in its activities by the principles consistent with the Charter of European Universities.
§5
1. The University supports the individualisation of student education.
The development strategy of the Faculty of Physics and Astronomy:
1. Undertaking activities to obtain the A scientific category by the Faculty of Physics and Astronomy.
2. Creating conditions conducive to obtaining further academic degrees.
3. Supporting scientific research conducted at the Faculty. Assisting in applying for and implementing scientific grants.
4. Expanding the educational offer. Conducting classes in English. Improving the quality of education.

3. Description of competencies expected from the candidate applying for admission to first-cycle studies, second-cycle studies or long-cycle master's degree studies

Knowledge and skills in the field of Physics, mathematics and foreign languages at the secondary school level.

4. Analysis of the compliance of the assumed learning outcomes with the needs of the labour market

The knowledge and skills acquired by Physics graduates are adapted to the needs of the modern labour market in relation to science, industry and public services. In particular, the graduate of first-cycle studies in Physics:
- demonstrates general knowledge of Physics based on thorough foundations of mathematical and natural sciences,
- shows the ability to understand and precisely describe physical phenomena occurring in the Universe, use modern measuring equipment and technical diagnostic systems,
- knows how to collect, process and transmit information,
- knows a foreign language at the B2 level of proficiency of the Common European Framework of Reference for Languages of the Council of Europe and is able to use technical language within the scope of physical sciences,
- the graduate is prepared to work in research, research and development and diagnostic laboratories,
- displays the necessary competences to operate and supervise devices whose operation requires basic knowledge of Physics.
- demonstrates specialist knowledge in the selected specialisation.

Graduates of the medical Physics specialization are prepared to work in healthcare units, development centres and research institutions.

Graduates of the teaching Physics specialisation are prepared to teach Physics in primary schools. Graduates are qualified to teach Physics in primary and secondary schools after completing the first and second cycle studies in Physics, specializing in teaching Physics, in accordance with the Regulation of the Minister of Science and Higher Education of July 25, 2019 on the standard of education required for the teaching profession.

The graduate is prepared to undertake second-cycle studies.

5. Description of methods for verifying and assessing the learning outcomes achieved by the student during the entire educational process

Subjects included in the programme of study for Physics end with an exam, a credit with a grade or a credit without a grade. The procedure, rules for obtaining credits, examinations and appeals against the grade suggested by the teacher in charge of the class are specified in the STUDY REGULATIONS of the University of Zielona Góra.

The general principles of verification of learning outcomes are presented in point 1.4, the detailed verification methods for individual modules are listed in the description of the modules (syllabi).

6. Programme of study for the field of study, profile and level of education including:

1.1 Description of expected learning outcomes with the assignment of the field of study to the fields of science and scientific disciplines or the fields of art and artistic disciplines to which the learning outcomes for this field apply.

Symbol	Learning outcomes for the course of study PHYSICS. After completing undergraduate studies in PHYSICS undergraduate:	Reference of learning outcomes in education in science
	KNOWLEDGE	
K1A_W01	Has general knowledge of classical and modern physics, measuring methods of physics and astronomy, which allows to understand the fundamental physical phenomena of the surrounding world, knows the causal links between them.	P6S_WG-O1 P6S_WK-O2.1
K1A_W02	Has sufficient knowledge of linear algebra and geometry, mathematical analysis and mathematical methods in physical sciences to allow quantitative description, understanding and modeling of physical problems with a medium level of complexity, in particular, knows matrix calculus, vector analysis, differential and integral calculus of functions of one and several variables	P6S_WG-O1
K1A_W03	Understands and can explain descriptions of phenomena and processes in physical sciences using the language of mathematics, can independently restore the claims and the laws of physics and selected calculations; is able to create a theoretical model of the phenomenon and relate it with the measurement's results	P6S_WG-O1

K1A_W04	Has general knowledge of computer techniques involving work in Linux operating system, has knowledge of other operating systems, knows databases, tools for analysis, processing and presentation of data, uses programming as a tool for solving problems in the field of physical sciences, mathematics and technology and modern applications of information technology	P6S_WG-O1
K1A_W05	Knows the basic aspects of the design and principles of working with equipment used in the physical sciences, can measure a physical quantity and interpret it	P6S_WG-O1
K1A_W06	Knows the basic principles of health and safety, recognizes hazards and selects the appropriate security measures to prevent them	P6S_WK-O2.2
K1A_W07	Has basic knowledge of the legal and ethical issues of scientific and educational activities	P6S_WK-O2.2
K1A_W08	Has basic knowledge of copyright, intellectual property protection, using the appropriate licenses and rights for scientific personal and commercial activity	P6S-WK-O2.2
K1A_W09	Is able to identify and select appropriate free software (alternative to commercial one) and tools of IT to enable and support the development of individual entrepreneurship and identify and characterize areas of its application in the physical sciences and technology	P6S_WK-O2.3
K1A_W10	Knows at least one foreign language at the intermediate level (B2)	P6S_WG-O1
	SKILLS	
K1A_U01	Is able to analyze and solve problems in the physical sciences, basing on acquired knowledge and information from available literature, databases, online resources in both and foreign languages	P6S_UW-O3 P6S_UK-O4.3
K1A_U02	Is able to perform the analysis of theoretical and experimental results, and on this basis to formulate appropriate conclusions	P6S_UW-O3 P6S_UK-O4.1
K1A_U03	Applies the methodology of physical measurements, can plan and carry out simple physical measurements, analyze measurement data, interpret and present the results of measurements	P6S_UW-O3 P6S_UK-O4.1 P6S_UK-O4.2 P6S_UO-O5.1 P6S_UO-O5.2
K1A_U04	Is able to work at Linux user level, can move in the system directory using the desktop and console, uses standard tools of Linux system, finds, evaluates and uses Open Source software to solve problems in the physical sciences	P6S_UW-O3
K1A_U05	Can discuss topics presenting a specific physical problem and provide its possible solutions	P6S_UW-O3

K1A_U06	Can talk about topics in the physical sciences using comprehensible simple language	P6S_UK-O4.1 P6S_UK-O4.2
K1A_U07	Can independently acquire knowledge and develop own skills using a variety of sources (in Polish and foreign languages) and modern technology	P6S_UK-O4.3 P6S_UU-O6 P6S_UO-O5.1
K1A_U08	Has the ability to prepare typical works written in Polish and foreign language from the physical sciences, using basic theoretical issues, as well as a variety of sources	P6S_UK-O4.1 P6S_UK-O4.3
K1A_U09	Has the ability to prepare oral presentations, in Polish and a foreign language, using basic theoretical approaches, as well as a variety of sources	P6S_UK-O4.1 P6S_UK-O4.2 P6S_UK-O4.3
K1A_U10	Has language skills in the physical sciences in accordance with the requirements for level B2 of the Common European Framework of Reference for Languages	P6S_UK-O4.3
	SOCIAL COMPETENCE	
K1A_K01	Is aware of own knowledge and skills, understands the need and knows the possibilities of continuous further education (studies of the second and third cycles, post-graduate studies) - raising professional and personal competences	P6S_KK-O7.1 P6S_KK-O7.2
K1A_K02	Is aware of the responsibility for own work and willing to comply with the principles of teamwork and responsible for the common tasks performed	P6S_KR-O9
K1A_K03	Is conscious of the importance of behaving in a professional manner, the principles of ethics and respect for diversity of views	P6S_KR-O9
K1A_K04	Understands the need to raise professional and personal competences; uses various sources of information in order to broaden and deepen own knowledge	P6S_KK-O7.1 P6S_KK-O7.2
K1A_K05	Is aware of the social role of a graduate in physics, and especially understands the need for formulating and providing the public with information and opinions on developments in the physical sciences, makes efforts to provide such information and opinions in a commonly understood manner	P6S_KO-O8.1 P6S_KO-O8.2
K1A_K06	Is able to think and act in an entrepreneurial way	P6S_KO-O8.3

REFERENCE TO POLISH QUALIFICATIONS FRAMEWORK LEVEL 6 DESCRIPTORS

First-cycle programme

Learning outcome category	Qualification code	Qualifications	Reference to learning outcomes

KNOWLEDGE (W)	**Knowledge: the graduate knows and understands**		
	P6S_WG-O1	The graduate has profound knowledge of selected facts, objects, phenomena, as well as methods and theories explaining the complex interrelationships between them, constituting basic general knowledge of scientific or artistic discipline and forming the theoretical basis, as well as detailed knowledge of selected issues – specific for the programme, and in the case of practical courses – the graduate knows practical applications of this knowledge in professional activity related to their field of study	K_W02, K_W03, K_W04, K_W05, K_W06, K_W07, K_W08, K_W09
	P6S_WK-O2.1	The graduate knows fundamental dilemmas of contemporary civilization	K_U02, K_U09.
	P6S_WK-O2.2	The graduate knows basic economic, legal and other conditions of various types of activities related to the given qualification, including basic concepts and principles of industrial property protection and copyright law	K_W01, K_W11
	P6S_WK-O2.3	The graduate knows basic principles of creation and development of various forms of entrepreneurship	
	Skills: the graduate can		
SKILLS (U)	P6S_UW-O3	The graduate can use their knowledge - formulate and solve complex and unusual problems and perform tasks in conditions that are not fully predictable by: − proper selection of sources and information, evaluation, critical analysis and synthesis of information, − selection and application of appropriate methods and tools, including advanced information and communication techniques	K_W08, K_W09, K_U01, K_U02, K_U03, K_U04, K_U05, K_U06, K_U07, K_U08
	P6S_UK-O4.1	The graduate can communicate with the environment using specialized terminology	K_U09
	P6S_UK-O4.2	The graduate can take part in a debate - present and evaluate different opinions and positions and discuss them	K_K02, K_K04
	P6S_UK-O4.3	The graduate can use a foreign language at B2 level of the Common European Framework of Reference for Languages	K_W10, K_K06
	P6S_UO-O5.1	The graduate can plan and organise individual and team work	K_U02, K_U03, K_U04, K_K03

P6S_UO-O5.2	The graduate can cooperate with other people as part of teamwork (also of an interdisciplinary nature)	K_K03
P6S_UU-O6	The graduate can independently plan and implement their own lifelong learning	K_U03, K_U04, K_U10, K_K02
Social competencies: the graduate is ready to		
P6S_KK-O7.1	The graduate is ready to critically assess their knowledge and received content	K_U09, K_K01, K_K02
P6S_KK-O7.2	The graduate is ready to recognize the importance of knowledge in solving cognitive and practical problems and seek expert opinions if the graduate is unable to solve a problem independently	K_U10, K_K01, K_K02 K_K03
P6S_KO-O8.1	The graduate is ready to fulfil social obligations, co-organize activities for social environment;	K_K04, K_K05
P6S_KO-O8.2	The graduate is ready to initiate actions in the public interest;	K_K04, K_K05
P6S_KO-O8.3	The graduate is ready to think and act resourcefully	K_K04
P6S_KR-O9	The graduate is ready to perform professional roles, which includes being able to: − comply with the rules of professional ethics and require others to do so, − care for the achievements and traditions of the profession	K_K03, K_K07

1.2 Indicators regarding the study programme

Indicators regarding the study programme in the assessed field of study, level and profile of education	
The number of ECTS points necessary to obtain qualifications corresponding to the level of education	180
The number of semesters necessary to obtain qualifications corresponding to the level of education	6
The number of ECTS points assigned to teaching activities requiring direct participation of academic teachers and students	91 (51%)

The number of ECTS points assigned to modules of classes related to scientific research in the field/fields of science/art relevant to the assessed field of study, serving the student to acquire in-depth knowledge and skills in conducting scientific research (for a field with a general academic profile)	111 92 – Teaching Physics Specialisation
The number of ECTS points assigned to modules of classes related to practical vocational preparation aimed at acquiring practical skills and social competences by the student (for fields with a practical profile)	not applicable
The number of ECTS points assigned to courses in the field of humanities or social sciences (in the case of fields of study assigned to fields other than humanities or social sciences, respectively)	5
The number of ECTS points assigned to elective subjects/modules	75 (42%)
The number of ECTS points assigned to vocational practice and the number of hours of vocational practice (if the study programme provides for vocational practice)	5, 60 h
The number of hours of physical education classes - in the case of full-time first-cycle studies and long-cycle master's degree studies	60

Course modules related to scientific research in the field of science or art related to the field of study, helping the student to acquire in-depth knowledge and skills in conducting scientific research			
Name of the class module	Form/forms of classes	Total number of hours	Number of ECTS points
Core subjects common to all specialisations			
Measurement Theory		30	2
Physical Laboratory 1 - Mechanics, Thermodynamics		45	4
Physical Laboratory 1 - Electricity and Magnetism		45	4
Physical Laboratory I - Optics, Modern Physics		45	4
Computer Data Collection and Processing		30	2
Introduction to Physics and Higher Mathematics		30	2
Classical and Relativistic Mechanics		60	6
Introduction to Quantum Physics		60	6
Electrodynamics		60	6
The Structure of Matter		60	6
Mathematical Methods of Physics		60	6
Introduction to Geophysics		45	3
Undergraduate Seminar		30	5
Monographic Lecture		30	4
Vocational Practice		-	5
Diploma Paper		-	8
	Total:	**630**	**73**
Specialisation: Computer Physics			

Numerical Methods		60	4
Object-Oriented Programming		60	6
Algorithms and Data Structures		60	5
Computer Measurement Systems		45	3
Data Analysis Methods		45	4
Modelling Phenomena in Nature		60	5
Signal Analysis		60	6
Introduction to Computer Simulations		75	7
	Total:	**465**	**40**
Specialisation: Computer Astrophysics			
Astronomical Instruments		60	4
Introduction to the Analysis of Astrophysical Time		30	3
Physics of Stars and Dispersed Matter		60	6
Scientific Calculations and Numerical Methods		45	3
Observation Methods and Data Analysis in Observational Astrophysics		60	6
Elements of Spherical Astronomy and Astrometry		60	6
Introduction to Celestial Mechanics and the Solar		60	5
Star Systems, Structure of the Universe and		60	5
Introduction to Astrophysics of Compact Objects		30	2
	Total:	**465**	**40**
Specialisation: General Physics			
Algebraic and Geometric Methods in Physics 2		45	4
Differential Equations in Physics		60	5
General Chemistry		45	3
Vibrations and Waves		30	3
Introduction to Electronics		45	4
Elements of Modern Physics		30	3
Physics in Nature		60	5
Physics Laboratory		60	6
History of Physics		30	2
Probability and Statistics		45	5
	Total:	**450**	**40**
Specialisation: Teaching Physics			
General Chemistry with Laboratory		45	4
History of Physics		30	3
Physics-Related Experiment in School Practice - Primary School		30	3
Working with an Exceptionally Gifted Student		30	2
Physics Teaching in Primary Schools		45	3
Mid-Year Vocational Practice in Primary School		30	2
Introduction to Teaching Methodology		30	2
	Total:	**240**	**19**
Specialisation - Medical Physics:			
Introduction to Medical Statistics		60	4
Introduction to Biology and Medical Biology		30	3
Introduction to Emergency Medicine		30	4
Biophysics with Elements of Biochemistry		60	4
Biophysical and Biochemical Laboratory		30	3
Signal Analysis		60	5
Nuclear Physics in Nuclear Medicine		60	4
Instrumentation, Imaging and Medical Diagnostics		60	6

Practical Methods of Medical Imaging - Cardiac Therapy	30	3
Physicochemical Foundations of Biological Life	30	3
Radiological Protection	15	1
Total:	**465**	**40**
Total:		
Specialisation: Computer Physics	**1095**	**113 (63%)**
Specialisation: Computer Astrophysics	**1095**	**113 (63%)**
Specialisation: General Physics	**1080**	**113 (63%)**
Specialisation: Teaching Physics	**870**	**92 (51%)**
Specialisation: Medical Physics	**1095**	**113(63%)**

General academic profile *– includes classes related to scientific activities conducted at the University in the discipline or disciplines to which the field of study is assigned, in an amount greater than 50% of the number of ECTS points and takes into account students' involvement in classes preparing to conduct scientific activities or participation in these activities.*

Class modules to elect			
Name of the class module	Form/forms of classes	Total number of	Number of ECTS
Core subjects common to all specialisations			
Foreign Language		120	8
Physical Education		60	0
Humanities Subject Elective		30	3
Social Science Elective		15	2
Undergraduate Seminar		30	5
Monographic Lecture		30	4
Vocational Practice		-	5
Diploma Paper		-	8
	Total:	**285**	**35**
Specialisation subjects (total)			
Specialisation: Computer Physics		465	40
Specialisation: Computer Astrophysics		465	40
Specialisation: General Physics		450	40
Specialisation: Teaching Physics		540	40
Specialisation: Medical Physics		465	**40**
	Total:		
	Specialisation: Computer Physics	**750**	**75**
	Specialisation: Computer Astrophysics	**750**	**75**
	Specialisation: General Physics	**735**	**75**
	Specialisation: Teaching Physics	**825**	**75**
	Specialisation: Medical Physics	**750**	**75**
			42%

The study programme allows the student to choose classes that are assigned ECTS points of no less than 30% of the number of ECTS points.

1.3 Classes or groups of classes – with the assignment of learning outcomes to each

module and the programme content, forms and methods of education ensuring the achievement of these outcomes, as well as the number of ECTS points (*syllabi*);

Electronic form, SylabUZ.

1.4 Methods of verifying and assessing the student's achievement of the expected learning outcomes;

Tests and examinations are administered in an oral or written form.

Learning outcomes are verified through assessments during classes and summative assessments at their end. The ongoing verification of the learning outcomes of the respective subjects is carried out orally or in writing - in the form of quizzes. This applies to learning outcomes related to preparation for classes or to learning outcomes related to previous classes. During laboratory exercises, the method of conducting the experiment, collecting measurement results, processing the obtained results and presenting conclusions is assessed. Studies on learning outcomes related to exercises or laboratory exercises are also planned.

The explanation on how to check learning outcomes for specific subjects is provided in their description.

The diploma paper and diploma examination constitute the verification of the student's achievement of all expected learning outcomes. The condition for taking the diploma examination is passing the courses provided for in the study plan and the preparation and positive assessment of one's master's thesis. The detailed rules regarding diploma papers are described in the Study Regulations of the University of Zielona Góra.

The diploma examination is conducted orally. The bachelor's level exam (licencjat) covers general issues related to the basics of Physics and the content included in the diploma thesis. The scope of the exam is outlined on the notice board of the Institute of Physics. The student participating in the exam should demonstrate the ability to analyse and synthesize the phenomena examined in the diploma thesis, as well as the ability to draw conclusions and generalize. The final grade is determined based on the grade from the diploma thesis, the grade from the exam and the average grade from the course of studies.

1.5 Study programme including course modules;

The study programme is presented in the Annex.

1.6 The scope, rules and form of vocational practice (*vocational practice for a field with a practical profile of the first cycle and long-cycle master's studies lasts 6 months - 720 hours, while for the second cycle – it is 3 months - 360 hours. For general academic fields, provided the study programme includes vocational practice).*

VOCATIONAL PRACTICE 1. ORGANIZATION OF VOCATIONAL PRACTICE:
1. First-cycle students are required to complete a 3-week vocational practice (60 hours, 5 ECTS points, after the 4th semester of study, credited without a grade in the 5th semester).
2. The vocational practice is included in the study programme and curriculum, therefore it is treated as a full-fledged subject the completion of which results in an entry in the student's credit book. Its nature must be consistent with the field and specialisation of the undertaken

studies.
3. The main goal of vocational practice is, above all, to enable the use of theoretical knowledge acquired during classes included in the study plan and to confront it with the real requirements set by employers.
4. Vocational practice should take place during the summer break. The Dean may, however, allow it to be held at other time not interfering with classes.
5. The student, in consultation with the Vocational Practice Supervisor, has the right to choose the workplace where the vocational practice will take place and the date of its completion.
6. The student completes the vocational practice on the basis of a Referral for a vocational practice in accordance with the Agreement on the organization of student vocational practice based on a referral from the University concluded with the workplace.
7. The student should take out personal accident insurance for the duration of vocational practice.
8. With the Dean's consent, a disabled student may complete vocational practice in an alternative form adapted to his or her abilities.
9. Teaching and educational supervision over vocational practice is exercised by Vocational Practice Supervisor. The role of Vocational Practice Supervisor is performed by vocational practice organizer at the Institute of Physics, appointed by the Dean.
10. The student is obliged to provide Vocational Practice Supervisor, within the deadline specified in the Vocational Practice Schedule, with the completed Information about the vocational practice necessary to issue documentation for the vocational practice.
11. The condition for crediting the vocational practice is the submission to the Vocational Practice Supervisor the Hours Completion Log filled in and confirmed by the workplace, the positive Opinion on the course of the vocational practice issued by the workplace, as well as participation in all meetings with the Vocational Practice Supervisor and the student's presentation of the vocational practice report. The opinion on the course of the vocational practice is considered positive when the student of Physics receives at least 15 points.
12. In the Hours Completion Log, the student summarizes the hours of vocational practice completed. Vocational Practice Supervisor may verify the Log for the compliance of hours.
13. The Vocational Practice Supervisor may credit the vocational practice of the student on the basis of the student's declaration of employment confirming that he or she is currently engaged in paid or volunteer work, including abroad, if its nature meets the requirements of the vocational practice, in particular if it is consistent with the field of study.

VOCATIONAL PRACTIVE FOR THE TEACHING PHYSICS SPECIALISATION:
The mid-year vocational practice includes 30 hours of teaching practice in primary school Physics.
Teaching practice is the equivalent of vocational practice for this specialty and includes 60 hours of teaching practice in Physics in primary schools. It is carried out in September and October.
Mid-year Educational Practice 1 includes 30 hours of practice in the field of psychological and pedagogical preparation in primary school.