



The Study Curriculum of the Doctoral School of Exact and Technical Sciences

I. General Information

1. The Doctoral School of Exact and Technical Sciences of the University of Zielona Góra, hereinafter referred to as the doctoral school, provides education in the following academic disciplines:\

- 1) astronomy
- 2) automatics, electronic, engineering and electrical engineering
- 3) technical and telecommunication computer science
- 4) civil engineering and transport
- 5) mechanical engineering
- 6) environmental engineering, mining and power engineering
- 7) mathematics
- 8) biological sciences
- 9) physical sciences

2. Education at the doctoral school:

- 1) prepares for the conferral of the doctoral degree;
- 2) lasts 6 semesters and ends with submission of the doctoral thesis;
- 3) is conducted on the basis of the study curriculum and the individual research plan (IRP).

3. Enrollment to the doctoral school takes place by means of a competition.

4. The organization of education at the doctoral school is specified by the rules and regulations of the doctoral school.

II. Characteristics of Study Curriculum

1. The education of a doctoral student includes: the implementation of the individual research plan and fulfillment of other requirements within the scope of conducting scientific research, as well as participation in didactic classes and professional practice.
2. The study curriculum and the individual research plan take into account the characteristics of the second level of learning outcomes for qualifications at level 8 of the Polish Qualifications Framework, specified in the Regulation of the Minister of Science and Higher Education of November 14, 2018 on the characteristics of the second level of learning outcomes for qualifications at levels 6-8 of the Polish Qualifications Framework (Journal of Laws of 2018, item 2218).
3. Education at the doctoral school is interdisciplinary and takes place in Polish and English.
4. The aim of education is to write and submit a doctoral thesis by the doctoral student and to prepare the doctoral student for the doctoral degree.

III. Characteristics of Learning Outcomes

1. The study curriculum and the individual research plan include the characteristics of the second level of learning outcomes for qualifications at level 8 of the Polish Qualifications Framework contained in the following categories:
 - 1) **knowledge**, with reference to which the characteristics specify:
 - a) the scope and depth – the completeness of the cognitive perspective and connections;
 - b) the context - conditions and effects.
 - 2) **skills**, with reference to which the characteristics specify:
 - a) within the scope of using knowledge – the problems solved and tasks performed;
 - b) within the scope of communication – the receipt and composition of statements, dissemination of knowledge in the scientific community and use of foreign language;
 - c) within the scope of work organization – planning and team work;
 - d) within the scope of learning - planning of own development and the development of others.
 - 3) **social competences**, with reference to which the characteristics specify:
 - a) within the scope of grades - critical approach;
 - b) within the scope of liability - fulfillment of social obligations and activity for the benefit of the public interest;
 - c) with reference to the professional role - independence and development of ethos.
 - d) with reference to the professional role - independence and development of ethos.

IV. Description of Learning Outcomes for Qualifications at Level 8 of the Polish Qualifications Framework

Outcome symbol	Description of learning outcomes	Characteristics of second degree of level 8 of the Polish Qualifications Framework
KNOWLEDGE: student knows and understands		
W01	world legacy including theoretical foundations and general issues as well as selected specific issues – specific for exact, natural and technical sciences, in particular for the represented scientific discipline to an extent enabling the revision of the existing paradigms. The main developmental tendencies of a given scientific discipline	P8S_WG
W02	aspects concerning methodology of carrying out scientific research	P8S_WG
W03	principles of disseminating research results, also in the course of free access	PS8_WG
W04	fundamental dilemmas of contemporary civilization and their references to specific areas in disciplines in the field of exact, natural and technical sciences	PS8_WK
W05	economic, legal, ethical and other significant conditions of scientific activity	PS8_WK
W06	basic principles of knowledge transfer to economic and social spheres and commercialization of scientific activity results	PS8_WK
SKILLS: student can		
U01	use the knowledge from the fields of exact, natural and technical sciences to creatively identify, formulate and innovatively solve complex issues or to perform tasks of a research nature, in particular: to define the purpose and subject matter of scientific research, to formulate research hypothesis	PS8_UW
U02	develop research methods, techniques and tools and creatively use them, draw conclusions on the basis of scientific research results; carry out critical analysis and assessment of scientific research results, expertise and other works of a creative nature and their contribution in the development of knowledge	PS8_UW
U03	transfer research work results to economic and social spheres	PS8_UW
U04	disseminate research results, also in popular forms	PS8_UK
U05	participate in scientific discourse, initiate disputes within the scope of a specific discipline and communicate in specialist subjects to an extent enabling active participation in the international scientific environment	PS8_UK
U06	use the English language to an extent enabling participation in the international scientific and professional environment, at least at B2 level	PS8_UK
U07	plan and implement individual and team research projects, also in an international environment	PS8_UO
U08	independently plan and act for one's own development as well	PS8_UU

	as inspire and organize the development of other people	
U09	forward knowledge and experience to others in the form of lectures and training, and use modern techniques, technology and methods	PS8_UU
SOCIAL COMPETENCE: student is ready to		
K01	critically assess the legacy of the practiced scientific discipline, critically assess his/her own contribution to the development of this discipline and to acknowledge the significance of knowledge in solving cognitive and practical problems	PS8_KK
K02	fulfill social obligations of researchers and creators within the scope of disseminating scientific research results	PS8_KO
K03	act for the benefit of public interest	PS8_KO
K04	respect the principles of ethics in science and respect the principle of public ownership of scientific research results having taken into consideration the principles of intellectual property	PS8_KR

Va. A List of Courses Together with their Description, Learning Outcomes and Methods of their Verification

Item	Course or type of classes	Course description and learning outcomes	Methods of verifying learning outcomes
1	Research trends part 1: Exact, natural and technical sciences Lecture	A presentation of issues of research areas in exact, natural and technical sciences. The most significant research trends. Information about platforms for disseminating knowledge in particular disciplines. W01, W04, U01, U02, U06	<i>In order to obtain a credit, each doctoral student presents a list of scientific references (initial bibliography for the doctoral thesis), together with a short description, containing research theoretical foundations which are to be performed within the framework of the Individual Research Plan (IRP).</i>
2	Research methodology: mini-project Lecture	Theory and methods of research within the scope of disciplines of exact, natural and technical sciences. W02, U01	<i>In order to obtain a credit, doctoral students present a proposal of mini-project subject matter in the group comprising representatives of various disciplines – two persons are the minimum.</i>
3	Scientific research ethics – copyright and patent rights Lecture	Familiarizing a doctoral student with ethics of scientific research and copyright referring to scientific activity. W05, U06, K04	<i>In order to obtain a credit, a doctoral student prepares a short description of an international case known from the mass media connected with noncompliance of research or copyright ethics in his/her discipline.</i>
4	The principles of writing research projects and reviews of articles Practical classes	A doctoral student learns about the possibility to submit applications for research grants. He/she learns how to construct particular parts of the application, which elements it should contain. Furthermore, a doctoral student learns the principles of creating research teams and implementation of research projects. U01, U02, U07, K01	<i>In order to obtain a credit, a doctoral student prepares an application for a grant to a selected institution corresponding to the subject matter of research within the scope of the Individual Research Plan.</i>
5	Editing and proofreading of scientific articles – presentation of results Practical classes	A doctoral student learns about the manner of writing and structure of texts published in scientific journals. W01, W03, W06, U01, U04, K01	<i>In order to obtain a credit, a doctoral student prepares a text from his/her discipline – within the scope of the Individual Research Plan and in accord with the requirements of a selected journal.</i>
6	Seminar 1: Presentation of IRP assumptions	A doctoral student presents the main assumptions of his/her IRP and carries out a discussion.	<i>A credit is obtained for the presentation.</i>

		W01, W02, U01	
7	Seminar 2: mini-projects – presentation of results	Doctoral students present results of the mini-project and carry out a discussion. U02, U04, U05, U07, K01	<i>A credit is obtained for the presentation.</i>
8	Seminar 3: presentation of article	A doctoral student presents a scientific article selected by him/her and carries out a discussion. - English in exact and technical sciences U05, U06	<i>A credit is obtained for attendance and discussion.</i>
9	Seminar 4: presentation of IRP results	A doctoral student presents preliminary IRP results and carries out a discussion. U01, U02, U05, K01	<i>A credit is obtained for the presentation. .</i>
10	Seminar 5: popularization of results	A doctoral student presents his/her IRP research results in a popular science form addressed also to doctoral students of another doctoral school and all people interested. U03, U04, K02, K03	<i>A credit is obtained for the presentation.</i>
11	Seminar Doctoral School Exact and Technical Sciences	School open seminar: speeches given by invited guests. W01, W04, K01	<i>A credit is obtained for attendance.</i>
12	Monographic lecture (in a discipline)	A doctoral student learns about selected issues from the scope of a given discipline. W01, W04, U01, U02, U06, K01	<i>A credit is obtained for attendance and discussion.</i>
13	Research trends: specific issues Lecture	A presentation of specific issues of research areas in a given discipline. Information about platforms for knowledge dissemination. Continuation of the course number 1. W04, W03, U02, U06, K01	<i>A credit is obtained within the scope of the course number 1</i>
14	Doctoral seminar	Work of thesis supervisor and doctoral student. Preparation for mid-term assessment. W06, U02, U03, U05, U06, U08	<i>A credit is obtained for attendance, discussion and performance of the tasks allotted.</i>
15	Professional practice	A doctoral student, by participating	<i>In order to obtain a credit, a</i>

		<p>in didactic classes, learns about methods of running classes, ways of interesting and effective teaching of students and popularization of scientific knowledge.</p> <p>U04, U05, U08, U09, K02, K03</p>	<p><i>doctoral student runs didactic classes under the care of the person in charge of the course and presents popular science lectures (2 hours per year) confirmed by an appropriate certificate.</i></p>
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Vb. A List of Courses Together with their Description, Learning Outcomes and Methods of their Verification - implementation doctorate program

Item	Course or type of classes	Course description and learning outcomes	Methods of verifying learning outcomes
1	Research methodology: mini-project Lecture	Theory and methods of research within the scope of disciplines of exact, natural and technical sciences. W02, U01	<i>In order to obtain a credit, doctoral students present a proposal of mini-project subject matter in the group comprising representatives of various disciplines – two persons are the minimum.</i>
2	Scientific research ethics – copyright and patent rights Lecture	Familiarizing a doctoral student with ethics of scientific research and copyright referring to scientific activity. W05, U06, K04	<i>In order to obtain a credit, a doctoral student prepares a short description of an international case known from the mass media connected with noncompliance of research or copyright ethics in his/her discipline.</i>
3	The principles of writing research projects and reviews of articles Practical classes	A doctoral student learns about the possibility to submit applications for research grants. He/she learns how to construct particular parts of the application, which elements it should contain. Furthermore, a doctoral student learns the principles of creating research teams and implementation of research projects. U01, U02, U07, K01	<i>In order to obtain a credit, a doctoral student prepares an application for a grant to a selected institution corresponding to the subject matter of research within the scope of the Individual Research Plan.</i>
4	Editing and proofreading of scientific articles – presentation of results Practical classes	A doctoral student learns about the manner of writing and structure of texts published in scientific journals. W01, W03, W06, U01, U04, K01	<i>In order to obtain a credit, a doctoral student prepares a text from his/her discipline – within the scope of the Individual Research Plan and in accord with the requirements of a selected journal.</i>
5	Seminar 1: Presentation of IRP assumptions	A doctoral student presents the main assumptions of his/her IRP and carries out a discussion. W01, W02, U01	<i>A credit is obtained for the presentation.</i>
6	Seminar 2: mini-projects – presentation of results	Doctoral students present results of the mini-project and carry out a discussion. U02, U04, U05, U07, K01	<i>A credit is obtained for the presentation.</i>
7	Seminar 3: presentation of article	A doctoral student presents a scientific article selected by him/her and carries out a	<i>A credit is obtained for attendance and discussion.</i>

		discussion. - English in exact and technical sciences U05, U06	
8	Seminar 4: presentation of IRP results	A doctoral student presents preliminary IRP results and carries out a discussion. U01, U02, U05, K01	<i>A credit is obtained for the presentation. .</i>
9	Seminar 5: popularization of results	A doctoral student presents his/her IRP research results in a popular science form addressed also to doctoral students of another doctoral school and all people interested. U03, U04, K02, K03	<i>A credit is obtained for the presentation.</i>
10	Seminar Doctoral School Exact and Technical Sciences	School open seminar: speeches given by invited guests. W01, W04, K01	<i>A credit is obtained for attendance.</i>
11	Monographic lecture (in a discipline)	A doctoral student learns about selected issues from the scope of a given discipline. W01, W04, U01, U02, U06, K01	<i>A credit is obtained for attendance and discussion.</i>
12	Research trends: specific issues Lecture	A presentation of specific issues of research areas in a given discipline. Information about platforms for knowledge dissemination. W04, W03, U02, U06, K01	<i>In order to obtain a credit, each doctoral student presents a list of scientific references (initial bibliography for the doctoral thesis), together with a short description, containing research theoretical foundations which are to be performed within the framework of the Individual Research Plan (IRP).</i>
13	Doctoral seminar	Work of thesis supervisor and doctoral student. Preparation for mid-term assessment. W06, U02, U03, U05, U06, U08	<i>A credit is obtained for attendance, discussion and performance of the tasks allotted.</i>
14	Professional practice	A doctoral student, by participating in didactic classes, learns about methods of running classes, ways of interesting and effective teaching of students and popularization of scientific knowledge. U04, U05, U08, U09, K02, K03	<i>In order to obtain a credit, a doctoral student runs didactic classes under the care of the person in charge of the course and presents popular science lectures (2 hours per year) confirmed by an appropriate certificate.</i>

Vla. The Schedule of Study Curriculum Implementation

Semester		1	2	3	4	5	6
General module		Number of hours					
1	Research trends part 1: exact, natural and technical sciences (L)	45	45				
2	Methodology of research: mini-project (L)	15					
3	Ethics of scientific research – copyright and patent rights (L)		15				
4	Principles of writing research projects and reviews of articles (PrCl)	15					
5	Editing and proofreading of scientific articles – presentation of results (PrCl)		15				
6	Seminar 1: presentation of IRP assumptions			15			
7	Seminar 2: mini-project; presentation of results			15			
8	Seminar 3: presentation of article	15	15	15			
9	Seminar 4: presentation of IRP results					30	
10	Seminar 5: popularization of results						30
11	Seminar Doctoral School of Exact and Technical Sciences	5	5	5	5	5	5
Discipline module							
12	Monographic lecture (in the discipline)	15	15		15		
13	Research trends part 2: specific issues (L)	5					
14	Doctoral seminar				15		
15	Professional practice		10	10	10	10	5
In total		425 hours	115	120	60	45	40

L - lecture

PrCl – practical classes

The form of obtaining a credit from a given course – credit without grade

Vlb. The Schedule of Study Curriculum Implementation - implementation doctorate

program

Semester		1	2	3	4	5	6
General module		Number of hours					
1	Methodology of research: mini-project (L)	15					
2	Ethics of scientific research – copyright and patent rights (L)		15				
3	Principles of writing research projects and reviews of articles (PrCl)	15					
4	Editing and proofreading of scientific articles – presentation of results (PrCl)		15				
5	Seminar 1: presentation of IRP assumptions			15			
6	Seminar 2: mini-project; presentation of results			15			
7	Seminar 3: presentation of article	15	15	15			
8	Seminar 4: presentation of IRP results					30	
9	Seminar 5: popularization of results						30
10	Seminar Doctoral School of Exact and Technical Sciences	5	5	5	5	5	5
Discipline module							
11	Monographic lecture (in discipline)	15	15		15		
12	Research trends: specific issues (L)	15					
13	Doctoral seminar				15		
14	Professional practice		10	10	10	10	5
In total		345 hours	80	75	60	45	40

L - lecture

PrCl – practical classes

The form of obtaining a credit from a given course – credit without grade