***Annex to Resolution No. 423 of the Senate of the University of Lodz of May 13, 2019***

**Study Program**

**at the University of Lodz**

**Doctoral School**

**of EXACT AND NATURAL SCIENCES**

**University of Lodz**

**Lodz 2019**

1. **The name of a doctoral school;**

 University of Lodz Doctoral School of Exact and Natural Sciences

1. **a brief description of the doctoral school with the objectives of education;**

The Doctoral School of Exact and Natural Sciences offers an important contribution to the process of improving the quality of advanced education at the academic level. It brings together doctoral students in the following disciplines: mathematics; biological sciences; chemical sciences; physical sciences; Earth and environmental sciences. The program provides the Doctoral Student with the opportunity to obtain qualifications at an advanced level in the field not only related to the process of dissertation, but also covering professional training (strengthening the research workshop and raising qualifications in the field of teaching) and personal development (soft skills, including actively planning own career and developing creative problem solving). These skills are necessary not only for successful completion of education at the Doctoral School, but also for the development of a professional career.

The key learning objective is to broaden and deepen the knowledge of doctoral students in the field of a selected scientific discipline in an interdisciplinary environment, enabling placing the competences related to a given scientific discipline in a broader context. The knowledge and skills acquired during education will prepare the Doctoral Student for independent planning, designing, and conducting scientific research as part of the Individual Research Plan – IPB. Doctoral students who have completed their education at the Doctoral School will be prepared to critically evaluate the results of scientific research, which serves as the basis for scientific publications, as well as to disseminate the findings among the international scientific community. Moreover, the Doctoral Student shall learn how to conduct didactic work at the level of a university by combining the acquired scientific knowledge using the latest methods of communication. A graduate of the Doctoral School will develop competences enabling conducting individual and team research (especially interdisciplinary) in national and international research teams, which will result in responsible application of acquired knowledge and research findings in an innovative economy and for the benefit of the society.

1. **scientific degree obtained by a Graduate;**

(1) doctor of exact and natural sciences in the discipline of mathematics ,or (2) doctor of exact and natural sciences in the discipline of biological sciences, or (3) doctor of exact and natural sciences in the discipline of chemical sciences, or (4) doctor of exact and natural sciences in the discipline of physical sciences, or (5) doctor of exact and natural sciences in the discipline of Earth and environmental sciences.

1. **entry requirements expressed in the language of Learning Outcomes;**

The Candidate:

* discusses issues in the field of mathematics, biological, chemical, physical, or Earth and environmental sciences at 7th level of the Polish Qualifications Framework (PRK);
* formulates and expresses thoughts and opinions about scientific research in a precise and comprehensive manner using specialized terminology;
* characterizes and uses basic techniques and tools used in research in a selected discipline;
* describes the principles of research ethics, in particular as regards respecting the work of others;
* demonstrates knowledge of a foreign language, enabling studying world literature in the field of the leading scientific discipline and planned own research;
* is motivated, provides the reasons for constant broadening of knowledge and implementation of new scientific research methods.
1. **scientific fields and disciplines referred to in Learning Outcomes;**

Field: Exact and Natural Sciences

Disciplines: mathematics; biological sciences; chemical sciences; physical sciences; Earth and environmental sciences.

1. **Learning Outcomes corresponding to the characteristics of the 2nd degree of the 8th level of the Polish Qualifications Network (PRK);**

Description of symbols: NSiP – refers to directional Learning Outcomes for the Doctoral School of Exact and Natural Sciences. After the underscore, the group of outcomes is indicated with a letter: W – knowledge, U – skills, K – competences. The following two digits indicate the number assigned to the Learning Outcome. The PRK code is in line with the annex to the Resolution of the Polish Ministry of Science and Higher Education of November 14, 2018 (Journal of Laws of 2018, item 2218): P8S = the 8th level, which is characteristic of higher education qualifications: WG = knowledge – depth and scope, WK = knowledge – context, UW = skills – use of knowledge, UK = skills – communication, UO = skills – work organization, UU = skills – learning, KK = social competences – evaluation (critical), KO = social competences – responsibility, CoR = social competences – professional role

|  |  |  |
| --- | --- | --- |
| Code | Learning Outcomes | PRK Code at the 8th Level |
| KNOWLEDGE– The Graduate: |
| NSiP\_3A\_W01 | describes the theoretical foundations, general issues, and selected specific issues of world achievements in the field of a selected discipline: mathematics; biological sciences; chemical sciences; physical sciences; Earth and environmental sciences, to the extent that enables revising the existing concepts and theories; | P8S\_WG |
| NSiP\_3A\_W02 | describes the main developmental trends driving the leading field in a selected discipline: mathematics, biological sciences, chemical sciences, physical sciences, or Earth and environmental sciences; | P8S\_WG |
| NSiP\_3A\_W03 | describes the methodology and principles of planning advanced scientific research characteristic of a selected discipline: mathematics; biological sciences; chemical sciences; physical sciences; Earth and environmental sciences; | P8S\_WG |
| NSiP\_3A\_W04 | describes economic, legal, ethical, and other principles of conducting research activities; | P8S\_WK |
| NSiP\_3A\_W05 | describes the principles of financing scientific research, obtaining research projects, including projects implemented in international teams; sources of financing and the existing procedures (grant application, application evaluation) | P8S\_WK |
| NSiP\_3A\_W06 | describes the principles and methods for preparing and evaluating scientific publications and research projects in accordance with the principle of open science; | P8S\_WK |
| NSiP\_3A\_W07 | describes the principles of commercialization of research findings and knowledge transfer for practical applications; | P8S\_WK |
| NSiP\_3A\_W08 | lists modern, innovative methods, concepts, and tools for teaching and disseminating science in a selected discipline: mathematics; biological sciences; chemical sciences; physical sciences; Earth and environmental sciences; | P8S\_WK |
| SKILLS - The Graduate |
| NSiP\_3A\_U01 | uses knowledge from various scientific fields to creatively identify, formulate, and solve complex problems or conduct research in an innovative manner, and to conduct interdisciplinary research activities – in particular: defines the objective and subject of research, formulates a scientific hypothesis; develops research methods, techniques, and tools, and applies them in a creative manner, as well as draws conclusions from research results; | P8S\_UW |
| NSiP\_3A\_U02 | conducts a critical analysis and evaluation of research results, expert activities, and other creative works and their contribution to the development of science; | P8S\_UW |
| NSiP\_3A\_U03 | assesses the possibility of transferring the research results to the economic and social sphere and initiates actions aimed at such a transfer; | P8S\_UW |
| NSiP\_3A\_U04 | disseminates research results, mainly in the form of original scientific publications, as well as in popular science forms; | P8S\_UK |
| NSiP\_3A\_U05 | initiates a debate and participates in a scientific discussion; | P8S\_UK |
| NSiP\_3A\_U06 | speaks a foreign language to the extent that enables participation in an international scientific community, in particular through participation in conferences, seminars, workshops, scientific visits, or internships abroad; | P8S\_UK |
| NSiP\_3A\_U07 | prepares an application for funding a research project; | P8S\_UO |
| NSiP\_3A\_U08 | plans and implements individual and team research projects, also in an international environment; | P8S\_UO |
| NSiP\_3A\_U09 | furthers own development, inspires and organizes the development of others – including by means of teaching courses and conducting activities related to the dissemination of knowledge; | P8S\_UU |
| NSiP\_3A\_U10 | develops and implements courses by using modern, innovative methods and tools. | P8S\_UU |
| SOCIAL COMPETENCES- The Graduate: |
| NSiP\_3A\_K01 | assesses the achievements in a selected scientific discipline in a critical manner: mathematics, biological sciences, chemical sciences, physical sciences, or Earth and environmental sciences, as well as their own contribution to the development of these disciplines; | P8S\_KK |
| NSiP\_3A\_K02 | recognizes the importance of knowledge in solving cognitive and practical problems, including these interdisciplinary in nature; | P8S\_KK |
| NSiP\_3A\_K03 | is ready to fulfill the social obligations of the researcher, provide the public with information and opinions resulting from the scientific achievements in a selected scientific discipline: mathematics, biological sciences, chemical sciences, physical sciences, or Earth and environmental sciences, and to engage in training specialists and undertaking activities leading to the development of a knowledge-based civil society; | P8S\_KO |
| NSiP\_3A\_K04 | is ready to think and act in an entrepreneurial manner, creating new ideas and seeking innovative solutions, tackling intellectual challenges in the scientific and public sphere, and bearing responsibility for the effects of their decisions; | P8S\_KO |
| NSiP\_3A\_K05 | conducts research independently, taking into account the existing financial or infrastructural limitations; | P8S\_KR |
| NSiP\_3A\_K06 | respects the principles of public ownership of scientific research results, including the legal principles of intellectual property protection. | P8S\_KR |

1. **Study Program (courses scheduled for respective semesters with an indicated number of hours and format);**

**Overview of Courses Offered by the Doctoral School of Exact and Natural Sciences:**

|  |  |  |  |
| --- | --- | --- | --- |
| Course Type | Total No. of Hours | Course Format | No. of Hours for Each Year of Education |
| OBLIGATORY COURSES |
|  |  |  | I | II | III | IV |
| Interdisciplinary Seminar | 156 | Seminar | 52 | 52 | 26 | 26 |
| Seminar in English | 52 | Seminar | - | - | 26 | 26 |
| Higher Education Didactics | 1313 | LectureWorkshop | 1313 | - | - | - |
| Teaching Practice | 120 | Teaching courses independently/Participating in Conducting Courses | 30 | 30 | 30 | 30 |
| Public Speaking Techniques | 13 | Workshop | 13 | - | - | - |
| Research Projects | 13 | Workshop | 13 | - | - | - |
| Commercialization of Research Results | 13 | Workshop | 13 | - | - | - |
| Introduction to Effective Publishing Strategies  | 13 | Workshop | 13 | - | - |
| FACULTATIVE OBLIGATORY COURSES |
| Group 1: Courses Developing Professional Skills (the Doctoral Student shall complete one course from each module) |
| Module 1: Language Courses  |  |  |  |  |  |  |
| English in *mathematics, biological, chemical, physical, or Earth and environmental sciences* | 26 | Seminars | 26 | - | - | - |
| according to a selected discipline, the Doctoral Student selects only one course |
| Module 2: Methodological Courses with Elements of Ethics |  |  |  |  |  |  |
| Methodology of *mathematics, biological, chemical, physical, or Earth and environmental sciences* | 13 | Seminars | 13 | - | - |  |
| according to a selected discipline, the Doctoral Student selects only one course |
| Module 3: IT Workshop |  |  |  |  |  |  |
| Information Technology | 13 | Workshop | 13 | - | - |
| Basic Statistical Analysis Methods  | 13 | Workshop | 13 | - | - |
| Advanced Statistical Analysis Methods | 13 | Workshop | 13 | - | - |
| Bibliographic Database Management | 13 | Workshop | 13 | - | - |
| Specialized Databases | 13 | Workshop | 13 | - | - |
| *Other (available in a given academic year)* | 13 | Lectures/Workshops | 13 | - | - |
| Group 2: Workshops Developing Personal and Social Competences (the Doctoral Student shall complete one course) |
| Introduction to Scientific Communication | 13 | Workshop | 13 | - | - |
| Oxford-Style Debate  | 13 | Workshop | 13 | - | - |
| Creativity and Innovation Workshop | 13 | Workshop | 13 | - | - |
| Voice Projection | 13 | Workshop | 13 | - | - |
| IT Tools and Gamification Workshop | 13 | Workshop | 13 | - | - |
| E-Learning and Blended Learning Techniques | 13 | Workshop | 13 | - | - |
| *Other (available in a given academic year)* | 13 | Workshop | 13 | - | - |
| Group 3: Specialist Courses Broadening Knowledge and Developing Practical Skills(the Doctoral Student shall complete two courses, including at least one interdisciplinary course; the available offer is updated on a yearly basis and made available to doctoral students) |
| Interdisciplinary courses* Monitoring Ecosystems
* Mathematical Modeling of Biological Systems
* From an Idea to a Drug in a Pharmacy
* Other *(available in a given academic year)*
 | 13 | Workshop | - | 13 |
| *Specialist courses for respective disciplines**(to be selected from the list of available courses for a given discipline)* | 26 | Workshop | 26 | - |
| OPTIONAL COURSES |
| Thematic Lectures | 13 | Lectures/Workshops | 13 | - |
| General University Courses | 13 | Lectures/Workshops | 13 | - |
| Other courses available in a given academic year offered by the University of Lodz/the Lodz Scientific Society (ŁTN), and by other doctoral schools at the University of Lodz | 13 | Lectures/Workshops | 13 | - |
| Min. No. of Hours in Total | **510** |

1. **course or module descriptions;**

Descriptions of respective courses in line with the requirements of the Doctoral School of Exact and Natural Sciences are available in the USOS system before the start of education.

1. **determining the correlation between Learning Outcomes described in point f) and the Learning Outcomes defined for specific courses or modules;**

Learning Outcomes specified in point f) of this document are consistent with the Learning Outcomes of individual modules and courses included in the Study Program. The table specifying the relationship between the Learning Outcomes specified for the Doctoral School curriculum and the Learning Outcomes defined for individual courses or modules during the course of education may be found in Annex No. 1.

1. **verifying Learning Outcomes for a given program with a reference to specific courses or modules;**

Learning Outcomes at the Doctoral School of Exact and Natural Sciences are achieved by completing obligatory courses, individual modules as part of facultative obligatory courses included in the curriculum, and Teaching Practice.

Learning Outcomes in terms of knowledge, skills, and social competences have been specified for each course. These are accompanied with a description of program content and credit conditions. Learning Outcomes of individual courses are correlated with the Learning Outcomes for the entire course of education at the Doctoral School.

Learning Outcomes are verified by means of:

* oral and written exams, practical tests, evaluation tests, assessment of lesson observation reports prepared by the lecturer and the course coordinator; detailed information on how to pass a course and obtain the Learning Outcomes, as well as program content are available in the USOS system;
* analysis of information on the progress of scientific and research work, including the implementation of the Individual Research Plan (IPB), involvement in teaching, and acquiring social competences, provided by the Doctoral Student in writing at the end of each academic year, reviewed by the Doctoral Adviser and the Director of the Doctoral School;
* a mid-term evaluation.

Courses completed at the Doctoral School are accounted for in annual cycles. In order to complete an academic year, the Doctoral Student is required to complete all courses indicated in the Study Program for a given year and in accordance with the selected courses specified in the IPB.

1. **prospective schedule of visiting lectures;**

No fixed timetable for visiting lecturers has been set. Doctoral students have the opportunity to participate in optional courses conducted by researchers from abroad employed by the University of Lodz as visiting professors. The offer for a given academic year depends on the schedule of visits of researchers from abroad.

1. **scope, rules, and forms of completing Teaching Practice;**

Doctoral students are required to complete an apprenticeship in the form of a Teaching Practice related to the discipline in which they conduct their doctoral research, or by means of participating in teaching courses. 30 didactic hours in each academic year must be completed. In the first year, only participation in teaching courses is recommended.

**Table 1: Determining the Correlation between Learning Outcomes for the Doctoral School of Exact and Natural Sciences and the Learning Outcomes Defined for Specific Courses or Modules:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Zajęcia obowiązkowe** | **Facultative Obligatory Courses** | **Optional Courses** |
|  |  | **Group 1**Courses Developing Professional Skills | **Group 2**Workshops Developing Personal and Social Competences | **Group 3**Specialist Courses Broadening Knowledge and Developing Practical Skills |  |
| Code | Seminar interdyscyplinary | Seminar in English | Higher Education Didactics | Teaching Practice | Public Speaking Techniques | Research Projects | Commercialization of Research Results | Introduction to Effective Publishing Strategies | **Module 1:** language courses | **Module 2:** Methodological courses with elements of ethics | **Module 3:** IT and technical workshops | Optional, to be selected from the offer of a given module | Optional, to be selected from the offer of a given module | Optional |
| NSiP\_3A\_W01 | × | × |  |  |  |  |  |  |  |  |  |  | × | x |
| NSiP\_3A\_W02 | × | × |  |  |  |  |  |  |  |  |  |  | × | x |
| NSiP\_3A\_W03 | × | × |  |  |  |  |  |  |  | × | × |  |  |  |
| NSiP\_3A\_W04 |  |  |  |  |  | × | × |  |  | × |  |  |  |  |
| NSiP\_3A\_W05 |  |  |  |  |  | × |  |  |  |  |  |  |  |  |
| NSiP\_3A\_W06 | × |  |  |  |  |  |  | × |  |  |  |  |  |  |
| NSiP\_3A\_W07 |  |  |  |  |  |  | × |  |  |  |  |  |  |  |
| NSiP\_3A\_W08 |  |  | × | × | × |  |  |  |  |  |  | × |  |  |
| NSiP\_3A\_U01 | × | × |  |  |  |  |  |  |  | × | × |  |  |  |
| NSiP\_3A\_U02 | × |  |  |  |  |  |  | × |  |  | × |  |  |  |
| NSiP\_3A\_U03 |  |  |  |  |  |  | × |  |  |  |  |  |  |  |
| NSiP\_3A\_U04 |  |  |  |  |  |  |  | × |  |  | × | × |  |  |
| NSiP\_3A\_U05 | × | × |  |  |  |  |  |  |  |  |  |  |  |  |
| NSiP\_3A\_U06 |  | × |  |  |  |  |  |  | × |  |  |  |  |  |
| NSiP\_3A\_U07 |  |  |  |  |  | × |  |  |  |  |  |  |  |  |
| NSiP\_3A\_U08 | x |  |  |  |  | x |  |  |  | x |  |  |  |  |
| NSiP\_3A\_U09 |  |  | × | × | × |  |  |  |  |  | × | × |  |  |
| NSiP\_3A\_U10 |  |  | × | × |  |  |  |  |  |  |  |  |  |  |
| NSiP\_3A\_K01 | × | × |  |  |  |  |  | × |  |  |  |  |  |  |
| NSiP\_3A\_K02 | × | × |  |  |  |  |  |  |  | × |  |  |  |  |
| NSiP\_3A\_K03 | × | × |  | × | × |  |  |  |  |  |  | × |  |  |
| NSiP\_3A\_K04 | × |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NSiP\_3A\_K05 | × |  |  |  |  | × |  |  |  |  |  |  |  |  |
| NSiP\_3A\_K06 |  |  | × | × | × |  |  | × |  | × |  |  |  |  |