

**STUDY PROGRAMME
AT THE DOCTORAL SCHOOL AT THE UNIVERSITY OF BIALYSTOK**

The Field of Exact and Natural Sciences

LEARNING OUTCOMES

1. Institution providing education at the doctoral school: **University of Bialystok**
2. The school provides education in the following field/fields of science and scientific discipline/disciplines the learning outcomes refer to:
the field of exact and natural sciences, scientific disciplines: mathematics, biological sciences, chemical sciences and physical sciences
3. Name of the doctoral school: **Doctoral School at the University of Bialystok**

| Symbol* in the description of the second degree characteristics of the National Qualification Framework (PRK) | DESCRIPTION OF PRK SECOND DEGREE CHARACTERISTICS | Learning outcome symbol** | DESCRIPTION OF ASSUMED LEARNING OUTCOMES After graduating from the doctoral school, graduates: |
|---|---|---------------------------|--|
| KNOWLEDGE, graduates know and understand: | | | |
| P8S_WG | To the extent enabling revision of the existing paradigms – global achievements, including theoretical background as well as general and selected detailed issues - relevant to a particular discipline of science or art | SD_WG01 | Theoretical background as well as general and detailed issues enabling revision of the existing paradigms in the field of exact and natural sciences |
| | | SD_WG02 | Current scientific achievements within one's specialisation based on specialist literature |

| | | | |
|---|---|---|--|
| | Major general development trends in disciplines of science or art in which education is provided | SD_WG03 | Contemporary development trends and the most recent achievements of exact and natural sciences (mathematics, biological sciences, chemical or physical sciences) |
| | Research methodology | SD_WG04 | Principles of methodology in exact and natural sciences as well as research methods and techniques applied in mathematics, biological sciences, chemical or physical sciences |
| | Rules for dissemination of research results including open access | SD_WG05 | Mechanism of dissemination of research findings including open access |
| P8S_WK | Fundamental dilemmas of contemporary world | SD_WK01 | Complexity of social systems and problems of contemporary world |
| | Economic, legal, ethical and other significant conditions of scientific activity | SD_WK02 | Functioning of the system of financing scientific activity |
| | | SD_WK03 | Legal conditions of scientific activity |
| | | SD_WK04 | Ethical conditions of scientific activity |
| Basic rules for the transfer of knowledge to economic and social areas as well as commercialisation of research activity findings and relevant know-how | SD_WK05 | Rules for the transfer of knowledge to economic and social areas as well as commercialisation of research activity findings and relevant know-how | |
| SKILLS, graduates are able to: | | | |
| P8S_UW | Use knowledge in various fields of science or art for the purpose of creative identification, formulation and innovative solution of complex research problems, or to carry out tasks, in particular: - define the purpose and subject of scientific research and formulate research hypothesis - develop and creatively apply research methods, techniques and tools - draw conclusions on the basis of research findings | SD_UW01 | Knowing the current state of the arts within the scope of mathematics, biology, chemistry or physics, define the purpose and subject of scientific research, formulate research hypothesis and select adequate methods and models to test it |
| | | SD_UW02 | Whenever necessary, design their own research techniques and tools or creatively adapt existing methods to achieve set objectives |
| | | SD_UW03 | Draw conclusions based on the confrontation of common literature with the results of their own research |
| | Carry out critical analyses and assessments of research findings, expert activities and other creative works as well as their contribution to the process of knowledge development | SD_UW04 | Carry out critical analyses and assessments of research findings and expert activities and their contribution to the development of mathematics, biological sciences, chemical sciences or physical sciences |

| | | | |
|--|---|---|---|
| | Transfer the results of scientific activity to economic and social spheres | SD_UW05 | Indicate application properties of research results and search possibilities of their transfer to the economic or social sphere |
| P8S_UK | Take part in communication on specialist subjects to the extent enabling active participation in international scientific community | SD_UK01 | Take active part in international and national scientific conferences and seminars |
| | Disseminate scientific activity results, in a popular form as well | SD_UK02 | Disseminate scientific activity results in the form of science and popular science publications and public appearances |
| | Initiate a debate | SD_UK04 | Take part in the scientific discourse and initiate a debate during scientific conferences and seminars |
| | Take part in the scientific discourse | | |
| Speak a foreign language at B2 level of the Common European Framework of Reference for Languages to the extent enabling participation in international scientific and professional community | SD_UK05 | Speak a foreign language at B2 level to the extent enabling contacts with international scientific and professional community | |
| P8S_UO | Plan and carry out individual and team research projects or creative undertakings, within the international community as well | SD_UO01 | Individually design a research project and draft an application for funding it |
| | | SD_UO02 | Carry out a research project individually or in a team, within international cooperation as well |
| P8S_UU | Plan and act for the purpose of their own personal development and inspire and organize development of other people | SD_UU01 | Individually plan a self-development process |
| | | SD_UU02 | Using acquired knowledge, inspire and organize development of other people |
| | Plan classes or a set of classes and conduct them with the use of modern methods and tools | SD_UU03 | Plan classes and draft syllabuses for the courses at the level of a school of higher education within the scope of their specialization in mathematics, biological sciences, chemical sciences or physical sciences |
| | | SD_UU04 | Conduct or co-conduct didactic classes in a school of higher education with the use of modern didactic methods and tools |
| SOCIAL COMPETENCES, graduates are ready to: | | | |
| P8S_KK | Critically evaluate achievements within a given discipline of science or art | SD_KK01 | Critically analyse sources of scientific information and research results in the discipline of mathematics, biological sciences, chemical sciences or physical sciences |

| | | | |
|---------------|---|----------------|--|
| | Critically evaluate their own contribution to the development of a given discipline of science or art | SD_KK02 | Self-criticise their scientific and didactic work |
| | Recognize the importance of knowledge in solving cognitive and practical problems | SD_KK03 | Recognize the importance of knowledge in solving cognitive and practical problems |
| P8S_KO | Fulfil social obligations of researchers and creators | SD_KO01 | Promote scientific achievements by popularizing them in professional and social contacts |
| | Initiate activities for the benefit of public interest | SD_KO02 | Initiate activities for the benefit of public interest |
| | Think and act resourcefully | SD_KO03 | Think and act resourcefully |
| P8S_KR | Support and develop the ethos of scientific and creative communities, including: - conducting independent scientific activity - respecting the principle of public ownership of scientific activity results, including the principles of intellectual property protection | SD_KR01 | Formulate and carry out original research problems based on their own methods and tools |
| | | SD_KR02 | Announce research results respecting the principles of intellectual property protection |

Explanation of the symbols:

***P8S_WG** – an example of the symbol in the description of the second degree characteristics of PRK

P8 – PRK level 8 – doctoral schools

S – characteristics typical of the qualifications obtained in higher education

W – knowledge (*descriptive category*)

G – *depth and range*

K – *context*

U – skills (*descriptive category*)

W – *application of knowledge*

K – *communicating*

O – *work organisation*

U – *learning*

K – social competences (*descriptive category*)

K – *critical evaluation*

O – *responsibility*

R – *professional role*

****SD_WG01** – an example of the symbol of a learning outcome

SD learning outcomes at the doctoral school

W – knowledge (*descriptive category*)

G – *depth and range*

K – *context*

U – skills (*descriptive category*)

W – *application of knowledge*

K – *communicating*

O – *work organisation*

U – *learning*

K – social competences (*descriptive category*)

K – *critical evaluation*

O – *responsibility*

R – *professional role*

01, 02, 03 and next – a number of a learning outcome

ASSUMPTIONS OF THE EDUCATION PROCESS

I. GENERAL INFORMATION

1. Name of the institution providing education at the doctoral school: **University of Bialystok**
2. Name of the doctoral school: **Doctoral School at the University of Bialystok**
3. Duration of education: **8 semesters**

II. GENERAL ASSUMPTIONS

1. Doctoral School prepares doctoral students to obtain a doctoral degree in the following disciplines: mathematics, biological sciences, chemical sciences or physical sciences.
2. A fundamental task of the School is to create scientific background and support for doctoral students carrying out research projects leading to a doctoral dissertation.
3. Education in the Doctoral School is greatly individualised and provides conditions to:
 - complete knowledge and competence in a selected scientific discipline,
 - increase knowledge in other scientific disciplines and fields,
 - develop scientific independence,
 - obtain soft skills necessary to function in the socio-economic environment and cooperate with representatives of other social groups,
 - take part in the national and international scientific community life,
 - assure reliable evaluation supporting doctoral student's development.
4. A doctoral student is obliged to carry out a research project and prepare a doctoral dissertation in a discipline of their choice and take part in the classes covered by the study programme. A doctoral student must attend all classes conducted at the School, take active part in them, take up a discussion, initiate topics for consideration, and critically approach issues under discussion.
5. Education is conducted individually under the direct guidance of a supervisor or supervisors. In consultation with the supervisor, a doctoral student prepares the Individual Research Plan, which is subject to the mid-term evaluation.
6. The study programme is divided into 5 modules.
7. **MODULE 1. GENERAL EDUCATION COURSES** cover courses aimed at increasing knowledge in other disciplines of science.
8. **MODULE 2. COURSES IN THE FIELD** embrace four courses preparing doctoral students to conduct didactic classes, deliver presentations at conferences, draft their own scientific articles and submit research projects to grants applications.
9. **MODULE 3. EDUCATION COURSES IN THE FIELD:**
MODULE 3a: mathematics
MODULE 3b: biological sciences,
MODULE 3c: chemical sciences,
MODULE 3d: physical sciences.
Each module offers specialised foreign language classes (conducted for 3 years of education) and 3 core classes in the field of the selected scientific discipline (mathematics, biological sciences, chemical sciences or physical sciences) aimed at completing the knowledge and competences that have been already acquired in this discipline. Additionally, in each discipline, in consultation with the supervisor, a doctoral student selects didactic classes within the field.
10. **MODULE 4. PREPARATION OF DOCTORAL DISSERTATION.** Doctoral students take part in a doctoral seminar (15 hours in each semester) throughout

the entire duration of education. Close scientific cooperation between a doctoral student and a supervisor is required during the seminar. The credit for the seminar is based not only on the progress made by a doctoral student in the preparation of the doctoral dissertation but also on the fulfilment of other elements of the Individual Research Plan.

11. **MODULE 5. VOCATIONAL INTERNSHIP.** Vocational internships in a higher education school prepare a doctoral student to work as an academic teacher. The internships last at least 15 hours but not longer than 60 didactic hours annually starting in the second year. During the internship, a doctoral student conducts didactic classes as envisaged in the study programme that are conducted by the institution pursuing a scientific activity in the discipline the doctoral school provides education in. The internship is first served within didactic classes held by the supervisor's Institute/Department. Doctoral students may conduct classes themselves or take part in the classes conducted by other academic teachers. The Dean decides about the form of the internship at the request of the supervisor and in consultation with the Head of the Doctoral School.
12. A doctoral student who pursues education in Polish may choose and attend classes in module 1 *General education courses* and module 2 *Courses in the field* in English, if they are provided, in a given academic year in both languages concurrently.
With the consent of the Head of the Doctoral School, a doctoral student may attend the doctoral seminar in English at his or her request accepted by the supervisor.

III. LEARNING MODULES/COURSES

| No. | Module/course name | Reference to the assumed learning outcomes | Ways of verifying the assumed learning outcomes | Hours | Semester |
|--|--|--|---|-------|-----------------|
| MODULE 1: GENERAL EDUCATION COURSES* | | | | | |
| 1. | A course outside the scientific discipline¹ | SD_WK01, SD_KK03 | Passing grade | 15 | up to 8 (incl.) |
| 2. | Soft skills course 1 | SD_UU01, SD_UU02 | Passing grade | 5 | 1 |
| 3. | Soft skills course 2 | SD_UU01, SD_UU02 | Passing grade | 5 | 3 |
| 4. | Copyright and protection of intellectual property | SD_WK03, SD_WK04, SD_KR02 | Passing grade | 5 | 1 |
| 5. | Commercialisation of research | SD_UW05, SD_WG05, SD_WK05, SD_KO03 | Passing grade | 5 | 3 |
| MODULE 2: COURSES IN THE FIELD OF EXACT AND NATURAL SCIENCES ** | | | | | |
| 6. | Academic didactics | SD_UU01, SD_UU02, SD_UU03 | Passing grade | 20 | up to 4 (incl.) |
| 7. | Forms of financing exact and natural sciences | SD_WK02, SD_UW01, SD_UO01 | Passing grade | 15 | up to 4 (incl.) |
| 8. | Poster preparation and art of presentation | SD_WG05, SD_UK02, SD_KR02 | Passing grade | 5 | up to 4 (incl.) |
| 9. | Preparation of a scientific article for publication | SD_WG05, SD_UK02, SD_KR02 | Passing grade | 5 | up to 4 (incl.) |
| MODULE 3: COURSES OF STUDY IN THE SCIENTIFIC DISCIPLINE | | | | | |
| MODULE 3a: MATHEMATICS | | | | | |
| 10. | Journal Club (specialised English language)² | SD_UW03, SD_UK04, SD_UK05, SD_KK01 | Passing grade/ Exam (6 sem) | 45 | 2,4,6 |
| 11. | Spectral theory and functional calculus | SD_WG04, SD_UW02, SD_KK03 | Passing grade | 30 | 2 |

| | | | | | |
|---|--|--|--------------------------------|-----|---------|
| 12. | Principal course ³ | SD_WG01, SD_WG03, SD_UU01 | Passing grade/ Exam (4 sem) | 30 | 2,4 |
| 13. | Selected issues in modern mathematics ⁴ | SD_WG01, SD_WG02, SD_WG03, SD_KK01 | Passing grade/ exam (8 sem) | 30 | 6,8 |
| 14. | Specialised classes ⁵ | SD_WG03, SD_UW04, SD_UK01, SD_UK04, SD_UK05, SD_UU01, SD_KO01, SD_KO02 | Passing grade | 35 | 2,4,6 |
| MODULE 3b: BIOLOGICAL SCIENCES | | | | | |
| 15. | Journal Club (specialised English language) ² | SD_UW03, SD_UK04, SD_UK05, SD_KK01 | Passing grade/ Exam (6 sem) | 45 | 2,4,6 |
| 16. | Statistics in biological sciences – theory and practice | SD_WG04, SD_UW02, SD_KK03 | Passing grade | 30 | 2 |
| 17. | Principal course ³ | SD_WG01, SD_WG03, SD_UU01 | Passing grade/ Exam (4 sem) | 30 | 2,4 |
| 18. | Selected issues in modern biology ⁴ | SD_WG01, SD_WG02, SD_WG03, SD_KK01 | Passing grade/ Exam (8 sem) | 30 | 6,8 |
| 19. | Specialised classes ⁵ | SD_WG03, SD_UW04, SD_UK01, SD_UK04, SD_UK05, SD_UU01, SD_KO01, SD_KO02 | Passing grade | 35 | 2,4,6 |
| MODULE 3c: CHEMICAL SCIENCES | | | | | |
| 20. | Journal Club (specialised English language) ² | SD_UW03, SD_UK04, SD_UK05, SD_KK01 | Passing grade/ exam (6 sem) | 45 | 2,4,6 |
| 21. | Statistics in chemical sciences – theory and practice | SD_WG04, SD_UW02, SD_KK03 | Passing grade | 30 | 2 |
| 22. | Principal course ³ | SD_WG01, SD_WG03, SD_UU01 | Passing grade/ exam (4 sem) | 30 | 2,4 |
| 23. | Selected issues in modern chemistry ⁴ | SD_WG01, SD_WG02, SD_WG03, SD_KK01 | Passing grade/ exam (8 sem) | 30 | 6,8 |
| 24. | Specialised classes ⁵ | SD_WG03, SD_UW04, SD_UK01, SD_UK04, SD_UK05, SD_UU01, SD_KO01, SD_KO02 | Passing grade | 35 | 2,4,6 |
| MODUŁ 3d. PHYSICAL SCIENCES | | | | | |
| 25. | Journal Club (specialised English language) ² | SD_UW03, SD_UK04, SD_UK05, SD_KK01 | Passing grade/ Exam (6 sem) | 45 | 2,4,6 |
| 26. | Statistics in physical sciences – theory and practice | SD_WG04, SD_UW02, SD_KK03 | Passing grade | 30 | 2 |
| 27. | Principal course ³ | SD_WG01, SD_WG03, SD_UU01 | Passing grade/ Exam (4 sem) | 30 | 2,4 |
| 28. | Selected issues in modern physics ⁴ | SD_WG01, SD_WG02, SD_WG03, SD_KK01 | Passing grade/ Exam (8 sem) | 30 | 6,8 |
| 29. | Specialised classes ⁵ | SD_WG03, SD_UW04, SD_UK01, SD_UK04, SD_UK05, SD_UU01, SD_KO01, SD_KO02 | Passing grade | 35 | 2,4,6 |
| MODULE 4: PREPARATION OF DOCTORAL DISSERTATION | | | | | |
| 30. | PhD seminar | SD_WG02, SD_WG04, SD_WG05, SD_UW01, SD_UW02, SD_UW03, SD_UW04, SD_UW05, SD_UK02, SD_UK04, SD_UO01, SD_UO02, SD_UU01, SD_KK01, SD_KK02, SD_KO03, SD_KR01, SD_KR02 | Passing grade | 120 | 2,4,6,8 |
| MODULE 5: VOCATIONAL INTERNSHIP | | | | | |
| 31. | Internships ⁶ | SD_UU02, SD_UU03, SD_UU04, SD_KK02, SD_KK03, SD_KO01, SD_KO03 | Passing grade | 45 | 4,6,8 |

* Module common for all doctoral students of the Doctoral School at the University of Białystok. Courses are taken together. A given course is not provided in every academic year.

** Courses provided together for the disciplines within the field of science.

- ¹ Elective course in the discipline other than the discipline in which a doctoral student pursues education.
- ² Classes in English conducted in the form of a discussion session on the latest research results published in leading scientific journals and in the scientific discipline in which a doctoral student pursues education.
- ³ Lectures to choose from the list of proposed principal courses within the discipline.
- ⁴ Lectures in Polish or English to be chosen by a student from the list of "Selected issues in modern mathematics/ biology/chemistry/physics".
- ⁵ Optional classes within the discipline chosen by a student in consultation with the supervisor.
- ⁶ Internships in the form of teaching or participating in teaching, not exceeding 60 hours per year

IV. REQUIREMENTS FOR THE COMPLETION OF THE DOCTORAL PROGRAMME

The requirement for graduation from the Doctoral School is the submission of a dissertation.

CURRICULUM/EDUCATIONAL PROGRAMME IMPLEMENTATION SCHEDULE

| Module/course name | Ways of verifying the assumed learning outcomes | Hours | | | | |
|--|---|------------------|-----------|-----------|-----------|-----------|
| | | Total, including | 1st year | 2nd year | 3rd year | 4th year |
| Module #1: General education courses* | | 35 | 10 | 10 | 0 | 15 |
| Course outside the scientific discipline # | PASSING GRADE | 15 | | | | 15 |
| Soft skills course 1 ** | PASSING GRADE | 5 | 5 | | | |
| Soft skills course 2 ** | PASSING GRADE | 5 | | 5 | | |
| Copyright and protection of intellectual property | PASSING GRADE | 5 | 5 | | | |
| Commercialisation of research | PASSING GRADE | 5 | | 5 | | |
| Module #2: Courses in the field of exact and natural sciences*** | | 45 | 30 | 15 | 0 | 0 |
| Academic didactics – discussion session | PASSING GRADE | 20 | 10 | 10 | | |
| Forms of financing exact and natural sciences – discussion session | PASSING GRADE | 15 | 15 | | | |
| Poster preparation and art of presentation – discussion session | PASSING GRADE | 5 | 5 | | | |
| Preparation of a scientific article for publication – discussion session | PASSING GRADE | 5 | | 5 | | |
| Module #3: Courses of study in the scientific discipline | | | | | | |
| Module #3a: Mathematics | | 170 | 70 | 40 | 45 | 15 |
| Journal Club (Specialised English) – discussion session | EXAM | 45 | 15 | 15 | 15 | |
| Spectral theory and functional calculus – discussion session | PASSING GRADE | 30 | 30 | | | |
| Principal course – lecture | EXAM | 30 | 15 | 15 | | |
| Selected issues in modern mathematics – lecture | EXAM | 30 | | | 15 | 15 |
| Specialised classes | PASSING GRADE | 35 | 10 | 10 | 15 | |
| Module #3b: Biological sciences | | 170 | 70 | 40 | 45 | 15 |
| Journal Club (Specialised English) – discussion session | EXAM | 45 | 15 | 15 | 15 | |
| Statistics in biological sciences – theory and practice – discussion session | PASSING GRADE | 30 | 30 | | | |
| Principal course – lecture | EXAM | 30 | 15 | 15 | | |

| | | | | | | |
|--|---------------|------------|------------|------------|-----------|-----------|
| Selected issues in modern biology – lecture | EXAM | 30 | | | 15 | 15 |
| Specialised classes | PASSING GRADE | 35 | 10 | 10 | 15 | |
| Module #3c: Chemical sciences | | 170 | 70 | 40 | 45 | 15 |
| Journal Club (Specialised English) – discussion session | EXAM | 45 | 15 | 15 | 15 | |
| Statistics in chemical sciences – theory and practice – discussion session | PASSING GRADE | 30 | 30 | | | |
| Principal course – lecture | EXAM | 30 | 15 | 15 | | |
| Selected issues in modern chemistry – lecture | EXAM | 30 | | | 15 | 15 |
| Specialised classes | PASSING GRADE | 35 | 10 | 10 | 15 | |
| Module #3d: Physical sciences | | 170 | 70 | 40 | 45 | 15 |
| Journal Club (Specialised English) – discussion session | EXAM | 45 | 15 | 15 | 15 | |
| Statistics in physical sciences – theory and practice – discussion session | PASSING GRADE | 30 | 30 | | | |
| Principal course – lecture | EXAM | 30 | 15 | 15 | | |
| Selected issues in modern physics – lecture | EXAM | 30 | | | 15 | 15 |
| Specialised classes | PASSING GRADE | 35 | 10 | 10 | 15 | |
| Module #4: Preparation of doctoral dissertation | | 120 | 30 | 30 | 30 | 30 |
| PhD seminar | PASSING GRADE | 120 | 30 | 30 | 30 | 30 |
| Module #5: Vocational internship**** | | 45 | 0 | 15 | 15 | 15 |
| Internships | PASSING GRADE | 45 | 0 | 15 | 15 | 15 |
| TOTAL: | | 415 | 140 | 110 | 90 | 75 |

* Module common for all doctoral students of the Doctoral School at the University of Bialystok. Courses are taken together. A given course is not provided in every academic year.

Elective course in the discipline other than the discipline in which a doctoral student pursues education. The course must be completed by the end of the 4th year of study.

** Soft skills course 1 and Soft skills course 2 - elective courses.

*** Courses provided together for the disciplines within the field of science.

**** Internships in the form of teaching or participating in teaching, not exceeding 60 teaching hours per year.