FACULTY OF MATHEMATICS AND NATURAL SCIENCES

Department of Geography, Ecology and Environmental protection

PhD PROGRAMME

PHYSICAL GEOGRAPHY

SCIENTIFIC FIELD:	4. NATURAL SCIENCES, MATHEMATICS AND INFORMATICS
PROFESSIONAL FIELD:	4.4 EARTH SCIENCES
NATIONAL QUALIFICATIONS FRAMEWORK LEVEL:	8
PROFESSIONAL QUALIFICATION:	RESEARCHER
PERIOD OF STUDY:	3 /three / or 4 /four/ YEARS
FORM OF EDUCATION:	FULL-TIME/ INDEPENDENT/PART-TIME / DISTANCE

THE CURRICULUM HAS BEEN APPROVED SINCE 2019

QUALIFICATION CHARACTERISTICS

1. GENERAL INTRODUCTION TO THE PhD PROGRAMME

The PhD programme "Physical Geography" is administered by the Department of geography, ecology and environmental protection at the Faculty of mathematics and natural sciences, South-West University "Neofit Rilski", Blagoevgrad. The qualification profile, curriculum, and course structure are fully aligned with the requirements of the Higher Education Act of the Republic of Bulgaria and the internal regulations of the University.

The programme is open to applicants from across Bulgaria, as well as from abroad. The duration of study is **three academic years** for full-time and independent study modes, and **four academic years** for part-time and distance learning modes. The curriculum consists of both **compulsory** and **elective** courses.

The PhD degree is awarded upon successful completion of all components of the individual study plan, including coursework, research activities, and the public defence of the doctoral dissertation. Graduates of the programme are conferred the **educational and scientific degree "Doctor" in Physical Geography**.

2. OBJECTIVES OF THE PhD PROGRAM

1. To educate highly qualified researchers and specialists with broad competencies in the field of physical geography.

2. To provide opportunities for acquiring advanced theoretical knowledge, alongside the development of methodological expertise and skills in planning and conducting scientific research.
3. To foster competencies for professional work—both individually and within teams—including the application of innovative scientific achievements in the conservation, sustainable use, and management of natural resources.
4. To cultivate critical thinking skills for the analysis of scientific results, the formulation of informed decisions, and the implementation of appropriate actions related to sustainable development and natural resource protection.
5. To ensure training in and mastery of modern methods, analytical approaches, and data processing techniques necessary for addressing key contemporary challenges, such as climate change and transformations in the natural environment.

3. GENERAL QUALIFICATION AND SPECIALISATION

The preparation of a doctoral dissertation in the field of Physical Geography constitutes an original research endeavour, aimed at addressing scientific or applied problems. The dissertation must present original theoretical or applied contributions and demonstrate that the candidate possesses in-depth scientific knowledge in the relevant field, as well as the capacity for independent research.

The doctoral training programme in Physical Geography offers structured academic supervision and resources to support both scientific and applied research. It facilitates the development of competencies in research methodology, fosters the ability to conduct critical analysis, and cultivates professional readiness for independent scholarly and teaching activities.

Additionally, the programme supports the development of practical skills and habits for the effective use of modern information and communication technologies in both research and academic teaching contexts.

4. KNOWLEDGE, SKILLS AND COMPETENCIES ACQUIRED ACCORDING TO THE NATIONAL QUALIFICATION FRAMEWORK

4.1 Knowledge (theoretical and/or factological)

The students who complete their doctoral degree will:

- ✓ Have systematic knowledge to critically analyse geospatial data and to generate and implement new ideas in the field of natural geography.
- ✓ Master the methods of research in the field of cartography;
- ✓ Have the ability to expand and modify existing knowledge in the field, as well as its interactions with related scientific fields;
- ✓ Possess knowledge with the highest degree of complexity and demonstrate ability to expand them in the specific thematic field;
- ✓ Have competencies in related scientific fields and will apply an interdisciplinary approach;
- ✓ Demonstrate knowledge through the degree of complexity of the conducted, understood and substantiated scientific research.

4.2. Skills (cognitive and/or practical)

The students who complete their doctoral degree will:

- ✓ Organise and plan scientific activity, analytically and critically evaluate experimental results, create and lead research groups or teams, manage human and financial resources.
- ✓ Argumentatively, with evidence analyses and defend theses related to the scientific field and the topic of the dissertation, seek innovative solutions by combining different strategies and models, improve, adapt and test new methods and approaches.
- ✓ Have skills such as creative thinking, analytical and intellectual flexibility, be able to find, summarise and evaluate relevant information from different sources in a certain sequence and logic.
- ✓ Professionally prepare and present scientific and technical documents and communicate through various media to different audiences.

4.3. Independence and responsibility

By the end of their training the PhD students will:

- ✓ Create and interpret new knowledge through own research or other scientific activity;
- ✓ Demonstrate interpretation competency of both own and other research, indicate that they have acquired skills in expanding the scope of the studied scientific field and in selection of up-to-date publications
- ✓ Possess self-criticism and ability to self-assess their scientific research achievements
- ✓ Have the ability to compose, design, implement and adapt a modern research process with scientific stability.

4.4. Learning competence

Demonstrate capacity for systematic acquisition, understanding and upgrading of a significant amount of knowledge related to contemporary scientific developments in the theory and practice of physical geography.

4.5. Communicative and social competencies

Upon completion of their doctoral studies, students will be able to:

- ✓ Demonstrate a high level of personal responsibility, independent initiative, and a scientific style of communication in various contexts, including academic discussions, consultations, debates, and the defence of scientific positions;
- ✓ Exhibit general competencies in conceptualising, designing, and implementing research projects; demonstrate the ability to engage with recent scientific advances and adapt project approaches in response to unforeseen challenges;

- ✓ Communicate effectively and fluently in Bulgarian, English and / or another foreign language.

4.6. Professional competencies

By the end of their training the PhD students will:

- ✓ Understand in detail techniques used for research and complex academic research;
- ✓ Carry out informed assessments on complex issues in the relevant field, often in the absence of complete data, as well as to present his ideas and conclusions clearly and effectively to specialists and non-specialists;
- ✓ Have the ability to continue research in the relevant scientific field at increasingly complex levels, contributing to the development of new techniques, ideas or approaches;
- ✓ Carry out independent research that requires fundamental training; have in-depth specialised knowledge in the professional field "Earth Sciences"; master the technologies for conducting modern scientific research;
- ✓ Have the necessary training for scientific and pedagogical work in higher and secondary schools;
- ✓ Be members or leaders of a research team on research projects related to the framework agreements of the EU, NATO, the Research Fund, etc.
- ✓ Develop and offer methods and technologies for research in the field of cartography and thematic mapping, to perform expert activities, to participate in the work of scientific councils, seminars, scientific conferences, etc.

5. FIELDS OF PROFESSIONAL REALISATION

PhD degree holders may pursue successful careers in research institutes and universities as researchers and academic lecturers. They may also work as experts in various ministries and regional authorities, as well as in municipal and district administrations, where expertise in the management and conservation of natural resources is required.

PhD graduates can serve as specialists in the field of environmental protection policy, the study and conservation of environmental components in national and nature parks, within basin directorates, and in institutions addressing climate change, natural hazard processes, and the sustainable use of energy resources, among others.

PhD STUDENTS EDUCATION

The PhD students are trained according to a Curriculum, which contains three main types of activities - educational activity, research activity and pedagogical activity. The individual work plan of the PhD student is accepted by the Council of the department of Geography, ecology and environmental protection and approved by the Council of the Faculty of Mathematics and Natural Science.

PhD students take exams in four compulsory courses during the educational process. Two of the compulsory courses are common to all PhD students in the SWU “N. Rilski”. These are "Project Preparation and Management" and "English Language". The proposed list of elective courses is indicative. The compulsory courses 1 and 2, as well as the elective course, are offered

in accordance with the topic of the dissertation. The courses are listed in the Individual work plan of the doctoral student.

CONDITIONS FOR ADMISSION TO THE PHD THESIS DEFENSE

The educational and scientific degree “Doctor of Philosophy” is acquired after fulfilling the obligations under Article 46, paragraph 2 of the Higher Education Act, Article 9, paragraph 2 of the Act for the Development of the Academic Staff in the Republic of Bulgaria, section II of the Regulations for the Application of the Act for the Development of the Academic Staff in the Republic of Bulgaria and according to the Terms and conditions for acquiring the educational and scientific degree PhD of the Internal Rules for Academic Staff Development of the South-West University "Neofit Rilski".

CURRICULUM CONTENT

I.	**EDUCATIONAL ACTIVITY**	
1.	Compulsory course 1 from the thematic field of the PhD thesis	9
2.	Compulsory course 2 from the thematic field of the PhD thesis	9
3.	Preparation and management of projects	3
4.	English language	4
5.	Elective course	5
	TOTAL:	**30**
II.	**RESEARCH ACTIVITY**	
1.	Elaboration and presentation of a concept for the structure and content of the PhD thesis, determining the purpose, tasks and methods of research.	3
2.	Finding and studying literature sources on the topic of the PhD thesis.	10
3.	Analysis of selected literature sources and writing the chapter "Literature Review" of the dissertation.	5
4.	Field and/or laboratory studies and/or searching and collecting data on the topic of the PhD dissertation.	18
5.	Preparation and writing parts of the dissertation: "Materials and methods" and "Description of the model object of the study".	10
6.	Systematisation, processing and analysis of the research data.	14
7.	Preparation and writing parts of the dissertation: „Results and discussion”.	20
8.	Preparation of a report and participation in a scientific forum on the topic of the PhD thesis.	12
9.	Preparation and publication of an article in a scientific journal on the topic of the PhD thesis.	12
10.	General processing of the dissertation.	15
11.	Preparation and presentation of the thesis work at a meeting of the department council.	5
12.	Editing of the PhD manuscript.	6
	TOTAL:	**130**
III.	**PEDAGOGICAL ACTIVITY**	
1.	Conducting field training and / or exercises / practicum in courses from the curriculum of the Bachelors programme in Geography and Regional Policy, Pedagogy of Geography and History, and Ecology and Environmental Protection”.	4
2.	Consulting/Advising students in courses from the curriculum of the Bachelor programme in Geography and Regional Policy, Pedagogy of Geography and History, and Ecology and Environmental Protection”.	3
3.	Reviewing tests, presentations, written works etc., prepared by students in Bachelor programme in Geography and Regional Policy, Pedagogy of Geography and History, and Ecology and Environmental Protection”.	6
4.	Writing reviews of diploma works of students in Bachelor or Master programme.	2
	TOTAL:	**15**
IV.	**OTHER**	
1.	Participation in meetings of the department “Geography, ecology and environmental protection”.	1
2.	Participation in the work of department commissions, workshops or other administrative activities.	4
	TOTAL:	**5**
	TOTAL (for the entire period of study):	**180**

	ELECTIVE COURSES	
1.	Application of GIS in geographical research	5
2.	Applied statistics	5
3.	Mathematical models in physical geography	5
4.	Remote sensing methods for assessment and analysis of environmental components	5
5.	* Or another academic course approved by the Departmental Council	5

COURSE DESCRIPTION

COMPULSORY COURSES

PROJECT PREPARATION AND MANAGEMENT

ECTS credits: 3.0
Form of assessment: exam **Examination type:** written / interview
Semester: I

Annotation:

The aim of the course *Project Preparation and Management* is to equip doctoral students with the knowledge and skills necessary for the effective preparation and management of projects at both national and trans-European levels. The course provides a comprehensive understanding of various types of projects and programmes, fostering the development of highly qualified specialists in this field.

The specific objectives of the course are as follows:

- To provide fundamental knowledge and skills in project management, with an emphasis on national and international instruments that support projects and programmes across different sectors.
- To deepen understanding of the nature and key characteristics of project management, including the management of project teams.
- To introduce best practices for making strategic and tactical decisions related to project implementation and management.

Upon successful completion of the course, doctoral students will acquire the competencies required to design and develop project proposals in various domains, participate effectively in project management processes, and contribute to the successful delivery of project outcomes. These competencies are particularly relevant given the increasing reliance on project- and programme-based approaches for the development of diverse economic sectors.

The course aligns with the mission and educational philosophy of the university, which is committed to delivering modern, relevant, and high-quality academic training. The course content and workload are consistent with the assigned credit value and the qualification framework of the PhD programme.

The achievement of the course objectives will be assessed through two tests: an entry test and a final test.

ENGLISH LANGUAGE

ECTS credits: 4.0 **Total workload:** 60 h. classes / 60 h. self-study
Form of assessment: exam **Course type:** compulsory
Semester: I **Examination type:** written / interview

Annotation:

According to Decision No. 21 of 04.09.2013 of the Academic Council, the English language course is compulsory for all doctoral students during the first year of their studies across all faculties of SWU "Neofit Rilski", regardless of their doctoral programme.

The course is intensive, comprising six hours of training per day. It is typically held annually during the first month following the end of the summer semester. Its duration may vary depending on the grouping of students according to their level of language competence. This level is determined by a preliminary entrance test, based on which participants are placed into groups corresponding to the following categories: beginners, intermediate, and advanced, aligned with levels A1, A2–B1, and B2–C1 of the Common European Framework of Reference for Languages (CEFR).

The aim of the course is to provide practical English language training. At the lower levels, the focus is on acquiring fundamental vocabulary and grammar, while at the higher levels, the emphasis is on expanding and refining language knowledge and increasing overall proficiency.

The training programme employs an integrative approach, with a focus on the development of the four core language skills: reading, writing, listening, and speaking. Particular emphasis is placed on enhancing speaking and listening abilities, as well as on mastering the fundamental principles of writing academic texts in English. The course also includes training in preparing presentations, CVs, abstracts, and academic articles in English.

The English language course for doctoral students comprises the following modules: practical grammar, vocabulary development, written exercises, reading and listening comprehension, and conversation practice. Depending on the specific needs of students from different faculties and academic disciplines, specialised vocabulary is incorporated, along with exercises in both specialised and general translation.

ELECTIVE COURSES

APPLICATION OF GIS IN GEOGRAPHICAL RESEARCH

ECTS credits: 5 **Total workload:** 30 h. consult. / 150 h. self-study
Form of assessment: exam **Course type:** optional
Semester: III - IV **Examination type:** written / interview

Annotation:

The course **"Application of GIS in Geographical Research"**, offered as part of the doctoral programme in *Physical Geography*, is designed to advance doctoral students' expertise in the use of Geographic Information Systems (GIS). It introduces key concepts underpinning the design, development, and implementation of GIS, situated within the context of contemporary scientific research. The course builds upon foundational knowledge acquired during undergraduate and master's studies, expanding it through a more in-depth exploration of theoretical and applied perspectives relevant to doctoral-level inquiry.

The primary objective of the course is to provide specialised knowledge concerning the growing role of GIS in addressing critical issues such as the spatial distribution of animal and plant species, the environmental factors influencing them, the dynamics of populations and ecosystem components, and the impact of anthropogenic disturbances on the natural environment.

A wide range of advanced topics is covered, including the practical application of map projections and transformations between coordinate systems, interpolation techniques, generalisation processes, data classification methods in digital environments, vector and raster analyses, and the visualisation of three-dimensional objects and surfaces. Particular emphasis is placed on the application of GIS-based spatial analysis to explore and interpret complex environmental and physical geographic problems.

The course adopts a strongly practice-oriented approach, enabling doctoral students to apply their acquired knowledge through the development of a thematic project closely aligned with

their dissertation research. This pedagogical strategy supports the effective integration of theoretical understanding with individual academic work.

By the end of the course, students are expected to demonstrate proficiency in the use of GIS tools for the visualisation and analysis of spatial data related to their research. They should also be capable of independently designing and managing a geodatabase to support and present their scientific findings effectively.

The skills and competencies developed through this course will prepare students for active engagement in scientific research, as well as for the planning and implementation of GIS-based projects within municipal, regional, and national institutions involved in environmental management, spatial planning, and sustainable development.

APPLIED STATISTICS

ECTS credits: 5 **Total workload:** 30h. consult. / 150h. self-study
Form of assessment: exam **Course type:** optional
Semester: III - IV **Examination type:** written / interview

Annotation:

The course **"Applied Statistics"** is designed to introduce students to the practical application of statistical methods using information technology tools. The course focuses on the modelling of empirical data and its application through contemporary IT environments. Students will become familiar with widely used statistical software, including **MS Excel**, **SPSS**, and **STATISTICA**.

Course Content:

The structure and content of the course are aligned with the students' level of IT knowledge as acquired during the corresponding stage of their academic programme. The course covers: methods of scientific investigation; project-based research; specific features of empirical studies in ecology; sample distributions and descriptive statistics; non-parametric tests for analysing distribution types; correlation analysis; and methods and technologies for statistical data analysis.

MATHEMATICAL MODELS IN PHYSICAL GEOGRAPHY

ECTS credits: 5 **Total workload:** 30h. consult. / 150h. self-study
Form of assessment: exam **Course type:** optional
Semester: III - IV **Examination type:** written / interview

Annotation:

The educational process in this course includes teaching of ecology in order to apply the methods of mathematical modelling for investigation of geographical problems, ecosystems and problems of the environment, in particular the air and water pollution, climatic changes etc. Basic mathematical models in geography will be considered and analysed with special attention to the application of the population theory.

Course content: Mathematical modelling. Systematic approach to the modelling of ecosystems. Models for assessment and management of exhaustible natural resources and renewable natural resources. Climate model of the secretion of carbon dioxide. Modelling

communities (plant associations). Modelling of forest ecosystems. Modelling of aquatic ecosystems. Modelling economic growth with exhaustible natural resources. Modelling of populations in protected areas. Control theory of dynamical systems. Solutions for open and closed loops. Stability and sustainability of ecosystems. Stability of equilibrium of open type fixed cycle.

REMOTE SENSING METHODS FOR ASSESSMENT AND ANALYSIS OF SPATIAL INFORMATION

ECTS credits: 5
Total workload: 30h. consult. / 150h. self-study
Form of assessment: exam
Course type: optional
Semester: III - IV
Examination type: written / interview

Annotation:

The course aims to introduce the technical capabilities and applications of remote sensing methods and technologies, with a particular focus on their use in the assessment and analysis of spatial information. Emphasis is placed on Earth observation through satellite-based remote sensing methodologies.

The course content is divided into two main parts. The first part provides a synthesised overview of remote sensing methods, including the fundamental properties of the electromagnetic spectrum, various types of scanning systems, and a description of key satellites and their technical specifications. The second part focuses on the primary tools for analysing the atmosphere and Earth's surface, along with core image processing techniques and their application in environmental studies.

The practical component includes exercises designed to improve students' understanding of atmospheric processes and phenomena, in addition to the utilisation of remote sensing as a tool for environmental analysis. A key element of the practical sessions involves the processing of satellite imagery and the extraction and interpretation of data using Geographic Information Systems (GIS).