SOUTH-WEST UNIVERSITY „NEOFIT RILSKI“
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INFORMATION PACKAGE

/ECTS/

FIELD OF HIGHER EDUCATION: 1. PEDAGOGICAL SCIENCES

PROFESSIONAL FIELD: 1.3. PEDAGOGY OF TEACHING IN …

SPECIALITY: PEDAGOGY OF TEACHING IN PHYSICS AND MATHEMATICS

QUALIFICATION CHARACTERISTICS
OF
SPECIALTY "**PEDAGOGY OF TEACHING IN PHYSICS AND MATHEMATICS**"

EDUCATIONAL-QUALIFICATIVE DEGREE: BACHELOR

PROFESSIONAL QUALIFICATION: TEACHER IN PHYSICS AND MATHEMATICS

TERM OF TRAINING: 4 /four/ years

FORM OF TRAINING: REGULAR

The main goal of the training in the specialty "Pedagogy of Teaching Physics and Mathematics" for the acquisition of the "Bachelor's" degree is the preparation of well-informed, practically trained, competent and competitive teachers of physics/physics and astronomy and mathematics, who will carry out quality educational, scientific-methodological and organizational-management activities in the school education system, as well as effective scientific research activities in the relevant scientific fields.
Tasks of the training in the specialty "Pedagogy of Teaching Physics and Mathematics", "Bachelor" degree:
• implementation of comprehensive theoretical and practical professional training, which ensures the acquisition and formation of fundamental, integrative and interdisciplinary knowledge, skills and attitudes in the field of physical sciences, mathematics, psychology, pedagogy, methodology of teaching physics and mathematics, etc.;
• creation of an educational environment, providing opportunities for students to acquire modern educational technologies, to master modern research methods, to develop their thinking, analytical skills, creative abilities, imagination, resourcefulness, etc.;
• implementation of specialized practical and applied training for the successful application of the acquired theoretical knowledge and acquired skills in pedagogical practice;
• building motivation and acquiring key competencies for lifelong learning, forming abilities and striving for continuous self-education, self-improvement, expansion and improvement of professional qualifications.

Purpose of the specialist

Graduates of the specialty "Pedagogy of Teaching Physics and Mathematics", Bachelor's Degree, acquire in-depth scientific and theoretical knowledge and practical skills and experience, which determine their professional purpose to be teachers of physics/physics and astronomy and mathematics, educators, etc. in the lower secondary and upper secondary stages of school education in all types of schools, as well as to carry out scientific research in the relevant scientific fields.

CURRICULUM

FIELD OF STUDY: **„ PEDAGOGY OF TEACHING IN PHYSICS AND MATHEMATICS “**

(Adopted in 2008, updated 2024)

First Year			
First Semester	ECTS credits	Second Semester	ECTS credits
Compulsory Courses		***Compulsory Courses***	
Introduction to Mathematics	4,0	Mathematical Analysis - Part II	7,0
Introduction in Physics	2,5	Algebra and Number Theory	7,0
Linear Algebra	5,0	Practical Course in Mathematical Analysis	2,0
Analytical Geometry	5,0	Molecular Physics	5,0
Mathematical Analysis - Part I	5,0	Laboratory Practicum in Molecular Physics	2,0
Practical Course in Linear Algebra and Analytical Geometry	2,0	Pedagogy	7,0
		Sports	0,0
Mechanics	4,5		
Laboratory Practicum in Mechanics	2,0		
	Total: 30		Total: 30
Second Year			
Third Semester	ECTS credits	Fourth Semester	ECTS credits
Compulsory Courses		***Compulsory Courses***	
Mathematical Methods of Physics	2,0	Optics	4,0
Electricity and Magnetism	4,0	Laboratory Practicum in Optics	2,0
Laboratory Practicum in Electricity and Magnetism	2,0	Theoretical Mechanics	4,0
		School Course in Mathematics - Part II	5,0
Psychology	6,0	Practical Course in Solving Problems From	2,0
School Course in Mathematics – Part I	6,0	The School Course in Geometry	
Practicum in Solving Problems from the School Course in Algebra and Analysis	2,0	Competency Approach and Innovations in Education	4,0
Numerical Methods	6,0	Foreign Language - Part II	3,0
Foreign Language – Part I	2,0	***Optional Courses 1 and 2***	
Sports	0,0	***(Students choose two courses (6 credits) from the first group)***	
		First Group – *Pedagogical, psychological, educational-management and private-didactic disciplines*	
		Digital Competence and Digital Creativity	3,0
		Development of Lessons for E-Learning	3,0
		Pedagogical Interaction in a Multicultural Environment	3,0
		Management of Educational Institutions	3,0
		Inclusive Education for Children and Students with Special Educational Needs	3,0
		Communication Skills in an Educational Environment	3,0
		Civic Education	3,0
		STEM Educational Technologies in Natural Sciences, Mathematics and Informatics Education	3,0
	Total: 30		Total: 30
Third Year			

Fifth Semester	ECTS credits	Sixth Semester	ECTS credits
Compulsory Courses		***Compulsory Courses***	
Geometry	5,0	Physics Teaching Methodology - II Part	4,0
Physics Teaching Methodology - I Part	3,5	Quantum Mechanics	4,0
Physics Observation	3,0	Mathematics Teaching Methodology -Part I	3,0
Information and Communication Technologies in Teaching and Working in a Digital Environment	3,0	Probability and Statistics - Methodology And Technologies	5,5
		Nuclear Physics	5,5
Atomic Physics	5,5	Methodology and Technique of School Physics Experiment	3,0
Electrodynamics	3,5		
Optional Courses 3 and 4		Mathematics Observation	2,0
(Students choose two courses (6,5 credits) from the second group)		Inclusive Education	3,0
Second Group – ***Interdisciplinary and applied-experimental disciplines and disciplines, the training in which provides upgrading of competencies related to the specifics of professional qualification***			
First Subgroup *(choose one subject)*			
Diagnostics of Academic Achievements in Physics	3,0		
Modern Educational Technologies in Physics Education	3,0		
Methodology of Teaching "Man and Nature" (Physics Module)	3,0		
History of Physics	3,0		
Specific STEM Educational Technologies in Physics Education	3,0		
Second Subgroup *(choose one subject)*			
Basics of Arithmetic	3,5		
Basics of Geometry	3,5		
Basics of Modeling	3,5		
Mathematical Structures	3,5		
	Total: 30		Total: 30

Fourth Year			
Seventh Semester	ECTS credits	Eighth Semester	ECTS credits
Compulsory Courses		***Compulsory Courses***	
Physics Problem Solving Methodology	6,0	Physics Internship	5,0
Mathematics Teaching Methodology - Part II	6,0	Mathematics Internship	5,0
Astronomy and Astrophysics	6,0	***Optional Courses 7 and 8***	
Current Pedagogical Practice in Physics	2,0	***(Students choose two courses (10 credits) from the second group)***	
Current Pedagogical Practice in Mathematics	2,0	**Second Group**	
Optional Courses 5 and 6		**Fifth Subgroup** *(choose one subject)*	
(Students choose two courses (8 credits) from the second group)		Computer Educational Games in Mathematics and Informatics Education	5,0
Second Group			
Third Subgroup *(choose one subject)*		Practical Course in Mathematical Modeling with Matlab	5,0
Laser Technique	4,0		
General Metrology	4,0	Numerical Methods Monte Carlo	5,0
Radiophysics	4,0	Polynomials of One and More Variables	5,0
Magnetic Phenomena and Materials	4,0	**Sixth Subgroup** *(choose one subject)*	

Fourth Subgroup *(choose one subject)* Symmetric Semigroups Mathematical Models in Economics Numerical Methods for Extremal Problems History of Mathematics Specific STEM Educational Technologies in Mathematics Education	 4,0 4,0 4,0 4,0	Basics of Optoelectronics and Optical Communications Protection in Extreme Conditions Environmental Physics Nano Technologies **Graduation:** 1. Written state exam in physics and mathematics or defense of a diploma thesis. 2. State practical-applied exam in mathematics (delivering a lesson developed by the student). 3. State practical-applied exam in physics (delivering a lesson developed by the student).	5,0 5,0 5,0 5,0 10,0
	Total: 30		Total: 30

TOTAL FOR 4 ACADEMIC YEARS: **240 credits**

DESCRIPTIONS OF THE COURSES

INTRODUCTION OF MATHEMATICS

ECTS credits: 4,0
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: current assessment
Course Status: Compulsory course
Semester: I

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Short Description:
The subject education includes the study of basic number system, the theory of algebrical polynomials and the basic algebrical theorem.

Course Aims:
The students obtain knowledges and skills in the already mentioned themes and learn how to use them in their future educational practice.

Teaching Methods: lectures, exercises discussions, partial exercises.

Requirements/Prerequisites: The students must have basic knowledge from school course of mathematics.

Evaluation: permanent control during the semester (two written exams) an exam in the semester's end in two parts- problems solving and answering theoretical questions**.**

Registration for the course: The course is obligatory.

Registration for exam: up to agreement with the teacher and the Educational Office

INTRODUCTION TO PHYSICS

ECTS credits: 2,5
Hours per week: 2 Lec. + 0 Sem. + 0 Lab.
Form of assessment: written exam
Course Status: Compulsory course
Semester: I

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation:
The course „Introduction to Physics" is included as a compulsory course in the specialty curriculum „Pedagogy of Teaching Physics and Mathematics". It is studied from students studying at educational and qualification degree „Bachelor".
The course „Introduction to Physics" is with total workload 30 hours lectures. The students' self-study is 45 hours.
Teaching on the course ends with a written exam.

Course content:
1. Mechanics.
2. Thermal phenomena.
3. Constant electric current.
4. Mechanical oscillations and waves.
5. Electrostatics.
6. Magnetism.
7. Variable electrical current.
8. Electromagnetic waves.
9. Light.
10. Atomic and nuclear physics.
11. Astronomy.

Teaching methods and evaluation:
Lectures are held in a lecture hall, that is equipped with the necessary technique – computer and multimedia projector, using the computer presentations, which are developed in accordance with the educational content of the lectures.
Current control of the students' educational achievements is carried out during the semester. The evaluation of the current control is formed on the basis of the presentation and of the defense of self-developed course assignment from each student. Certification of the semester get students who have received an evaluation of the current control at least „Satisfied 3“ (D). Teaching on the course ends with a written exam on the educational content. Final evaluation is formed only if the student has received an evaluation of the written exam at least „Satisfied 3“ (D). In forming of the final evaluation are reported the evaluations from the written exam (60 %) and from the current control (40 %).

LINEAR ALGEBRA

ECTS credits: 5,0 **Hours per week:** 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: written exam **Course Status:** Compulsory course
Semester: I

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Short Description:
The education of that discipline includes some of the basic notations in combinatory and complex numbers. Students study matrices, determinants, systems linear equations and methods for their solving, linear spaces, linear transformations, and quadratic forms.

Course Aims:
The students have to obtain knowledge and skills to apply the learned theory for modeling and solving real practical tasks, to do basic operations with matrices, to solving determinants and systems linear equations using the methods of Gauss and Kramer, to be able to distinguish the correspondence between algebraic objects, to determine their characteristics and to transfer them on others – difficult to examine.

Teaching Methods: lectures, tutorials, homework, and problem solving tests.

Requirements/Prerequisites: The students should have basics knowledge from school mathematics.

Assessment: permanent control during the semester including homework and two written exams, and written exam in the semester's end on topics from tutorials and on topics from lectures**.**

Registration for the exam: coordinated with the lecturer and student Service Department

ANALYTICAL GEOMETRY

ECTS credits: 5,0
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: written exam
Course Status: Compulsory course
Semester: I

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Short Description:
The education of that discipline includes learning of vector calculus, affine coordinate systems and analytic representations of straight lines and planes. After introducing the cross ratio, the projective coordinate systems are used as well. The basic elements of the projective, of the affine and of the metric theory of the curves and the surfaces of the second degree are taught.

Course Aims:
The students have to obtain knowledge and skills for application of the analytic apparatus for research of geometric objects.

Teaching Methods: lectures, tutorials, homeworks, problem solving tests.

Requirements/Prerequisites: Linear Algebra and Mathematical Analysis

Assessment: written exam on topics from tutorials and on topics from lectures.

Registration for the exam: coordinated with the lecturer and student Service Department

MATHEMATICAL ANALYSIS – PART I

ECTS credits: 5,0
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: written exam
Course Status: Compulsory course
Semester: I

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Short Description: The main topics to be considered:

- Numerical sequences

- Numerical series
- Limit, continuity and differentiability of functions
- Integrals of functions of real variables
- Applications of the integral calculation

Course Aims: This course develops in details the problems of numerical sequences, numerical series, differential and integral calculation of functions of one real variable.

Teaching Methods: Lectures, tutorials, homework, problem-solving tests. During the lectures students are acquainted with the basic theoretical material- definitions, theorems, applications, with the methods of theorems proofs. During seminars students solve practical problems. The knowledge obtained within the theoretical practice is used and it is also used in the process of problem solving.

Requirements/Prerequisites: Basic knowledge of courses in Elementary Mathematics, Linear Algebra, Analytical Geometry is necessary.

Assessment: written exam on seminars and discussion on the theoretical material from the lectures.

Registration for the exam: Students and the lecturer agree on the convenient dates within the announced calendar schedule of examination session.

PRACTICUM IN LINEAR ALGEBRA AND ANALYTICAL GEOMETRY

ECTS credits: 2,0
Hours per week: 0 Lec. + 0 Sem. + 2 Lab.
Form of assessment: current assessment
Course Status: Compulsory course
Semester: I

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Status: Compulsory course in the B.S. Curriculum of „Pedagogy of Teaching of Physics and Mathematics".

Short Description: The education of that discipline includes some of the basic notations in Linear Algebra and Analytical Geometry, and the included topics are analyzed and implemented with the help of basic software.

Course Aims: The purpose of this course is to introduce students with the opportunity to use modern methods and tools for solving problems of Linear Algebra and Analytical Geometry.

Teaching Methods: tutorials, homework and tests.

Requirements/Prerequisites: The students should have basic knowledge in Linear Algebra and Analytical Geometry.

Assessment: permanent control during the semester including two homework and two tests, or exam in the semester's end.

Registration for the exam: coordinated with the lecturer and student Service Department

MECHANICS

ECTS credits: 4,5
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Form of assessment: written exam
Course Status: Obligatory course
Semester: I

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: The university course "Mechanics" aims to provide basic knowledge in the field of mechanical phenomena that appear as foundation of physical science. In this way, students prepare for a more detailed study of the physical phenomena that are subject to specialized disciplines in the higher courses. Laboratory classes give the students practical skills for physical observations and experiment.

Course content: The material covered in the lectures includes the following sections:

- Particle kinematics
- Particle dynamics
- Work and energy,
- Laws of conservation of energy, momentum and angular momentum
- Mechanics of rigid body
- Elastic properties of bodies
- Fluid mechanics.

Technology training and assessment: The course ends in a written exam. During the period of education, students sit for written tests on the material covered in the seminars and defend protocols on the laboratory exercises. Their results are included in the formation of the final grade.

LABORATORY PRACTICUM IN MECHANICS

ECTS credits: 4,0
Hours per week: 0 Lec. + 0 Sem. + 3 Lab.
Form of assessment: ongoing assessment
Course Status: Obligatory course
Semester: I

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Subject Description: The obligatory discipline "Laboratory Practicum in Mechanics" is an integral part of the basic course in general physics in the training of students for obtaining the educational degree "Bachelor". The practical classes give students the opportunity to experimentally study the basic physical phenomena and their application.

Specific Goals of the Subject: The course aims to gives students a necessary minimum basic knowledge about the main macroscopic physical phenomena in the field of the mechanics.

Teaching Methods: Laboratory exercises with the implementation of laboratory tasks and compilation of the respective protocols.

Requirements/Prerequisites: basic knowledge in mechanics and mathematics.

Evaluation Method: Evaluation defined by current assessment and current control of the laboratory exercises taken certain gravity.

Registration for the course: Not necessary.

Registration for the Exam: coordinated with the lecturer and Students Service Department.

MATHEMATICAL ANALYSIS - PART II

ECTS credits: 7,0
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: exam
Course Status: Compulsory course
Semester: II

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course in Mathematical Analysis II includes basic concepts of mathematical analysis: improper integral, functions of two and more variables; continuity of functions of several variables; partial derivatives, local and relative extrema; implicit functions; double and triple Riemanm integral, and their applications for finding arias and volumes; line integrals of first and second type; surface integrals of first and second type; basic formulas for integrals of Mathematical Physics.

Course Aims: Students should obtain knowledge for Mathematical Analysis II, which is a basic mathematical discipline. This knowledge is necessary for studying, Mathematical Analysis III, Ordinary Differential Equations, Numerical Methods, Optimization.

Teaching Methods: lectures and seminars

Requirements/Prerequisites: Mathematical Analysis I

Assessment: written final exam, two problems solving tests per semester

Registration for the Course: by request at the end of the current semester

Registration for the Exam: coordinated with lecturer and Student Service Department

ALGEBRA AND NUMBER THEORY

ECTS credits: 4,0
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: written exam
Course Status: Compulsory course
Semester: I

Methodological guidance:
Department of Mathematics and Physics,

Faculty: Natural Sciences & Mathematics

Short Description: The course considers the main notations from number theory (first part), theory of algebraic structures (second part), and algebraic polynomials (third part). The education starts with some basic notations from set theory, relations, operations and mappings. In the first part, we introduce the main definitions and propositions from number theory like divisibility, congruences, primes and the fundamental theorem of arithmetic. The second part of the course consider algebraic structures with one binary operation (semigroups and groups) and algebraic structures with two binary operations (rings and fields). The definitions are introduced in an abstract way and explained with many examples. In the last part the classical polynomial questions like quotient/remainder theorem, Euclid's algorithm, Horner's scheme, roots of polynomials, and symmetric polynomials are considered.

Course Aims: The students have to obtain knowledge and skills for the basic notions and methods of the elementary number theory, the semigroup and group theory, the ring and field theory, and the polynomials with one and with more variables.

Teaching Methods: lectures, tutorials, homework, and problem-solving tests.

Requirements/Prerequisites: The students should have basics knowledge from Elementary Mathematics and Linear algebra.

Assessment: permanent control during the semester including homework and two written exams, and written exam in the semester's end on topics from tutorials and on topics from lectures.

Registration for the exam: coordinated with the lecturer and student Service Department

PRACTICAL COURSE IN MATHEMATICAL ANALYSIS

ECTS credits: 4,0
Hours per week: 1 Lec. + 2 Sem. + 0 Lab.
Form of assessment: current assessment
Course Status: Compulsory course
Semester: I

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Short Description: The education of that discipline includes some of the basic notations in Mathematical Analysis, and the included topics are analyzed and implemented with the help of basic software.

Course Aims: The purpose of this course is to introduce students with the opportunity to use modern methods and tools for solving problems of Mathematical Analysis.

Teaching Methods: tutorials, homework and tests.

Requirements/Prerequisites: The students should have basic knowledge in Mathematical Analysis.

Assessment: permanent control during the semester including two homework and two tests, or exam in the semester's end.

Registration for the exam: coordinated with the lecturer and student Service Department

MOLECULAR PHYSICS

ECTS credits: 5.0
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Form of assessment: Written exam
Course Status: Obligatory course
Semester: II

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Subject Description: The main topics to be considered:

- Bases of equilibrium thermodynamics
- Thermodynamic and statistical interpretation of basic thermodynamic quantities
- Surface tension
- Variation of physical condition
- Elements of non-equilibrium thermodynamics. Transmission processes – diffusion, thermal conductivity and internal friction.

Specific Goals of the Subject: The course aims to gives students a necessary minimum basic knowledge about the main macroscopic physical phenomena in the field of the thermodynamics and molecular physics. Some practical applications of this knowledge are an object of treatment in laboratory exercises and seminars.

Teaching Methods: lectures, laboratory exercises, tutorials, individual student's work, test-papers.

Requirements/Prerequisites: basic knowledge in mechanics and mathematics.

Evaluation Method: Evaluation defined by a written exam and current control of the seminar exercises taken certain gravity. Some intermediate tests conduct through the semester.

Registration for the course: Not necessary.

Registration for the Exam: coordinated with the lecturer and Students Service Department.

Note: The lecture course is suitable for students of all natural and technical sciences.

LABORATORY PRACTICUM IN MOLECULAR PHYSICS

ECTS credits: 2.0
Hours per week: 0 Lec. + 0 Sem. + 2 Lab.
Form of assessment: Current assessment
Course Status: Obligatory course
Semester: II

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Subject Description: The obligatory discipline "Laboratory Practicum in Molecular Physics and Thermodynamic" is an integral part of the basic course in general physics in the training of students for obtaining the educational degree "Bachelor". The practical classes give students the opportunity to experimentally study the basic physical phenomena and their application.

Specific Goals of the Subject: The course aims to gives students a necessary minimum basic knowledge about the main macroscopic physical phenomena in the field of the thermodynamics and molecular physics.

Teaching Methods: Laboratory exercises with the implementation of laboratory tasks and compilation of the respective protocols.

Requirements/Prerequisites: basic knowledge in mechanics and mathematics.

Evaluation Method: Evaluation defined by current assessment and current control of the laboratory exercises taken certain gravity.

Registration for the course: Not necessary.

Registration for the Exam: coordinated with the lecturer and Students Service Department.

PEDAGOGY

ECTS credits: 6,0
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: written exam
Course Status: Compulsory course
Semester: I

Methodological guidance:
Faculty of Pedagogy

Course description:
This lecture course in pedagogy is developed in accordance with the qualification profile of the specialty "Pedagogy of Teaching Physics and Mathematics" and provides an opportunity for students to acquire pedagogical competency in line with national requirements. The aim of the course is to develop and enrich students' theoretical thinking, their ability to analyze the fundamental relationships between tradition and innovation in the fields of education and upbringing, and to help them navigate the changing pedagogical reality. The course presents key theoretical concepts and approaches related to the education and upbringing systems in Bulgaria and around the world.
Given the profound and radical socio-economic, cultural, ideological, demographic, and ecological changes in society, a reassessment of contemporary educational problems from new methodological perspectives is essential. This is also true for didactics. Through a scientific approach to these issues, students will gain a deep understanding of the nature, principles, and technologies of teaching.

Course content:
- Module 1: Theory of Education
- Module 2: Didactics

Teaching and assessment methodology:
Each lecture includes three mandatory components: a problem-based block, an informational block, and a curiosity-enhancing block. Additional blocks may include corrective feedback and self-assessment components. These are designed to systematize students' accumulated pedagogical experience and to ensure that new knowledge builds upon a well-established foundation.
An enrichment principle is applied, incorporating interdisciplinary connections with subjects such as Comparative Pedagogy, Developmental Pedagogy, Experimental Pedagogy, Pedagogical Innovations, Sociology of Education, History of Pedagogy, and the History of Bulgarian Education, among others.
The final grade is based on the results of continuous assessment and the final exam.

MATHEMATICAL METHODS IN PHYSICS

ECTS credits: 2.0
Workload per week: 1 Lec. + 1 Sem. + 0 Lab.
Form of assessment: Written exam
Course Status: Obligatory course
Semester: III

Methodological guidance:
Department of Mathematics and Physics,
Faculty of Natural Sciences & Mathematics

Annotation: The course aims to give fundamental knowledge in Mathematical Physics and to serve as a foundation for courses in Theoretical Physics, Quantum Electronics, Astrophysics and other special-purpose courses.

Course content: The course deals with material from various chapters of Mathematical Analysis:

1. Vector and Tensor Analysis.
2. Ordinary differential equations.
3. Systems of ordinary differential equations.

Technology trainingandassessment: The course ends in a written exam which is held in two parts: problems and a written theoretical exposition. During the period of education students sit for written tests on the material covered in the seminars. Their results are included in the formation of the final grade.

ELECTRICITY AND MAGNETISM

ECTS credits: 4.0
Hours per week: 2 Lec. + 1 Sem.+ 0 Lab.
Evaluation Method: Written exam
Course status: Compulsory
Semester: III

Methodological guidance:
Department of Mathematics and Physics,
Faculty of Natural Sciences & Mathematics

Annotation: The course "Electrical and Magnetism" is compulsory for the specialty and is aimed at providing the basic preparation in the field of experimental physics and creates a foundation for learning the material taught in the basic physical disciplines in the above

courses. The subject deals with the basic laws of electrical and magnetic phenomena. The practical exercises enable students to experimentally explore the basic physical phenomena and their application.

Subject Description: The course considers the general laws of electrical and magnetic phenomena. The first part studies basic laws of electrical phenomena such as electromotive force, electric fields, electrical potential, Gauss law, dielectrics and metals in electrical field, conductors, and electrical current. The second part considers magnetic phenomena and includes field of moving charge, electrical dipole, magnetic forces, electromagnetic induction, and magnetic properties of mater. The third section concerns questions of movement of the electrical parts in electric and magnetic fields.

Pedagogical methods and type of evaluation: Lectures are visualized by demonstrations and laboratory tasks performance during the laboratory classes. From methods point of view teaching material is grouped in sections following logical consistency of the cause. Final examination is in written form. Some intermediate tests conduct through the semester.

LABORATORY PRACTICUM IN ELECTRICITY AND MAGNETISM

ECTS credits: 2,0
Hours per week: 0 Lec. + 0 Sem. + 2 Lab.
Form of assessment: written exam
Course Status: Compulsory course
Semester: III

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: The course aims to expand students' knowledge of the basic laws describing electrical and magnetic phenomena by acquiring habits and skills for practical measurement of electrical and magnetic quantities. It is the basis for other courses studied at the Faculty of Natural Sciences and Mathematics, such as Optics, including electromagnetic theory of light, Electrodynamics, Radiophysics and Electronics, Photovoltaics and more.

Subject Description: The course considers the basic laws of electrical and magnetic phenomena. Includes the implementation of laboratory exercises on topics illustrating the lecture material in the discipline of Electricity and Magnetism. Current flow in different media, electrical properties of different materials are studied, experimental verification of basic electrical laws is performed, alternating current circuits, electric oscillating circuit, etc. are studied.

Evaluation Methods: Laboratory tasks performance during the laboratory classes.

PSYHOLOGY

ECTS credits: 5,0
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: written exam
Course Status: Compulsory course
Semester: I

Methodological guidance:
Department of Psychology
Faculty of Philosophy

Course Description:
Psychology occupies an important place in the overall training of students. It explores key regularities and psychological conditions for the functioning of an individual's psyche. This course provides knowledge in general psychology, developmental psychology, and educational psychology.

Course Objective:
The goals and tasks of the course in psychology involve the study of the cognitive, emotional-volitional, and behavioral aspects of human mental activity. It addresses the psychological developments in both ontogenetic and phylogenetic contexts.

Teaching Methods:
The lecture course employs active interaction methods in the teacher-student relationship, both verbal and non-verbal, with appropriate visual aids such as diagrams, audio, and video materials.

Assessment:
The final grade in the course "Psychology" is determined based on the written response to one topic from the syllabus (weighted at 60%) and the results of continuous assessment (independent work, weighted at 40%).

Exam Registration: No registration is required.

SCHOOL COURSE IN MATHEMATICS – PART I

ECTS credits: 6,0
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: written exam
Course Status: Compulsory course
Semester: III

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The construction and development of the notion "number" is a difficult process not only for its mathematical and philosophical character, but for its educative character, too. The course "Scholar course of education in mathematics-1" for the students from second course in specialty "PEFM" follow the development of the4 notion "number", which is known from the course "Bases of the Arithmetic". This course formulates the basic principles of Algebra – commutative, associative and distributive; idempotents (neutral elements); the operations addition and multiplication of natural numbers H. on the base of the operations addition and multiplication, the course defines the respective orders. It lists the basic properties of the linear order – each set of natural numbers is limited from below, Archimedean principle, the method of the mathematical order and etc. the course considers the question about the division of the natural numbers and the notion "prime number". All of this illustrated by concrete examples. The number in different cardinal (countable) systems.
In this course we show that each two natural numbers a, b $\in$ א the equations a+x=b and a x=b do not have solutions in the semiring of the natural numbers א. This lead to the necessity of enlargement of the semiring א to the ring of the integer numbers Z, to the semifield of the fraction Q_t, and finally to the field rational numbers Q. The course makes clear the validation

of the basic properties of the introduced orders in the semiring of the natural numbers, for each of mentioned above structures. All of this is illustrated by appropriate example and problems. The most of the school hours is spared for the field of the real numbers and respective problems, such as quadratic equations and inequality, systems of equations and inequality, some of them with irrational expressions, some equivalent expressions with the collaboration of a special function like exponential, logarithmic, trigonometric and etc. out auditorium work for this course include homework, course tasks, work in library and computer room, consultation, preparation for test-paper, assimilation of the lection materials and etc. the proportion between auditorium and out auditorium work is 60:120.

Course Aims: The introduced course of lections and tutorials shows the status of the mentioned above material, which is taught in a school course in Mathematics. It is developed on the base of well known algebraic structures. Students should learn this basic structures and problems which can be solved in them. With the help of the obtained knowledge and skills students should receive a complete canonical form of an algebraic equation or system of algebraic equations, using possible equivalent transformations.

Teaching Methods: lectures and tutorials.

Requirements / Prerequisites: Higher Algebra, Bases of the Arithmetic.

Assessment: written final exam

Registration for the Exam: coordinated with lecturer and Student Service Department

PRACTICUM IN SOLVING PROBLEMS FROM THE SCHOOL COURSE IN ALGEBRA AND ANALYSIS

ECTS credits: 2,0
Hours per week: 0 Lec. + 0 Sem. + 1 Lab.
Form of assessment: written exam
Course Status: Compulsory course
Semester: III

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The formation and development of the concept of number is complex not only in its mathematical and philosophical essence but also in its pedagogical nature. Following the approach known from basic arithmetic, the course “Practicum in Solving Problems from the School Course in Algebra and Analysis” (PSSCA) for 8-semester students in the “Pedagogy of Teaching Physics and Mathematics” program (regular study form) begins with the formulation of the basic algebraic laws - commutative, associative, and idempotent (neutral) elements in addition and multiplication - as well as the distributive law unifying the two operations in the set of natural numbers **N**.
Based on addition and multiplication, the corresponding orders are defined. Key properties of linear order are listed - boundedness from below for any subset of **N**, the Archimedean property, etc. - as well as the method of mathematical induction related to both orders. The topic of divisibility in **N** and the concept of prime numbers is addressed and illustrated with concrete examples. The representation of natural numbers in various numeral systems is also discussed.

It is shown that the equations $a + x = b$ and $a \times x = b$ have no solutions in the semiring of natural numbers **N**, which motivates the need to extend **N** to the ring of integers **Z**, the field of rational numbers **Q**, and ultimately the field of real numbers $\mathbb{R}$. For each structure, the preservation of the essential properties and order relations from **N** is emphasized. These are illustrated with appropriate examples and problems.
The majority of the course time is devoted to the field of real numbers and corresponding tasks - quadratic equations and inequalities, systems of equations and inequalities (including irrational expressions), and their equivalents involving special functions such as exponential, logarithmic, trigonometric, and others.
Out of class activities include homework, course assignments, work in libraries and computer labs, consultations, preparation for tests, and review of lecture material.

Course Objective: Students are expected to understand and internalize the basic concepts, operations, and orders related to the extensions of the number system, and to competently apply problem-solving methods for equations, inequalities, and systems within these number sets.

Teaching Methods: Lectures, seminar exercises, consultations, homework, course assignments, and written tests.

Prerequisites: Students are expected to have a solid command of the high school mathematics curriculum.

Assessment: Written exam based on the seminar exercises and lecture material.

Exam Registration: Students arrange exam dates with the instructor in accordance with the official academic exam schedule.

NUMERICAL METHODS

ECTS credits: 6,0
Hours per week: 2 Lec. + 2 Sem. +0 Lab.
Form of assessment: written exam
Course Status: Compulsory course
Semester: III

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description:
The goal and main task of studying the discipline Numerical Methods is for students to acquire knowledge about the basic numerical methods of mathematical analysis, algebra and differential equations, which are used in solving various technical, physical and other problems.

Course Objective:
A detailed study of interpolation is planned as a way to approximate functions given in tables: classical interpolation problem, Lagrange's interpolation formula, interpolation error (formula and error estimate), divided differences and Newton's interpolation formula with divided differences, finite differences and interpolation formulas with finite differences, interpolation with spline functions (linear and cubic splines), Hermite's interpolation problem, inverse

interpolation. Another basic approach to approximating functions is also considered - mean square approximations (least squares method). A place is reserved for the topics of numerical differentiation and numerical integration - Newton-Coates quadrature formulas (rectangle, trapezoid and Simpson formulas) and Gauss. The study of the main methods for numerically solving nonlinear equations is planned: the method of chords, the method of secants, Newton's method. Another important topic is the solution of systems of linear equations, which is achieved in many mathematical, physical, technical and other problems: exact methods - Gauss and Gauss-Jordan methods, the method of triangular decomposition (LU-method), Cholesky's method (square root method); iterative methods - the method of simple iteration (Jacobi method), Seidel's method. The study of methods for numerically solving the Cauchy problem for ordinary differential equations (ODE) of the first order is planned - Euler's method, Runge-Kutta methods, Adams' methods; numerical solution of the boundary value problem for ordinary differential equations of the second order and variational methods for solving operator (including differential) equations.
It is planned to get acquainted with software products that implement some of the considered methods.

Teaching Methods:
The final grade is formed as 20% of the grade from two homework assignments, 20% of the grade from two course assignments, 30% of the grade from Part I (respectively, from the grade from the current control works - in case of exemption from Part I) and 30% of the grade from Part II of the exam.

Prerequisites:
Basic knowledge in mathematical analysis, algebra, and programming.

Assessment:
Written exam including theoretical questions and practical problems. Continuous assessment may include homework, software-based tasks, and midterm tests.

FOREIGN LANGUAGE I

ECTS credits: 2,0
Hours per week: 0 Lec. + 2 Sem. + 0 Lab.
Evaluation: ongoing assessment
Course status: Compulsory
Semester: I

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: The aim of the course “Foreign language – English” is to ensure the development of communication skills, reaching of certain phonetic, grammatical, lexical and thematic minimum, skills and habits for participation in real, communicative situations, knowledge and individual work with vocabulary. It aims to review and systematize the basic knowledge of the undergraduates and provides equal start level for the next stage of education, called "language of the programme”. The choice of topics is based on their high particularly in the scientific style of speech and their unconditional structural significance and necessity of learning a foreign language. Widely used communicative exercises focus that strengthen the necessary grammatical habits and encourage students to be active speech activity in the studied subjects. The practical course is based on the thematic texts reflecting

everyday student life, elementary special technical terminology on the subject and aims to stimulate the desire and motivation of students to enhance their language and consistent level – Elementary and Pre-intermediate.

Purpose of the course: The aim of the course is to build an initial communicative competence, as the ability to understand and draw meaningful oral and written statements, in accordance with the rules of the English language to develop reading skills and comprehension of texts from everyday communication and presentation and related texts the basic terms in the specialty; develop skills in physical vocabulary can make translations of physical texts from English Into Bulgarian language using a dictionary.

Educational Methods: Active methods are used through different exercises; based tests are made for control of the learned, translation of physical literature.

OPTICS

ECTS credits: 8.0
Evaluation Method: Written exam
Semester: IV
Hours per week: 2 Lec. + 1 Sem. +0 Lab.
Status of the Subject: Compulsory

Methodological guidance:
Department of Mathematics and Physics,
Faculty of Natural Sciences & Mathematics

Annotation: The course "Optics" is compulsory for the specialty and is aimed at providing the basic preparation in the field of experimental physics and creates a foundation for learning the material taught in the basic physical disciplines in the above courses. The subject deals with the basic laws of optical. The practical exercises enable students to experimentally explore the basic physical phenomena and their application.

Subject Description: The course considers optics phenomena on the base of theory of electromagnetic wave propagation. It starts with Maxwell's equations and describes the general properties of the light waves. Particular attention is paid to such phenomena as refraction on the dielectric and metal surface, total internal refraction. Important part of the course is the consideration of the interference and the diffraction of the light, some types of interferometers and principles of the working of diffractive gratings. In addition the basic principles of geometric optics are present.

Pedagogical methods and type of evaluation: Lectures are visualized by demonstrations and laboratory tasks performance during the laboratory classes. From methods point of view teaching material is grouped in sections following logical consistency of the cause. Final examination is in written form. Some intermediate tests conduct through the semester.

LABORATORY PRACTICUM IN OPTICS

ECTS credits: 4,0
Evaluation Method: Current semester grade
Semester: IV
Hours per week: 0 Lec. + 0 Sem. + 2 Lab.
Course Status: Compulsory course

Methodological guidance:
Department of Mathematics and Physics,

Faculty: Natural Sciences & Mathematics

Annotation: The course aims to expand students' knowledge of the basic phenomena and laws of light propagation by creating skills and habits for experimental study of these phenomena and practical determination of the values of quantities describing these phenomena. The course provides the basis for further specialized courses such as Quantum Electronics, Optical Communications and others.

Subject Description: The course deals with the issues of wave optics based on Maxwell's electro-magnetic theory of light. It includes the implementation of laboratory exercises on topics illustrating the lecture material in the discipline of Optics. Laboratory exercises include topics related to the basic properties of light, reflection and refraction of light at the boundary of two dielectrics, total internal reflection, light interference, diffraction phenomena, the principle of operation of diffraction gratings, geometric optics.

Pedagogical Methods: Laboratory exercises, consisting of elaboration of laboratory tasks on established laboratory installations and compilation of the respective protocols.

Subsidiary Materials: Educational literature on General and Applied Physics and printed materials on the topics given by lecturer.

Evaluation Method: Laboratory tasks performance during the laboratory classes.

THEORETICAL MECHANICS

ECTS credits: 4
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: IV

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: Students acquire knowledge about basic principles and properties of the classical mechanical phenomena. The course gives a base for others special courses such as Electrodynamics, Quantum mechanics, Atomic physics etc.

Course content: The course considers theoretical bases of Classical Mechanics. The development follows where possible the axiomatic lines, the Newton’s concepts of time and space and the variational principle in its Lagrangian and Hamiltonian forms. The equations of motions are derived from these principles. The mechanical systems of harmonic oscillator, particle in central field and solid body are considered in greater detail. A stress is put on the equations of motion, conservation laws and Galilean relativity in mechanics.

Pedagogical Methods and type of evaluation: Lectures and seminar classes. During the seminar classes students solve varied problems on mechanical systems and their description. Parts of topics with practical importance are directed to the seminar classes. Basic knowledge in General Physics and Mathematical Calculus are needed.
The course is completed by a written examination. Some intermediate tests are conducted through the semester.

SCHOOL COURSE OF MATHEMATICS - II PART

ECTS credits: 5
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: IV

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Short Description: The course includes studying of the basic geometrical transformations: congruence, similarity, affinity. Some principal topics, connected with the area of polygon and volume of tetrahedron, are considered.

Course Aims: Students should obtain theoretical and practical knowledge, necessary for teaching High School Geometry.

Teaching Methods: lectures, tutorials, homeworks, problem solving tests.

Requirements/Prerequisites: High School Geometry

Assessment: written exam on topics from tutorials and on topics from lectures.

Registration for the exam: coordinated with the lecturer and student Service Department

PRACTICUM IN SOLVING PROBLEMS FROM THE SCHOOL GEOMETRY COURSE

ECTS credits: 2.0
Hours per week: 0 Lec. + 2 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: IV

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Descriptions: The training in the course “Practical for Solving Problems from the School Course in Geometry” includes solving problems on the specified topics from the curriculum, analyzing and summarizing the methods for solving, applying their knowledge of methodology and what was learned in the disciplines: “Fundamentals of the School Course in Algebra” and “Fundamentals of the School Course in Geometry”. The practical for solving problems gives students - future teachers, an idea of the system of problems in the school course in algebra, analysis and geometry, and more precisely algebra: identity transformations of expressions, equations, inequalities and systems; analysis: numerical series, functions - limits, derivatives, extrema; geometry: geometric transformations in the plane, vectors, geometric loci of points, polygon, line and plane in space, geometric bodies.
For each topic under consideration, a brief theoretical and methodological summary is made under the direct supervision of the teacher. Students have the opportunity to independently develop groups of tasks of varying degrees of complexity, systematize and clarify the main methods for solving the tasks under consideration.

Course Objectives: The purpose of the course "Practical Course for Solving Problems from the School Course in Geometry" is:
• formation of skills for solving problems from the School Course in Geometry with the knowledge of students of the respective age group;
• formation of skills for determining the goals, tasks and expected results pursued by solving a given mathematical problem;
• systematization and consolidation of what has been learned in the methodology of teaching mathematics;
• expansion and deepening of students' preparation for their future profession.
Expected results: each student should be able to develop a didactic system of tasks for a specific topic from the school course in mathematics and clarify the main methods for solving the tasks under consideration.

Teaching methods: Lectures, seminars, consultations, homework, course assignments, control checks.

Prerequisites: Students are expected to have a good knowledge of the high school mathematics course.

Assessment: Current control is applied to assess activities that assess the degree of mastery of the material, the acquired knowledge, skills and competencies during the semester. It consists of a periodic check of the knowledge acquired by the students and their ability to absorb new knowledge. It is carried out by controlling the attendance of seminar exercises, 2 control papers, homework and the development of a course work.

Exam registration: Students coordinate with the teacher the desired exam dates within the announced calendar schedule for the exam sessions.

COMPETENCY APPROACH AND INNOVATION IN EDUCATION

ECTS credits: 4
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: IV

Methodological guidance:
Faculty of Pedagogy

Course Description: The course of study in the subject *Competency Approach and Innovation in Education* takes into account the importance of the competency approach in educational theory and practice, as well as the significance of innovation processes in the field of education. Attention is focused on the processes related to improving the pedagogical environment, increasing the efficiency and productivity of functioning educational structures. Within the framework of the course, emphasis is placed on the role and essence of the competency approach in training, types of competencies, the main methodological approaches for the formation of key competencies, as well as on the development of an innovation culture of students from the specialties in which future teachers are prepared. In the process of training, students have the opportunity to acquire knowledge, build skills and competencies for adequate actions and behavior in the specific conditions of innovation in modern schools. The focus of attention is on new ideas implemented in the specific pedagogical environment

and their technological dimensions in new approaches, forms, methods, didactic and educational tools.
The course of study in the discipline has the task of stimulating creativity in students and forming in them professional and personal readiness to perceive, understand and support innovations, as well as successfully embedding the innovation culture in the overall structure of the professional pedagogical competence of the modern teacher for the application of strategies, didactic technologies and methodological approaches and forms for building and developing key competencies of students in the educational process.

Course Aims: The purpose of the training in the discipline is to make students understand the issues related to the competency approach and innovation processes in the educational environment, as well as their specificity in school education, building an innovation culture as a complex construct, which includes in itself, in addition to knowledge, skills and attitudes for innovation activity, and readiness to perceive and evaluate innovative ideas, as well as the ability to assist in the implementation of innovations with a predicted positive effect in the pedagogical environment.

Teaching methods: presentation, lecture, discussion, carried out in conditions of interactivity and dialogicity, team organization of the activity, development of educational research projects, application of various interactive methods, solving cases, etc.

Assessment: At the end of the semester, students graduate with an exam grade. It is obtained on the basis of the students' activity during the lectures and seminars, through control works (tests) during the seventh week of the semester and at the end of the semester, the quality of the developed essays and individual educational projects.

Foreign Language II

ECTS credits: 2,0
Hours per week: 0 Lec. + 2 Sem. + 0 Lab.
Evaluation: ongoing assessment
Course status: Compulsory
Semester: IV

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: The aim of the course „Foreign language – English" is to ensure the development of communication skills, reaching of certain phonetic, grammatical, lexical and thematic minimum, skills and habits for participation in real, communicative situations, knowledge and individual work with vocabulary. It aims to review and systematize the basic knowledge of the undergraduates and provides equal start level for the next stage of education, called "language of the programme". The choice of topics is based on their high particularly in the scientific style of speech and their unconditional structural significance and necessity of learning a foreign language. Widely used communicative exercises focus that strengthen the necessary grammatical habits and encourage students to be active speech activity in the studied subjects. The practical course is based on the thematic texts reflecting everyday student life, elementary special technical terminology on the subject and aims to stimulate the desire and motivation of students to enhance their language and consistent level – Elementary and Pre-intermediate.

Purpose of the course: The aim of the course is to build an initial communicative competence, as the ability to understand and draw meaningful oral and written statements, in accordance with the rules of the English language to develop reading skills and comprehension of texts from everyday communication and presentation and related texts the basic terms in the specialty; develop skills in physical vocabulary can make translations of physical texts from English Into Bulgarian language using a dictionary.

Educational Methods: Active methods are used through different exercises; based tests are made for control of the learned, translation of physical literature.

DIGITAL COMPETENCE AND DIGITAL CREATIVITY

ECTS credits: 3
Hours per week: 2 Lec. + 0 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: IV

Methodological guidance:
Department of Informatics
Faculty: Natural Sciences & Mathematics

Description of the course:

The "Digital Competence and Digital Creativity" course aims to increase the knowledge and skills of future educators about modern information and communication technologies (ICT) and their use during the teaching and the learning process.

The course consists of two main modules: Digital competence and digital creative. Digital competence includes a variety of knowledge, skills, and attitudes in several areas, including the creative use of digital technologies, the safe and responsible use and provision of data. Digital creativity is related to the possibility of using digital technologies for various creative activities. All of this is important not only for learners but also for learners and contributes to the confident and competent use of digital technologies in education, in the workplace, and even in everyday life

Content of the course:

Basic knowledge and skills related to digital competence; Digital creativity as a means to improve the learning process; Browsers, portals and ways to search for information on the Internet; E-mail and spam; Digital communication - video calls and real-time text messaging (chat); Blogs and discussion groups (newsgroups); Privacy, social media and cyberbullying; Cyberattacks and cybersecurity; Digital libraries as a means of enriching the teaching content; Types of e-learning and e-learning environments; Augmented, virtual and mixed reality in learning; Cloud technologies as sharing learning content tools; Machine learning and artificial intelligence in the learning process; Copyright and licensing agreements; Web development.

Training and assessment technology:

The lectures are illustrated with presentations and practical tasks that demonstrated the way of applying the teaching material.

The assessment is based on an exam test after the end of the course. During the course, the students should be doing various practical tasks, the evaluation of that participate in the final assessment.

DEVELOPMENT OF LESSONS FOR E-LEARNING

ECTS credits: 3
Hours per week: 2 Lec. + 0 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: IV

Methodological guidance:
Department of Informatics
Faculty: Natural Sciences & Mathematics

Description of the course:
In the 21st century, teachers should have not only pedagogical knowledge but also have high digital literacy. They should be able to integrate the learning process in a digital environment. This is not always an easy task, as the market is crowded with software products that provide similar capabilities but often require different levels of computer literacy. On the other hand, the learning resources that can be found on the Internet are not always free, reliable, or suitable for the separate age group of students. Therefore, teachers should be able to select the appropriate software to create their teaching resources for e-learning.
Extracurricular activities in the discipline include work in the library, work on the Internet and development of coursework.

Content of the course:
E-learning - history, present and future; Modern computer devices and their application as a learning tool; Synchronous and asynchronous e-learning systems; Creating and working with vector graphics; Creating and working with raster graphics; Word processing systems; Graphics, tables, images, and templates in word processing systems; Working with spreadsheets; Developing of documents for e-learning; Creating and editing interactive multimedia presentations; Developing and publish a video.

Training and assessment technology:
The lectures are illustrated with presentations and practical tasks that demonstrated the way of applying the teaching material.
The assessment is based on an exam test after the end of the course. During the course, the students should be doing various practical tasks, the evaluation of that participate in the final assessment.

PEDAGOGICAL INTERACTION IN A MULTICULTURAL ENVIRONMENT

ECTS credits: 3
Hours per week: 2 Lec. + 0 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: IV

Methodological guidance:
Faculty of Pedagogy

Course description: The course content clarifies the essence, characteristics and features of pedagogical interaction in a multicultural environment, problematizes the issues of cultural difference in the aspect of their manifestations in a school environment, argues the importance of intercultural education for the harmonization of cultural differences in the educational

space and the intercultural upbringing of adolescents, discusses the specific problems in the process of educational integration of children and students from minority ethnocultural groups, and on this basis outlines pedagogical strategies, approaches and methods for implementing effective pedagogical interaction in a multicultural environment.

Course objective: The main objective of training in the course is for students to master competencies for implementing effective pedagogical interaction in a multicultural environment.

Assessment: Assessment of the acquired knowledge in the course is carried out through ongoing control and by taking a semester exam.

Exam registration: required

MANAGEMENT OF EDUCATIONAL INSTITUTIONS

ECTS credits: 3
Hours per week: 2 Lec. + 0 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: IV

Methodological guidance:
Faculty of Pedagogy

Course Description: The course "Management of Educational Institutions" allows students to increase the level of their professional competence by enriching their administrative and legal literacy. In the process of training, problems related to: the structure, organization and philosophy of education; implementation of professional activities in accordance with the regulatory requirements and regulations for public participation in the activities of the institution; awareness of the relationship between the regulatory framework and the autonomy of the institution (the possibilities for independent decisions in the selection and introduction of new moments in the organization and content of the educational process), based on regulatory documents in the Republic of Bulgaria, which is a prerequisite for lawful, responsible, calm and secure management of the institution.

Course Objective: To familiarize students with the management of educational institutions and develop competencies in terms of knowledge, skills and attitudes, as follows:
- consolidating and enriching knowledge and skills for analyzing the results of the institution's activities, for developing, approving and implementing programs, documents, mechanisms for the development of the institution and identifying measures to increase the quality and efficiency of work;
- understanding the functions and competencies of the director in order to improve the skills of planning, motivating, organizing, controlling, etc.
- increasing knowledge about human resource management and the quality of the educational institution;
- systematizing knowledge and improving skills for the implementation of the regulatory framework in the field of preschool and school education, state educational standards and other subordinate normative documents.

Teaching methods: The main form of organization and implementation of the educational process in the discipline are lectures. The lectures are in an interactive and consultative form

for an initial introduction to the issues of the course. During the lectures, time is also allocated for solving tasks/case studies, discussing the process of developing documents, discussing presented problems, as well as discussing materials prepared by students in extracurricular activities. The educational content is presented through presentations and the use of interactive methods such as: brainstorming, role-playing games, discussions, etc.

Exam registration: required

INCLUSIVE EDUCATION OF CHILDREN AND STUDENTS WITH SPECIAL EDUCATIONAL NEEDS

ECTS credits: 3
Hours per week: 2 Lec. + 0 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: IV

Methodological guidance:
Faculty of Pedagogy

Course Description: Training in the course "Inclusive Education of Children and Students with Special Educational Needs" involves the study of a number of important problems of inclusive education of children with special educational needs. A significant place is given to the theoretical and substantive analysis of a number of basic concepts. The main forms of integrative and inclusive education and education of children with developmental anomalies are considered; various models of this education, which have proven their effectiveness in countries that have already gained experience; the main prerequisites for creating a system of inclusive education; the role and significance of the special school, the SEN center in the inclusive process.

Course Objective: The course aims to provide students with basic knowledge on the problems related to the inclusion and social adaptation of children with special educational needs; to familiarize them with basic international documents dealing with these issues; with the normative basis of inclusive education in our country; with the methodology of education in the conditions of special and mass educational institutions of children with special educational needs.

Teaching methods: Lectures; stimulating active debate in subgroups; planning and conducting mini-experiments to analyze the behavior of children with special educational needs in different situations and different socio-cultural environments; business games, etc.

Exam registration: required

COMMUNICATION SKILLS IN AN EDUCATIONAL ENVIRONMENT

ECTS credits: 3
Hours per week: 2 Lec. + 0 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: IV

Methodological guidance:
Faculty of Pedagogy

Course Description: The proposed course clarifies and analyzes the communicative competence of the teacher as a primary resource for the implementation of effective pedagogical interaction.
In terms of content, specific tools from the field of communicative behavior (speech culture, verbal communication, paralinguistic expressiveness) are emphasized, which optimize pedagogical communication in the direction of (1) educational relationships as a result and condition for effective pedagogical interactions with students, (2) mutual knowledge, understanding, influence and self-knowledge in communication (verbal - non-verbal - paraverbal); (3) inclusion, interaction and cooperation with the parents of students as active partners in the educational process.

Course Objective: The main objective of the course is to familiarize students with the theoretical foundations, characteristics and functions of communication and to form skills for application in pedagogical practice with a view to optimizing the educational environment.

Teaching methods: Lectures; stimulation of active debate in subgroups; planning and conducting mini-experiments to analyze the behavior of children with special educational needs in different situations and different socio-cultural environments; business games, etc.

Exam registration: required

CIVIC EDUCATION

ECTS credits: 3
Hours per week: 2 Lec. + 0 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: IV

Methodological guidance:
Faculty of Pedagogy

Course Description: The course “Civic Education” enables students to acquire knowledge about the essence, principles, approaches and methods of working with students in the field of civic education.

Purpose of the course: The aim is to enable students to develop and expand their understanding of the connections between education and citizenship; to stimulate their critical thinking and active participation, as well as to expand their competence for democratic culture.
Main tasks:
• Familiarization with the opportunities for building civic awareness and behavior in students through the use of innovative approaches to active learning.
• Upgrading knowledge about the relationship citizen/civil society/civic education.
• Students' understanding of the issues from the positions of new thinking and current educational trends in relation to civic education.

Teaching methods: Lectures; stimulating active debate in subgroups; content analysis of teaching materials; business games, etc.

Exam registration: required

STEM EDUCATIONAL TECHNOLOGIES IN NATURAL SCIENCES, MATHEMATICS AND INFORMATICS EDUCATION

ECTS credits: 3
Evaluation Method: Written exam
Semester: IV

Hours per week: 1 Lec. + 0 Sem. + 1 Lab.
Course Status: Optional course

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The main idea of the course is to introduce students to an educational environment – a STEM center, which will allow, through the implementation of innovative technologies and software solutions, to visualize various aspects of the teaching material in the educational process of future mathematics teachers.

Course Objective: The aim of this course is to introduce students to the STEM environment, which will help them to be creative when working with students and will prepare them for successful future implementation in various spheres of life, developing their logical thinking, problem-solving skills, digital literacy and emotional intelligence.

Teaching methods: STEM modeling methods; experiment and augmented reality in STEM education; mixing virtual data (audiovisual and multimedia content); STEM research approach; practical work and work with Internet simulations; STEM methods for practical activity through a situational method; simulations of real problems; combining traditional/standard teaching methods with STEM methods.

Assessment: The main form of testing and assessing students' knowledge is the written exam. Students' knowledge and skills are assessed according to the six-point system, which includes: Excellent 6, Very good 5, Good 4, Average 3, Weak 2. The assessment procedures that are applied during the training of students in the specialty "Pedagogy of Teaching Mathematics, Informatics and Information Technologies" are: current control, current assessment and exam. In case of a "Weak" grade from the current control, the student must additionally meet the requirements for a minimum "Average" grade from the current control in order to be admitted to the exam.

Registration for the exam: required

GEOMETRY

ECTS credits: 5
Evaluation Method: Written exam
Semester: V

Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Course Status: Compulsory course

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Short Description: The course includes: studying of basic themes of the classical differential geometry of the curves, the one-parametric sets of straight lines and the surfaces in the three-dimensional real Euclidean space.

Course Aims: The students have to obtain knowledge and skills for application of the differential-geometric methods for learning of geometric objects.

Teaching Methods: Lectures, tutorials, home works, problem solving tests.

Requirements/ Prerequisites: Analytic Geometry, Mathematical Analysis, Differential Equations.

Assessment: written exam on topics from tutorials and on topics from lectures.

Registration for the Exam: coordinated with the lecturer and Student Service Department.

PHYSICS TEACHING METHODOLOGY – PART I

ECTS credits: 3.5
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course is built in accordance with modern ideas and trends in the development of the methodology of teaching physics as a pedagogical science and in the practice of teaching physics in secondary schools. The first part of the course reveals the theoretical and methodological foundations of the content, organization and management of the educational process in physics in secondary schools and presents the main state-approved educational and methodological documentation.

Course Objective: The main objective of the course is for students to receive the necessary theoretical preparation for organizing and conducting an effective educational process in physics in secondary schools, by applying modern didactic technologies appropriate for the purpose. Along with theoretical knowledge, they must also master a number of important skills of an applied nature. These skills are related to scientific and methodological analysis of the physics teaching material, development of criteria for orientation and selection of teaching content and forms, means and methods of teaching for its study, methodological development of physics lessons, planning, organization and management of students' cognitive activity, testing and evaluation of knowledge, etc.

Teaching methods: lectures, seminars and extracurricular work

Prerequisites: basic knowledge of pedagogy and psychology

Supporting materials: physics textbooks for secondary and higher education, educational literature on physics teaching methodology, collections, reference books and encyclopedic dictionaries on physics

Assessment method: written exam on the lecture material

Registration for training in the discipline: not necessary

Registration for the exam: agreed with the teacher and the academic department

PHYSICS OBSERVATION

ECTS credits: 3
Hours per week: 0 Lec. + 0 Sem. + 2 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course "Physics Observation" is included as a mandatory course in the curriculum for the specialty "Pedagogy of Teaching Physics and Mathematics". It is held in parallel with the lectures on Physics Teaching Methodology and corresponds to the requirements for the practical training of students receiving the "teacher" qualification. The full implementation of the course provides the foundations for the successful implementation of both the current and pre-diploma pedagogical practice in physics. Students must have basic knowledge of physics, pedagogy, pedagogical psychology, physics teaching methodology and audiovisual and information technologies in education.
Physics observation is held in a basic school. Under the guidance of a practice leader, observations and analysis of lessons at the junior high and high school levels are carried out. Each observed lesson is debriefed, the positive aspects and mistakes made are indicated.

Course Objective: The main objective of the course is to provide students - future teachers - with basic knowledge about the practical implementation of school activities. Students must: develop skills in observing and analyzing physics lessons; become familiar with the requirements and possible approaches in developing a teaching methodology for a specific educational content; form initial skills in planning, organizing and managing students' cognitive activity; form professional competencies in classroom behavior, determining the optimal pace of work, presenting the material, diction, conducting a conversation, organizing students' independent work, physical experiment, etc.

Teaching methods: The following teaching methods are used when conducting exercises:
• verbal - conversation, dialogue, explanation, story, discussion, etc.;
• visual - observation, presentation of graphs, drawings, formulas, various images, schemes, data tables, etc., etc.;
• practical - independent work, solving problems, etc.

Prerequisites: basic knowledge of general physics (all sections), pedagogy and psychology

Supporting materials: physics textbooks for secondary and higher education, educational literature on physics teaching methodology, collections, reference books and encyclopedic dictionaries on physics

Assessment method: The assessment procedures that are applied during the training of students in the specialty are: current control and current assessment. Current assessment is the assessment from the current control conducted during practical exercises.

Enrollment for training in the discipline: not necessary

Enrollment for the exam: agreed with the teacher and the academic department

INFORMATION AND COMMUNICATION TECHNOLOGIES IN TRAINING AND WORK IN A DIGITAL ENVIRONMENT

ECTS credits: 3
Hours per week: 1 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: V

Methodological guidance:
Department of Informatics
Faculty: Natural Sciences & Mathematics

Course Description: The curriculum is oriented towards mastering modern tools and technologies applicable in education. The main characteristics and applications of software packages in informatics and IT education are examined. The emphasis is on the use of various multimedia products for education and the use of Internet technologies for searching and developing auxiliary educational materials. Education is supported by educational materials published in the e-learning system, maintained by the Scientific Research Laboratory for e-learning at the Faculty of Mathematics and Physics: www.e-learning.swu.bg

Goal of the course: After completing the course, students should be able to: • master the principles of using software products in informatics education; • master the knowledge and skills to work with tools for presenting educational materials and creating interactive tests. • know the trends in the development of multimedia technologies in education. • create their own multimedia teaching materials to support the learning process

Teaching methods: lectures, laboratory exercises, discussions and solving practical problems.

Prerequisites: No special knowledge is required beyond that acquired in the courses in Informatics and Information Technologies from secondary school.

Supporting materials: physics textbooks for secondary and higher schools, educational literature on physics teaching methodology, collections, reference books and encyclopedic dictionaries in physics

Assessment method: assessment from ongoing control and written exam (test).

Enrollment for training in the discipline: not required

Enrollment for the exam: agreed with the teacher and the academic department

ATOMIC PHYSICS

ECTS credits: 5.5
Hours per week: 2 Lec. + 1 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: The subject is a compulsory course studied by students to acquire a Bachelor degree on Physics. The students acquire basic knowledges required about Atomic and Molecular Physics. Material is selected depending of the specificity of the speciality. For that reason some specific topics are presented which are not included in the Physics programme for non-physical students. Material is selected depending of the specificity of the speciality. For that reason some specific topics are presented which are not included in the Physics programme for non-physical students.

Course content: Basic concepts and definitions in metrology. Dimension and units of physical quantities. Systems units. Accuracy and error. Measuring devices. Processing of measurement results. Categories and types of standards.

Pedagogical Methods and type of evaluation: Basic knowledge in General Physics, Mathematics and Thermal Physics are needed. Lectures are visualised by demonstrations and laboratory tasks performance during the laboratory classes. From methods point of view teaching material is grouped in sections by logical consistency from Structure of Atoms and Atomic Models via Interaction of Atoms with External Electric and Magnetic Fields to Fine and Hyperfine Structure and the nature of Chemical Bonds. Practical topics are directed to the laboratory classes.
The course is completed by a written examination. Some intermediate tests are conducted through the semester.

ELECTRODYNAMICS

ECTS credits: 3.5
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: Students acquire knowledge about basic principles and properties of the classical electromagnetic field. The course gives a base for others courses such as Quantum mechanics, Atomic physics, Astrophysics.

Course content: The course considers theoretical bases of classical electrodynamics, the main features of the special theory of relativity being studied first. This allows later apply the Lagrange variational principle to derive the Maxwell equations in their relativistic covariant form and to obtain the field invariants. The more detailed properties of the field are studied on

the base of three dimensional form of Maxwell equations, considering first the free field in vacuum, then field with sources and finally field in continuous media, including the nonlinear media.

Pedagogical Methods and type of evaluation: Lectures and seminar classes. During the seminar classes students solve varied problems on mechanical systems and their description. Parts of topics with practical importance are directed to the seminar classes. Basic knowledge in General Physics and Mathematical methods are needed.
The course is completed by a written examination. Some intermediate tests are conducted through the semester.

DIAGNOSTICS OF ACADEMIC ACHIEVEMENTS IN PHYSICS

ECTS credits: 3
Hours per week: 1 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation:
The course „Diagnostics of the educational achievements on physics“ is included as an elective course in the specialty curriculum „Pedagogy of Teaching Physics and Mathematics“. It is studied from students studying at educational and qualification degree „Bachelor“.
The course „Diagnostics of the educational achievements on physics“ is with total workload 30 hours, which includes 15 hours lectures and 15 hours practical (laboratory) exercises. The students’ self-study is 60 hours.
Current control of the students' educational achievements is carried out during the semester in the hours of practical exercises.
Teaching on the course ends with a written exam.

Course content:
1. Introduction to pedagogical diagnostics.
2. Theoretical and methodological foundations of the pedagogical diagnostics.
3. Methods of the pedagogical diagnostics.
4. Qualitative techniques for diagnostics and evaluation.
5. Quantitative techniques for diagnostics and evaluation.
6. Taxonomy of the Bloom's Cognitive purposes.
7. Didactic tests as a basic method for diagnostics of the educational achievements on physics.
8. Evaluation scales.
9. Measuring qualities of the tests.

Teaching methods and evaluation:
Lectures are held in a lecture hall, that is equipped with the necessary technique – computer and multimedia projector, using the computer presentations, which are developed in accordance with the educational content of the lectures.
To conduct the practical exercises is used the material base of the Department of Physics. Students perform practical tasks that are given by the assistant and are discussed with him. At the end of each practical exercise students present and defend the performance of their tasks.

Certification of the semester get students who have received an evaluation of the current control at least „Satisfied 3“ (D).
Teaching on the course „Diagnostics of the educational achievements on physics“ ends with a written exam on the educational content. Final evaluation is formed only if the student has received an evaluation of the written exam at least „Satisfied 3“ (D). In forming of the final evaluation are reported the evaluations from the written exam (60 %) and from the current control (40 %).

MODERN EDUCATIONAL TECHNOLOGIES IN PHYSICS TEACHING

ECTS credits: 3
Hours per week: 1 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Subject Description: Motion of the heavenly bodies in the Solar system. Cosmic research. Stars and constellations. Solids and substances. Temperature and heat. Transitions between physical conditions of bodies and substance. Motion of the bodies. Types of forces. Action of forces. Forces and pressure. Electric forces. Magnetic forces.

Specific Goals of the Subject: The course goal is to introduce students to the content and methodology of teaching the course “The Man and the Nature”, included in the school curriculum for 5-th and 6-th classes. The course is an integration of physical, chemical and biological knowledge. The accent is on the first part entitled “Physical phenomena”. From methodological point of view, various approaches are considered for forming student’s basic knowledge about objects, processes and phenomena in the live and dead nature, in their unity and diversity. They are conformed to the students age and they are directed towards recognition, description and comparison of various objects, phenomena and processes as well as obtaining the interdependence between them, mainly on the qualitative level. Special attention is paid to the relations between various courses.

Teaching Methods: lectures, tutorials, individual student’s work

Requirements/Prerequisites: Basic knowledge in Physics, Chemistry and Biology

Evaluation Method: Evaluation defined by a written exam and current control taken certain gravity.

Inscribing for tuition: necessary.

Inscribing for exam: Agreement with the lecturer.

METHODOLOGY OF TEACHING ON "MAN AND NATURE"(PHYSICS MODULE)

ECTS credits: 3
Hours per week: 1 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: Motion of celestial bodies in the Solar System. Space Studies. Stars and Constellations. Bodies and Substances. Temperature and Heat. Transitions between aggregate states of bodies and substances. Motion of bodies. Types of forces. Action of forces. Forces and pressure. Electric forces. Electric current. Magnetic forces.

Course Objective: The course aims to introduce the content and methodology of teaching the subject "Man and Nature", included in the junior high school stage (V, VI grade) of the basic educational level. In essence, it represents an integration of physical, chemical and biological knowledge. The emphasis is placed on the first part, called "Physical Phenomena". From a methodological point of view, various approaches are considered for the formation of basic knowledge in students about objects, processes and phenomena in inanimate and animate nature, in their unity and diversity. They are tailored to the age characteristics of the students and are aimed at recognizing, describing and comparing different objects, phenomena and processes, as well as revealing dependencies between them, mainly at a qualitative level. Special attention is paid to inter-subject connections.

Teaching methods: lectures, exercises and extracurricular work

Prerequisites: basic knowledge of physics, chemistry and biology

Supporting materials: textbooks on the subject "Man and Nature" for primary school, educational literature on the methodology of teaching physics and reference books on physics

Assessment method: written exam on practical exercises and theoretical material from the lectures

Registration for training in the discipline: required

Registration for the exam: agreed with the teacher and the academic department

PHYSICS HYSTORY

ECTS credits: 3
Hours per week: 2 Lec. + 0 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course "History of Physics" is included as an elective in the curriculum of the specialty "Pedagogy of Teaching Physics and Mathematics". It is studied by students studying in the educational and qualification degree "Bachelor",
The course "History of Physics" has a total teaching load of 30 hours of lectures. The extracurricular employment of students is 60 hours.
The training in the course ends with a written exam,

Content of the course:
1. The emergence of physics.
2. The development of physics in the Middle Ages.
3. The development of physics during the Renaissance (XV-XVI centuries).
4. The formation and development of classical physics in the XVII century.
5. The development of physics in the XVIII century as an independent science.
6. The development of physics in the first half of the XIX century.
7. Development of physics in the second half of the 19th century.
8. Revolutionary discoveries in physics in the period 1890-1912.
9. Development of physics in the first half of the 20th century.
10. History and development of physics in Bulgaria. Bulgarian discoveries and famous physicists.

Teaching and assessment technology: Lectures are held in a lecture hall equipped with the necessary equipment - a computer and a multimedia projector, using computer presentations developed in accordance with the lecture content.
Current control of students' academic achievements is carried out during the semester. The assessment of the current control is formed on the basis of the presentation and defense of an independently developed course assignment by each student. The semester certificate is awarded to students who have received a current control assessment of at least "Average 3".
The training in the course "History of Physics" ends with a written exam on the course content. A final grade is formed only if the student has received a grade from the written exam of at least "Average 3". When forming the final grade, the grades from the written exam (70%) and the current control (30%) are taken into account.

SPECIFIC STEM EDUCATIONAL TECHNOLOGIES IN PHYSICS EDUCATION

ECTS credits: 3
Hours per week: 1 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The elective course “Specific STEM Educational Technologies in Physics Education” is an integral part of the students’ training for the Bachelor’s degree. In today’s rapidly changing and technological society, science education, and more specifically physics and astronomy, is crucial for developing the necessary competencies of young people. Competence in the field of exact sciences refers to the ability and willingness to explain the natural world through accumulated knowledge and used methodologies, including observation and experimentation, in order to ask questions and formulate conclusions based on facts. This competence includes understanding the changes caused by human activity and the responsibility of the individual citizen.

The modernization of the educational process is also associated with the need to emphasize the applied nature of natural knowledge in various aspects. In the modern world, there is a certain contradiction between the progress of technology and the decreased interest of students in natural disciplines. Therefore, through the application of modern methods

embedded in STEM (Science - Technology - Engineering - Mathematics) education, it will lead to the formation of a scientific and technical elite.

The main idea of the course is to familiarize students with an educational environment - a STEM center, which will allow, through the implementation of innovative technologies and software solutions, to visualize various aspects of the educational material in the educational process of future teachers of physics and astronomy.

Course Objective: The course aims to introduce students to the STEM environment, which will help them demonstrate creativity when working with students and prepare them for successful future implementation in various spheres of life, developing their logical thinking, problem-solving skills, digital literacy, and emotional intelligence.

Teaching methods: Lectures, exercises, consultations, coursework, presentations.

Assessment: Ongoing control during the semester including one essay and multimedia presentation on it, and an exam on a pre-set course project.

Exam registration: Students coordinate with the lecturer the desired dates within the announced calendar schedule for the exam sessions.

BASICS OF ARITHMETIC

ECTS credits: 3.5
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The main goal of the comprehensive high school algebra course is to develop the concept of number and the operations related to it and the order relation, starting with natural numbers, passing through whole and rational numbers and reaching real numbers, and in some cases complex numbers. The overall theoretical development and development of the above-mentioned concepts is also the goal of the proposed course. The basis of the course is set-theoretic. It begins with the definition of the concept of finite set, following the concept of induction set, introduced at the beginning of the 20th century by Bertrand Russell. Particular attention is paid at the beginning to the concept of natural number, to the operations of addition and multiplication of two natural numbers and the laws that they satisfy, as well as to inequality between two natural numbers. The course moves from decimal to arbitrary number systems and continues with extensions of the semi-ring of natural numbers to the ring of integers, to the semi-field of fractions and their orders, as extensions of those already established in the semi-ring of natural numbers. The course concludes with the examination of real and complex numbers.

Course Objective: To familiarize students with contemporary theoretical ideas and an exposition of the complete high school course of study in algebra.

Teaching Methods: Lectures, seminars, consultations, coursework, presentations.

Prerequisites: Basic knowledge of Algebra and Number Theory is required.

Assessment: Ongoing control during the semester including one essay and multimedia presentation on it, and an exam on a previously assigned course project.

Exam Registration: Students coordinate with the teacher the desired dates within the announced calendar schedule for the exam sessions.

BASICS OF GEOMETRY

ECTS credits: 3.5
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Short Description: The course includes studying of the following basic topics: Hilbert's axiomatic, Kolmogorov's metric axiomatic and Well's axiomatic of the Euklidean Geomery and their equivalence is proved.

Course Aims: Students should obtain knowledge and skills about rigorous construct of a mathematical discipline.

Teaching Methods: lectures, tutorials, homeworks and tests.

Requirements/Prerequisites: High School Mathematics ,

Assessment: written exam on topics from tutorials and on topics from lectures.

Registration for the Course: by request at the end of the current semester

Registration for the Exam: coordinated with lecturer and Student Service Department

BASICS OF MODELING

ECTS credits: 3.5
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Short Description: The program contains the traditional material for the fundamentals of mathematical modeling. The course starts with the concept of model and what is the essence of modeling. A classification of mathematical models has been made and a large number of elementary models from different fields are considered - physics, chemistry, biology, medicine, economics and others.

Course Aims: The purpose of this course is to introduce students with the essence of mathematical modeling and some basic models from different fields of science.

Teaching Methods: lectures, tutorials, projects, and presentations.

Requirements/Prerequisites: The students should have basic knowledge in Differential and Integral Calculus.

Assessment: permanent control during the semester including one project and presentation, and exam in the semester's end.

Registration for the exam: coordinated with the lecturer and student Service Department

MATHEMATICAL STRUCTURES

ECTS credits: 3,5
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course on mathematical structures presents logically, consistently and completely the theory of the basic number systems taught in school - natural numbers, integers, rational numbers and real numbers. These number systems are built using the terminology and basic results of modern mathematics. This makes it possible not only to construct these number systems constructively, but also to interpret them meaningfully as semigroups, groups, semirings, rings, fields. The theory of real numbers is built as Dedekind sections, as a Cantor completion of the ordered field of rational numbers, as decimal fractions and as continued fractions. The basic algebraic systems are presented not only from the point of view of main operations, but also from the point of view of main relations, especially the relations of linear and complete ordering.

Course Objectives: The aim of this course is for students to gain knowledge and skills on the specified topics for training, as well as to apply this knowledge in their future pedagogical work.

Teaching methods: lectures, exercises, consultations, homework, course assignments, tests.

Prerequisites: Basic knowledge of higher algebra, number theory and mathematical analysis is required.

Assessment: ongoing control during the semester (test and control) and written exam.

Exam registration: agreed with the teacher and academic department.

TEACHING PHYSICS METHODOLOGY - PART II

ECTS credits: 4
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: VI

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course is built in accordance with modern ideas and trends in the development of the methodology of teaching physics as a pedagogical science and in the practice of teaching physics in secondary schools. The second part of the course examines issues related to the main sections and topics of the school physics course. The emphasis is placed on the most important structural element in the content of physics education - physical theory. In the context of a given physical theory, a scientific and methodological analysis of the studied material is made and on this basis original methodological solutions are sought for presenting the educational content, which are justified from a didactic and psychological point of view.

Course Objective: The main objective of the course is for students to receive the necessary theoretical preparation for organizing and conducting an effective educational process in physics in secondary schools, by applying modern didactic technologies appropriate for the purpose. Along with theoretical knowledge, they must also master a number of important skills of an applied nature. These skills are related to scientific and methodological analysis of the physics teaching material, development of criteria for orientation and selection of teaching content and forms, means and methods of teaching for its study, methodological development of physics lessons, planning, organization and management of students' cognitive activity, testing and evaluation of knowledge, etc.

Teaching methods: lectures, seminars and extracurricular work

Prerequisites: basic knowledge of pedagogy and psychology

Supporting materials: physics textbooks for secondary and higher education, educational literature on physics teaching methodology, collections, reference books and encyclopedic dictionaries on physics

Assessment method: written exam on the lecture material

Registration for training in the discipline: not necessary

Registration for the exam: agreed with the teacher and the academic department

QUANTUM MECHANICS

ECTS credits: 4
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: VI

Methodological guidance:

Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Subject Description: Basic quantum mechanical postulates. Quantum mechanical formalism: state space and Hermitean operators. Schrodinger equation: exactly solvable models: Hydrogen atom, harmonic oscilator, potential well.Approximate methods: perturbation theory, Hartry-Fock method. Identical particles and Pauli principle. Angular momentum and spin. Many-electron atoms and periodic system of elements. Scattering theory and Rutherford formula. Klein-Gordon and Dirac equations.

Specific Goals of the Subject: The course aims at giving fundamentals knowledge of quantum physics and to serve as a foundation for courses as statistical physics, quantum electronics astrophysics and other special courses.

Teaching Methods: lectures, tutorials, individual student's work

Requirements/Prerequisites: General knowledge in mathematical methods of physics and analysis

Evaluation Method: Evaluation defined by a written exam and current control of the seminars taken certain gravity. Some intermediate tests conduct through the semester.

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

MATHEMATICS TEACHING METHODOLOGY – PART I

ECTS credits: 3
Hours per week: 2 Lec. + 0 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: VI

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course includes problems from the general methodology of mathematics education such as studying mathematical concepts, theorems, proofs in the school mathematics course, the forms of problem-solving skills.

Course Objective: To prepare students to be able to teach students in mathematics at school.
This objective is achieved by solving the following tasks:
1. Mastering methods and tools that ensure effective mastery of the basic carriers of mathematical information - concepts, axioms, theorems, proofs of theorems, problems and their solutions.
2. Familiarization with the specifics of the organization of the learning process in mathematics, determined by the specific structure of mathematical knowledge.

Teaching methods: lectures and exercises.

Prerequisites: knowledge of the content of the school mathematics course, as well as knowledge of psychology and pedagogy.

Assessment: written exam.

Registration for the exam: agreed with the teacher and the academic department.

PROBABILITY AND STATISTICS – METHODOLOGY AND TECHNOLOGIES

ECTS credits: 5,5
Hours per week: 2 Lec. + 0 Sem. + 2 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: VI

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course is designed as an extension of the basic course in probability and statistics.
The aim of the course is to familiarize students with the essence and numerous applications of non-parametric statistical methods as well as with the possibilities for implementing some of these procedures with the help of Information Technology (MS-Excel, VBA, SPSS, etc.).
The structure and content of the course are tailored to the students' knowledge of informatics and probability and statistics obtained in the relevant courses. The topics of the curriculum are related to all disciplines that require analysis of empirical data.

Course Objectives: After completing the course, students should be able to:
• apply the methods of non-parametric statistics
• implement specific applications using various technological tools.

Teaching methods: seminar, discussion, exercises

Prerequisites: Students must have studied the subjects “Probability and Statistics” and “Information Technologies”

Assessment:
• coursework - 30% of the grade
• written exam-test 70% of the grade
The course is considered successfully completed with a minimum of 50% of the maximum score.

NUCLEAR PHYSICS

ECTS credits: 5,5
Hours per week: 2 Lec. + 1 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: VI

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: The subject is a compulsory course studied by students to acquire a Bachelor degree on Physics. Students acquire basic knowledges required about Nuclear and Neutron Physics and Radiation Safety. Material is selected depending of the specificity of the speciality. For that reason some specific topics are presented which are not included in the Physics programme for non-Physical subjects. Material is selected depending of the specificity of the speciality.

Course content: Subject Description: Basic concepts of Nuclear Physics. Nuclear structure. Nuclear models. Nuclear Forces. Isotopic Spin. Parity Violation. Nuclear reactions. Fission. Fusion. Scattering theory. Neutron Physics. Accelerators. Nuclear reactors. Radiation α, β and γ. Basic concepts of Radiation Safety.

Pedagogical Methods and type of evaluation: Basic knowledge in General Physics, Mathematics and Thermal Physics are needed. Lectures are visualised by demonstrations and laboratory tasks performance during the laboratory classes. From methods point of view teaching material is grouped in sections by logical consistency from Structure of Nuclei and Nuclear Models via Nuclear reactions, Neutron Physics to Radiation and Radiation Safety. Practical topics are directed to the laboratory classes.
The course is completed by a written examination. Some intermediate tests are conducted through the semester.

METHODOLOGY AND TECHNIQUE OF SCHOOL PHYSICS EXPERIMENT

ECTS credits: 3
Hours per week: 0 Lec. + 0 Sem. + 2 Lab.
Evaluation Method: Current assessment
Course Status: Compulsory course
Semester: VI

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: Introduction. Kinematics. Dynamics and Statics. Mechanical Work and Energy. Fluid Mechanics. Structure and Properties of Gases, Solids and Liquids. Transitions Between Aggregate States of Matter. Electrostatics. Direct Electric Current. Current in Different Media. Mechanical Oscillations and Waves. Sound. Magnetism. Optics.

Course Objective: Studying the course is related to building practical skills and habits among students for organizing, preparing and implementing physical experiments in education, covering all its varieties. The program allows for a close connection between students' theoretical knowledge of specific physical phenomena and processes and the practical implementation of selected, in accordance with them, various experiments. Their development is precisely tailored to the curriculum in physics in secondary school. The main goal of the course is to prepare students for teaching physics as an experimental science.

Teaching methods: Students carry out practical demonstration experiments, frontal experiments, laboratory work and experimental tasks. After each laboratory exercise, they draw up the relevant protocols.

Prerequisites: basic knowledge of physics and physics teaching methodology

Supporting materials: physics textbooks for secondary school, educational literature on physics experiments, collections, reference books and encyclopedic dictionaries on physics

Assessment method: Current assessment after completing the course. It is formed on the basis of the theoretical knowledge and practical skills demonstrated by the students during the training for conducting an educational physics experiment, as well as the grades from the defense of the protocols from the laboratory exercises.

MATHEMATICS OBSERVATION

ECTS credits: 2
Hours per week: 0 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Current assessment
Course Status: Compulsory course
Semester: VI

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course "Mathematics Observation" is part of the curriculum and provides practical training for students.
Mathematics observation is conducted in a basic school. Under the guidance of a practice leader, observations and analysis of lessons at the junior high and high school levels are carried out. Each observed lesson is discussed, the positive aspects and mistakes made are indicated.

Course Objective: The aim of the course "Mathematics Observation" is to form skills for analyzing observed pedagogical activity in a real environment in terms of: determining the topic, goals and objectives of the lesson; determining the principles, forms, methods and means of pedagogical activity; in the material and technical provision of pedagogical activity; pedagogical interaction with students.
After completing the course, students should be able to:
• Purposefully observe various pedagogical activities;
• Keep notes on observed pedagogical activity;
• Analyze a specific pedagogical activity;
• Determine the topic, goals and objectives of the lesson;
• Determine the principles, forms, methods and means of pedagogical activity;
• Analyze lessons according to an established system of pedagogical and methodological criteria;

Teaching methods: Mathematics observation is carried out in basic schools under the guidance of a practice manager and a basic teacher. The basic teachers with whom the students will practice are determined in advance. An instruction is held with the students and basic teachers to familiarize them with the goals and objectives of the observation, the rights and obligations of each of the participants, the requirements, criteria and indicators for assessment.
The main way to conduct mathematics observation is observation of mathematics lessons and is combined with an analysis of various pedagogical situations and activities. The teacher who is the head of the observation determines in advance the topic and didactic tasks for each observation. Students keep notes on each observed lesson and make analyses of 3 observed lessons. All notes of observed lessons are presented when the final grade is formed.

Assessment method: The current grade for the subject Mathematics Observation is formed on the basis of:
• Student participation during the debriefing of the observed lessons (20%);
• Notes taken (20%);
• Analyses of 3 observed lessons (60%)

INCLUSIVE EDUCATION

ECTS credits: 3
Hours per week: 1 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: VI

Methodological guidance:
Department of Educational Management and Social Pedagogy
Faculty of Pedagogy

Course Description: The training in the course "Inclusive Education" is aimed at clarifying inclusive education as a key policy related to the implementation of large-scale changes and rethinking of traditional educational models; as a process of changing the school environment, based on respect and acceptance of the other. A significant place is given to the theoretical and content analysis of a number of basic concepts. The challenges facing education in the context of inclusive education are considered; factors for inclusion; conditions for effective inclusive education; prevention of school dropout and forms of professional training of teachers in the context of inclusive education, etc.

Course Objective: The course aims to familiarize students with the challenge of inclusive education; to present the main documents regulating the need for its practical implementation; to reveal the diversity of educational needs, requiring an adequate response to deal with difference and individual characteristics and awareness of the need for inclusive policies to overcome social and educational isolation.

Teaching methods: lectures, stimulating active debate in subgroups, didactic games, case analysis, planning and conducting mini-experiments to analyze the behavior of students with special educational needs at different moments of the lesson and extracurricular activities.

Assessment method: written exam

Registration for training in the discipline: Not necessary.

Registration for the exam: agreed with the teacher.

METHODOLOGY OF SOLVING PHYSICS PROBLEMS

ECTS credits: 6
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Subject Description: This course reveals the essence of the concept *physics problem*, the place, role and didactic functions of physical problems in the process of education, as well as their classification, the methods of solving the basic problem types, the system of units of measurement in physics as an object and means of cognition. Special attention is paid to the opportunities for problem solving offers for establishing inter-disciplinary connections in education.

Specific Goals of the Subject: The course aims at providing students with both theoretical and practically oriented knowledge for efficient application of adequate didactic techniques for using physics problems in the education in physics at middle and secondary school. In the pursuit of this goal, the syllabus focuses on the profound methodological preparation of would-be teachers, the formation of criteria and skills for selecting the proper physics problems and the methods for their application in the teaching process.

Teaching Methods: lectures, seminars, individual student's work

Requirements/Prerequisites: Basic knowledge in Physics, Mathematics and Methods for teaching physics

Evaluation Method: Evaluation defined by a written exam and current control of the seminars taken certain gravity.

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

MATHEMATICS TEACHING METHODOLOGY – II PART

ECTS credits: 6
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course description: The course includes problems from the special methodology of mathematics education, namely on the topics: functions, relations and operations, equations and inequalities, identities and details, vectors, geometric figures in the plane and space and their place in the school mathematics course.

Course objective: To prepare students for their future realization as teachers of mathematics and computer science.

Teaching methods: lectures and exercises

Prerequisites: Knowledge of the content of the Mathematics Curriculum, as well as knowledge of psychology and pedagogy.

Assessment: written exam

Registration for the exam: agreed with the teacher and the academic department

ASTRONOMY AND ASTROPHYSICS

ECTS credits: 6
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Compulsory course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation:
The course "Astronomy and Astrophysics" is included as compulsory course in the specialty curriculum. It is studied from students studying at educational and qualification degree "Bachelor".
The course "Astronomy and Astrophysics" is with total workload 60 hours, which includes 30 hours lectures and 30 hours seminars. The students' self-study is 120 hours.
Teaching on the course "Astronomy and Astrophysics" has theoretic-applied character.
Current control of the students' educational achievements is carried out during the semester in the hours for seminars. Teaching on the course ends with a written exam.

Course content:
1. Astronomy and astrophysics as science.
2. Visible positions and movements of the celestial objects.
3. Sun. Movement of the Sun.
4. Solar system.
5. Moon. Movement of the Moon.
6. Astronomical methods for measuring the time.
7. Stars. Stellar evolution.
8. Interstellar medium.
9. Galaxies and Universe.
10. Milky Way Galaxy.
11. Fundamentals of the contemporary astrophysics.
12. Methods and instruments of the astrophysics.
13. Astrodynamics.

Teaching methods and evaluation:
Lectures are held in a lecture hall, that is equipped with the necessary technique – computer and multimedia projector, using the computer presentations, which are developed in accordance with the educational content of the lectures.
To conduct the seminars are used variety of didactic materials – computer presentations, electronic visual materials, tasks and other.
Certification of the semester get students who have received an evaluation of the current control at least "Satisfied 3" (D).
Teaching on the course "Astronomy and Astrophysics" ends with a written exam on the educational content. A final evaluation is formed only if the student has received an

evaluation of the written exam at least “Satisfied 3” (D). In forming of the final evaluation are reported the evaluations from the written exam (70 %) and from the current control (30 %).

CURRENT PEDAGOGICAL PRACTICE IN PHYSICS

ECTS credits: 2
Hours per week: 0 Lec. + 0 Sem. + 2 Lab.
Evaluation Method: Current assessment
Course Status: Compulsory course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course "Current Pedagogical Practice in Physics" is included as mandatory in the curriculum for the specialty "Pedagogy of Teaching Physics and Mathematics". It is held after the lectures on Physics Teaching Methodology and the exercises on Physics Visiting, corresponding to the requirements for the practical training of students receiving the "teacher" qualification. The full-fledged conduct of the course provides the foundations for the successful conduct of the internship practice in physics. Students carry out a complex development and practical implementation of lessons, both on the content of the subject "Man and Nature" in 5th - 6th grade, and on the educational content of the school course in physics and astronomy in 7th - 12th grade. Current pedagogical practice in physics is held in a basic school under the guidance of a basic teacher and practice leader. Each student prepares at least 2 lessons for new knowledge in physics, which he delivers in different classes. He must observe the lessons of the other students in the group. Each observed lesson is discussed, the positive aspects and mistakes made are indicated.

Course Objective: The main objective of the course is for students - future teachers - to acquire initial professional skills for the complex development and practical implementation of physics lessons. Students must: consolidate their skills in observing and analyzing physics lessons; form skills in developing teaching methodologies on specific educational content; consolidate their skills in planning, organizing and managing students' cognitive activity; implement at least two physics lessons in practice; continue the formation of professional competencies regarding classroom behavior, determining the optimal pace of work, presenting the material, diction, conducting a conversation, organizing students' independent work, a physics experiment, etc.
The expected results are related to and arise from the main goal and the tasks set. The results of the comprehensive assimilation of knowledge and the full formation of skills are manifested further in the learning process and in the future professional practice of students.

Teaching methods: The following teaching methods are used when conducting exercises:
• verbal – conversation, dialogue, explanation, story, discussion, etc.;
• visual – observation, presentation of graphs, drawings, formulas, various images, schemes, data tables, etc., etc.;
• practical – independent work, solving problems, etc.

Assessment: The assessment procedures that are applied during the training of students in the specialty are: ongoing control and ongoing assessment. The ongoing assessment is the assessment from the ongoing control conducted during the practical exercises.

Exam registration: agreed with the teacher and the academic department

CURRENT PEDAGOGICAL PRACTICE IN MATHEMATICS

ECTS credits: 2
Hours per week: 0 Lec. + 0 Sem. + 2 Lab.
Evaluation Method: Current assessment
Course Status: Compulsory course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course "Current Pedagogical Practice in Mathematics" is part of the curriculum and provides practical training for students.
Current pedagogical practice is conducted at school under the guidance of a basic teacher and practice supervisor. Each student develops and conducts two lessons – one in the middle course (grades 5-8) and one in the upper course (grades 8-12), in the presence of a basic teacher, practice supervisor and the other students in the group. Each observed lesson is debriefed, the positive aspects and mistakes made are indicated.
As a form of control, a current assessment is provided.

Course Objective: Formation of skills for planning, organizing, conducting and analyzing specific lessons in a real learning environment.

Teaching methods: Practical exercises.

Assessment: Students are required to present developments of the delivered mathematics lessons and three analyses of observed lessons to their colleagues in writing.
Current grade – 100%
The grade is based on the lessons delivered (60%), the presented papers (20%) and the analysis of observed lessons (20%).

Exam registration: agreed with the teacher and the academic department

LASER TECHNIQUE

ECTS credits: 4
Hours per week: 2 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: The aim of the course is to acquaint students with the most modern sources of light - lasers with the properties of coherence and monochromaticity and to show their application in science and technology.

Course content: The course examines the physical foundations of laser technology and provides a description of the principle of operation of the most common laser sources. The physical principles of amplification and generation of light based on induced radiation are

examined. Also, open laser resonators, the principles of operation of gas and solid-state lasers, as well as some tunable laser sources are examined.

Teaching and assessment technology: Lectures, illustrated with demonstrations, laboratory exercises with solving practical problems.
The laboratory "Quantum Electronics" is used to conduct laboratory exercises. After each laboratory exercise, students prepare a protocol. The exercise is considered completed after submitting and defending the corresponding protocol. Admission to the exam is granted to students who have completed all laboratory exercises, submitted and defended the relevant protocols and received a minimum "Average 3" grade in the current control.
The training in the course "Laser Technique" ends with a written exam on the course content. When forming the final grade, the grades from the written exam (60%) and the current control (40%) are taken into account.

GENERAL METROLOGY

ECTS credits: 4
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: The course "General Metrology" is included as a mandatory course in the curriculum of the specialty "Physics". It is studied by students studying in the educational and qualification degree "Bachelor".
The course "Condensed Matter Physics" has a total teaching load of 45 hours, of which 30 hours of lectures and 15 hours of laboratory exercises. The extracurricular employment of students is 60 hours.
Current control of the students' academic achievements is carried out during the semester in the hours for laboratory exercises. Training in the course ends with a written exam.

Course content:
1. Introduction to general metrology. Historical development and importance of metrology.
2. Divisions of metrology.
3. Normative documents in metrology.
4. Physical quantities and units of measurement.
5. Standards.
6. Accuracy and errors.
7. Measuring instruments. Main characteristics.
8. Basic measurements in metrology.
9. Metrological control of measuring instruments.
10. Standardization and certification in metrology.

Teaching and assessment technology: Lectures are held in a lecture hall equipped with the necessary equipment - a computer and a multimedia projector, using computer presentations developed in accordance with the lecture content.
The laboratory of "General Metrology" is used to conduct laboratory exercises. Laboratory exercises are conducted in groups. Students work in subgroups of 2-3 people at a workplace

and perform practical tasks described in the methodological instructions and previously discussed with the assistant. After each laboratory exercise, students prepare a protocol. The exercise is considered completed after submitting and defending the relevant protocol. Students who have completed all laboratory exercises, submitted and defended the relevant protocols and received a grade of at least "Average 3" in the current control receive a certificate of the semester.
The training in the course "General Metrology" ends with a written exam on the course content. A final grade is formed only if the student has received a grade from the written exam of at least "Average 3". When forming the final grade, the grades from the written exam (60%) and the current control (40%) are taken into account.

RADIOPHYSICS

ECTS credits: 4
Hours per week: 2 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: The course aims to familiarize students with the basic laws describing AC circuits and electromagnetic and waves.

Course content: Course "Radiophysics-I part" is compulsory for specialty and aims to provide basic training in the physics of wave processes. It is dedicated to the study of electromagnetic oscillations and resonance phenomena occurring in electrical circuits.

Pedagogical Methods: Lectures are visualized by demonstrations and laboratory tasks performance during the laboratory classes. From methods point of view teaching material is grouped in sections following logical consistency of the cause.

Evaluation Method: Final examination in written form. Some intermediate tests conduct through the semester.

MAGNETIC PHENOMENA AND MATERIALS

ECTS credits: 4
Hours per week: 2 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Subject Description: The program contains materials on the basic experimental facts, the important quantitative relationships between quantities and generally accepted models to explain the more important phenomena in the field of magnetism.
The practical classes consist in acquainting students with the basic experimental methods of magnetism and in particular with the methods for studying the basic magnetic characteristics of substances.

Specific Goals of the Subject: The aim of the course is for students to acquire knowledge of the basic concepts in the field of magnetism and magnetic materials and their methods for their study.

Teaching Methods: lectures, tutorials, individual student's work

Requirements/Prerequisites: General knowledge in mathematical methods of physics and analysis

Evaluation Method: Evaluation defined by a written exam and current control of the laboratory exercises taken certain gravity. Some intermediate tests conduct through the semester.

Registration for the Exam: coordinated with the lecturer and Students Service Department.

SYMMETRIC SEMIGROUPS

ECTS credits: 4
Hours per week: 3 Lec. + 0 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Short Description: Symmetric semigroups (transformation semigroups) belong to the most fundamental objects in Mathematics. They arise naturally as endomorphism semigroups of various mathematical structures. They also occur in theoretical computer science, where properties of languages depend on algebraic properties of various transformation semigroups related to them. Transformation semigroups are of essential importance for the structure theory of finite state machines or automata. They also occur in the theory of digital networks by viewing a state machine as a network composition of coupled smaller state machines, of which there are five basic types (since there are five non-isomorphic semigroups of order 2). Of course, transformation semigroups are also of great importance for semigroup theory, as every semigroup is isomorphic to a transformation semigroup. The course begins with the study of basic concepts, properties and examples of the theory of semigroups. Particular attention is paid to the Green's relations for symmetric semigroups. Some special elements like idempotents, regular and inverse elements, as well as generating sets and rank of semigroups are considered. The course continued with the study of a number of symmetric semigroups with specific properties such as semigroups of order-preserving or order-reversing transformations, semigroups of orientation-preserving or orientation-reversing transformations, partial symmetric semigroups, symmetric inverse semigroups.

Course Aims: The purpose of this course is to introduce students to the basic theory of the symmetric semigroups and its applications to the other mathematical disciplines. The content of the course gives the students the opportunity to be able: to study alone and in more details the theory of the symmetric semigroups; to follow other courses that use semigroup theory; to attend specialized scientific seminars in algebra; to reading articles and books in this field.

Teaching Methods: lectures, projects, and presentations.

Requirements/Prerequisites: The students should have basic knowledge in Abstract algebra.

Assessment: permanent control during the semester including one project and presentation, and exam in the semester's end.

Registration for the exam: coordinated with the lecturer and student Service Department

MATHEMATICAL MODELS IN ECONOMY

ECTS credits: 4
Hours per week: 2 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The presented course on mathematical models in economics examines models that are often used in macro- and microeconomics. The set of mathematical models that to one degree or another correctly describe economic processes can be united under the name "Mathematical Economics". This includes models of production activity (the so-called real economy) and financial and credit activity. The course presents methods of modeling pricing and taxation. From the point of view of mathematics, issues of forecasting and regulation of the economy are considered and analyzed.

Course Objectives: With the course presented in the program, mathematics students are introduced to mathematical models of economic phenomena, it provides an opportunity to study the possibilities of applying these models and methods in practice.

Teaching methods: lectures, laboratory exercises, course assignments.

Assessment: written exam

Registering for the exam: Students coordinate with the instructor the desired exam dates within the announced calendar schedule for the exam sessions.

NUMERICAL METHODS FOR EXTREME PROBLEMS

ECTS credits: 4
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The issue of algorithm, algorithmic representation, composite representation and convergence of algorithmic representations is examined. The main methods for one-dimensional minimization are presented: the bisection method, the golden

section method, the Fibonacci method, Newton's method, the method of parabolas. The main methods for unconditional optimization are also planned to be studied: zero-order methods (coordinate descent method, Hooke and Jeeves method, Rosenbrock method), first-order (gradient methods: the method of the fastest descent), second-order (Newton's method, modifications of the method), as well as conjugate direction methods (conjugate gradient method: Fletcher - Reeves method, Pollack - Ribiera method; quasi-Newton methods: Davidon - Fletcher - Powell method). Methods for conditional optimization are considered - methods of possible directions (Zeutendijk, Rosen, reduced gradient), methods of penalty (fining) and barrier functions. A place is devoted to the basics of non-smooth analysis and methods for non-differentiable (non-smooth) optimization. The study of basic results and methods of stochastic optimization is planned. Numerical methods for solving separable optimization problems are presented. The basics of the dynamic optimization method and R. Bellman's principle are studied. Vector (multi-criteria) optimization and Pareto optimality are considered.

Course Objective: The objective and main task of studying the course Numerical Methods for Extremal Problems is for students to acquire knowledge about the basic numerical methods for solving different classes of optimization (extremal) problems.

Teaching methods: Lectures, laboratory exercises, course assignments.

Prerequisites: knowledge of mathematical analysis, linear algebra, analytical geometry and mathematical optimization.

Assessment: The exam is written. It is conducted on two topics from the syllabus, drawn at random.
The assessment is also formed by two course assignments, solved in advance by applying the methods studied in the lecture course and the software products used in the laboratory classes, and/or by preparing programs (in a programming language of your choice) that implement given numerical methods.
The final assessment is formed as 40% of the assessment from the course assignments and 60% of the assessment from the theoretical exam.

Exam registration: Students coordinate with the lecturer the desired exam dates, within the announced calendar schedule for the exam sessions.

MATHEMATICS HYSTORY

ECTS credits: 4
Hours per week: 3 Lec. + 0 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics
Course Description: Includes the main stages in the development of mathematical knowledge until the end of the 20th century.

Course Objective: To familiarize students with the main stages in the development of mathematical knowledge until the end of the 20th century and to give them an idea of how this knowledge can be used in their future work as mathematics teachers.

Teaching Methods: Lectures and consultations. The course "History of Mathematics" is taught according to the current curriculum - lectures, grouped in blocks of 3 hours per week.

Prerequisites: Knowledge from the school mathematics course.

Assessment: Written exam on the theory

Exam registration: Students coordinate with the teacher the desired exam dates within the announced calendar schedule for the exam sessions.

SPECIFIC STEM EDUCATIONAL TECHNOLOGIES IN MATHEMATICS TEACHING

ECTS credits: 4
Hours per week: 1 Lec. + 0 Sem. + 2 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The research approach in STEM education is of utmost importance as a link between natural sciences and their real-life application. That is why mathematics and the idea of mathematical modeling should be considered an essential element of all STEM areas and the methodologies for teaching mathematics should be in sync with the STEM approach. They challenge students to explore and model mathematical concepts, to build the meaning and connection between different academic disciplines and their real-life application in real-life cases. That is why the development of mathematical competencies at an early age is an important factor for future realization in the labor market.

Course Objective: The aim of this course is for students to gain practical experience in a STEM environment, which will allow the implementation of innovative technologies and software solutions in the field of mathematics in teaching the subject at school. This will help them to show creativity in teaching and prepare students for successful future realization in different spheres of life, developing their logical thinking, problem-solving skills, digital literacy and emotional intelligence.

Teaching methods: Lectures, seminars, consultations, control checks.

Assessment: Current control is carried out during lectures. The final assessment takes into account the results of the current control during the semester and the exam score.

Exam registration: Students coordinate with the teacher the desired dates within the announced calendar schedule for the exam sessions.

INTERNSHIP IN PHYSICS

ECTS credits: 5
Hours per week: 0 Lec. + 0 Sem. + 3 Lab.
Evaluation Method: Current assessment
Course Status: Compulsory course
Semester: VIII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Descriptions: The course "Physics Internship" is included as mandatory in the curriculum for the specialty "Pedagogy of Teaching Physics and Mathematics". It is conducted after the internship and the current pedagogical practice in physics, and corresponds to the requirements for the practical training of students receiving the "teacher" qualification. The full-fledged conduct of the course provides the necessary preparation for the successful professional realization of the students.
The physics internship is conducted in a basic school under the guidance of a basic teacher. Each student prepares a minimum of 10 lessons for new knowledge in physics, which he delivers in different classes. He must observe the lessons of other students who are distributed in practice in the same school. Together with the basic teacher, everyone participates in the discussion of the delivered lessons.
As a form of control, an ongoing assessment is provided.

Course Objective: The main objective of the course is for students to acquire the necessary professional skills for quality realization as future physics teachers.
Students must: consolidate their knowledge and skills to develop a teaching methodology related to specific learning content; improve their skills in planning, organizing and managing students' cognitive activity; implement in practice at least ten lessons of new knowledge, which they can repeat in other classes in order to achieve a higher quality of skills for teaching physics lessons; continue the formation of professional competencies regarding classroom behavior, determining the optimal pace of work, presenting the material, diction, conducting a conversation, organizing students' independent work, a physical experiment, etc.
The expected results are related and arise from the main goal and the tasks set. The results of the comprehensive assimilation of knowledge and the full formation of skills are manifested further in the learning process and in the future professional practice of students.

Teaching methods: When conducting exercises, the following teaching methods are used:
• verbal - conversation, dialogue, explanation, story, discussion, etc.;
• visual – observation, presentation of graphs, drawings, formulas, various images, diagrams, data tables, etc., etc.;
• practical – independent work, solving problems, etc.

Assessment: A current assessment is formed based on the assessment by the practice leader for the implementation of a specific lesson (U), by the basic teacher for the overall performance of the student (B) and the assessment for the development of plan-summaries of the delivered lessons and notes on the observed lessons (P) provided that each of these assessments is at least Average 3.00. The current assessment is calculated according to the formula:
TO = 0.5U + 0.3B + 0.2P
and is rounded to an integer.

Exam registration: Students agree with the teacher on the desired exam dates within the announced calendar schedule for the exam sessions.

INTERNSHIP IN MATHEMATICS

ECTS credits: 5
Hours per week: 0 Lec. + 0 Sem. + 3 Lab.
Evaluation Method: Current assessment
Course Status: Compulsory course
Semester: VIII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Descriptions: The course "Internship in Mathematics" is part of the curriculum and provides practical training for students.
Internship is conducted in a school under the supervision of a basic teacher and a practice supervisor. Each student must deliver 15 lessons in the middle course and 15 lessons in the upper course - a total of 30 lessons (3 lessons per week) and must also observe 20 lessons delivered by their colleagues or the basic teacher. The student prepares a lesson plan-synopsis for each delivered lesson. All lesson plans are presented during the final assessment.

Course Objective: Formation and improvement of students' skills for conducting and organizing independent pedagogical activity in a real learning environment.

Teaching Methods: Internship in Mathematics is conducted in basic schools under the supervision of a basic teacher. The basic teachers with whom the students will practice are determined in advance. An instruction is held with the students and the basic teachers to familiarize themselves with the goals and objectives of the pre-diploma pedagogical practice, the rights and obligations of each of the participants, the requirements, criteria and evaluation indicators.
Each student must deliver 15 lessons in the middle course and 15 lessons in the upper course - a total of 30 lessons (3 lessons per week) and must also observe 20 lessons delivered by their colleagues or the basic teacher.
The main way to conduct a pre-diploma pedagogical practice in mathematics is to independently plan, organize and implement the learning activity in the classes entrusted to him with minimal assistance from the basic teacher. The student prepares a plan-synopsis for each delivered lesson. All plan-synopsis are presented when the final assessment is made.
The practice leader organizes and controls the practice through direct observations of each student's lessons and through discussion of the delivered lessons. He checks and evaluates the lesson summaries that the student prepares and implements.

Prerequisites: A student who has not met the requirements for hosting and current teaching practice is not allowed to participate in the pre-graduate teaching practice

Assessment:
Current assessment – 100%
The assessment is based on the lessons taught (80%), the presented papers (20%) and the assessment of the basic teacher.

COMPUTER EDUCATIONAL GAMES IN MATHEMATICS AND INFORMATICS EDUCATION

ECTS credits: 5
Hours per week: 2 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VIII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course "Computer Educational Games in Mathematics and Informatics Education" is part of the curriculum and includes 8 general topics. As a form of control, ongoing control and an exam are provided.
The content of the program covers the main issues related to the theoretical, methodological and technical preparation for the creation and use of computer educational games in mathematics and informatics.
The successful passer of the exam in "Computer Educational Games in Mathematics and Informatics Education" will acquire the necessary minimum of knowledge both for creating prototypes of elementary educational games and for finding ways to implement them in the educational process.
In the practical classes, students are trained in the development of scenarios and the creation of educational games. Finding the place and role of computer games in the educational process in mathematics and informatics.

Course Objectives: The purpose of the course "Computer Educational Games in Mathematics and Informatics Education" is to form knowledge and skills for creating scenarios and prototypes of educational computer games and their application in the educational process.
After completing the course, students should be able to:
• Create scenarios for computer educational games for primary school.
• Create prototypes of elementary educational games with various technological means.
• Plan lesson activities.
• Apply educational computer games in the educational process.

Teaching methods: Lectures are held sequentially, according to the planned curriculum. Multimedia lessons are provided, for which a multimedia projector and an interactive whiteboard are required.
Practical exercises are held in a computer room. It is planned to use the Moodle e-learning system, supported by the Research Laboratory for e-learning (http://www.e-learning.swu.bg/moodle and www.leo.swu.bg). Each student is assigned different topics for developing scenarios for an educational game and creating prototypes of elementary computer games.

Assessment:
1. Current assessment of developed scenarios for educational computer games, description of existing online educational games, etc. (70% of the final grade)
2. Exam: defense and presentation of the projects (30% of the final grade).

In case of a "weak" grade under item 1 of the assessment, the student must additionally meet the requirements for a minimum "average" grade from current control in order to be admitted to the exam.

Exam registration: Students coordinate with the teacher the desired exam days, within the announced calendar schedule for the exam sessions.

PRACTICAL COURSE IN MATHEMATICAL MODELING WITH Matlab

ECTS credits: 5
Hours per week: 1 Lec. + 0 Sem. + 2 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VIII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course is included as an elective in the curriculum of the specialty "Pedagogy of Teaching Physics and Mathematics" and is intended for students with a strong interest in mathematical modeling and numerical implementation of mathematical models using software products, in particular - the Matlab programming environment. It introduces students to the rich capabilities of Matlab, which is a solid basis for performing analytical and numerical calculations in a number of areas, as well as for creating their own program packages.

Course Objectives: The course examines the main functions of the Matlab kernel and how to create new programs (m-files). Particular attention is paid to programming and creating user programs that solve mathematical models. The purpose of the laboratory exercises is for students to become familiar with the graphical environment for simulating Simulink systems and the rich capabilities of Matlab for calculating limits, derivatives, integrals, studying functions and actions with complex numbers or, in general, in the application of the environment in mathematical modeling.

Teaching methods: Lectures, laboratory exercises, consultations, tests.

Prerequisites: Basic knowledge of the school mathematics course and disciplines such as "Linear Algebra", "Analytical Geometry", "Mathematical Analysis" is required. If a programming language has been studied, it is also an advantage.

Assessment: Ongoing control during the semester including two tests, and a written exam on laboratory exercises and lecture material.

Exam registration: Students coordinate with the teacher the desired dates within the announced calendar schedule for the exam sessions.

NUMERICAL METHODS MONTE CARLO

ECTS credits: 5
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VIII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The course includes studying elements of probability theory, as the basis of Monte Carlo methods of financial mathematics. The main components of this discipline are also studied - Brownian motion, the variation reduction technique, stochastic methods of these problems and applications for the study of American Options.

Course Objective: Mastering the basic concepts and methods for stochastic study of random variables.

Teaching methods: Lectures, seminars, homework, consultations, control checks.

Prerequisites: good knowledge of the field of mathematical analysis, probability theory, differential equations and other areas.

Assessment: Written exam on the lecture material.

Exam registration: Students agree with the teacher on the desired exam days, within the announced calendar schedule for the exam sessions.

POLYNOMIALS OF ONE OR MORE VARIABLES

ECTS credits: 5
Hours per week: 2 Lec. + 1 Sem. + 0 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VIII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: The elective course "Polynomials of One and More Variables" deepens and expands the knowledge of students acquired in the course of Algebra and Number Theory. The course begins with a review of basic concepts, such as polynomials of one variable, operations with polynomials, zeros of polynomials, decomposition of polynomials. The algebraic closure of the field of complex numbers is proven. Some basic consequences of D'Alembert's theorem are examined. The decomposition of polynomials with real and complex coefficients is studied. Students are introduced to Cardano's formulas for solving equations of the third and fourth degree. Definitions and examples of cyclotomic (circular) polynomials and matrix polynomials are given. In the part on polynomials of several variables, basic concepts and statements related to symmetric polynomials are first recalled, then power sums are introduced and Newton's formulas for the relationship between power sums and elementary symmetric polynomials are given. The concepts of discriminant and resultant of polynomials are examined. Attention is paid to solving nonlinear algebraic systems of equations using the resultant.

Course Objectives: The aim of this course is for students to gain more in-depth knowledge and skills about polynomials of one and more variables, as well as the applications of this apparatus for the algebraic solvability of some special types of equations.

Teaching methods: Lectures, seminars, consultations, homework, control tests.

Prerequisites: Basic knowledge from the courses in Linear Algebra and Algebra and Number Theory is required.

Assessment: Ongoing control during the semester including homework and tests, and a written exam on the seminar exercises and lecture material.

Exam registration: Students coordinate with the lecturer the desired dates within the announced calendar schedule for the exam sessions.

BASICS OF OPTOELECTRONICS AND OPTICAL COMMUNICATIONS

ECTS credits: 5
Hours per week: 2 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VIII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Annotation: The course "Optoelectronics and Optical Communication Systems" examines the physical principles of optical communication system optoelectronic devices related to radiation, amplification and registration of optical impulses. The issues related to the communication capacity of the fiber optic lines and the factors limiting it are clarified.

Subject Description: The course consists of two parts. The first part discusses the basic principles of light propagation in optical fiber lines. Consideration begins with planar waveguide as the simplest light-guide structure and continue with basic concepts such as waveguide light wave propagation, formation of waveguide's modes, step index fibers, graded index fibers, single mode fibers, intermodal dispersion, material and waveguide dispersion in single mode fibers, fiber loss, methods for fabrication and parameters control. The second part considers optical sources and transmitters including semiconductor lasers and light emitting diodes, optical detectors and receivers, optical amplifiers, system design and performance, passive optical component.

Pedagogical methods and type of evaluation: Lectures are visualized by demonstrations and laboratory tasks performance during the laboratory classes. From methods point of view teaching material is grouped in sections following logical consistency of the cause. Final examination is in written form. Some intermediate tests conduct through the semester.

PROTECTION IN EXTREME CONDITIONS

ECTS credits: 5
Hours per week: 0 Lec. + 2 Sem. + 1 Lab.
Evaluation Method: Current assessment
Course Status: Optional course
Semester: VIII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Course Description: Natural disasters such as earthquakes, fires, floods, hurricanes and others are extremely dangerous for people, as they occur suddenly, develop rapidly and affect vast areas. When natural disasters occur, the normal way of life of people is sharply disrupted, buildings and facilities are destroyed and huge human casualties are caused. In addition to these natural catastrophic processes, severe accidents can occur in power or experimental nuclear reactors, which are accompanied by contamination of the environment with radioactive substances and people can receive doses of radioactive radiation several times higher than the maximum permissible values /Chernobyl - 1986/. Moreover, radiation is the most powerful mutagenic and carcinogenic factor for humans. In the case of severe accidents in nuclear reactors, even those of medium power, the consequences for people and the environment are unpredictable. Also, the terrorist attacks that took place in the USA in 2001, Spain in 2004, Russia in 2004, England in 2005 proved that any country in the world can be the target of mass terrorism. In these cases, there is a particularly great danger to people's lives in higher education institutions, primary and secondary schools, government agencies, railway stations and other sites where a large number of people are concentrated.

Course Objectives: The goals and objectives of the course are for students to acquire knowledge about the basic principles of correct actions in the event of earthquakes, fires, floods, hurricanes, etc. The main ways and means of organizing and conducting rescue operations in areas of destruction. Methods and means of providing first aid to injured people, etc. The main teaching methods used in the course are discussion exercises. When conducting them, the educational content is illustrated using a video system, computer configuration, etc. In addition, practical demonstrations are held with technical means for providing first aid, ways to rescue people from burning buildings, ways and means for extinguishing fires, etc.

Teaching method: The main methods used for training students are discussion talks using a video system and computer configuration, practical demonstrations with technical means of various methods and means for protecting people in natural disasters, serious accidents, providing first aid to injured people, etc.

Assessment: The main form of testing and assessing students' knowledge is the written exam

Registration for training in the discipline: It is necessary to submit an application to the head of the department at the end of the previous semester.

Registration for the exam: agreed with the teacher.

ENVIRONMENTAL PHYSICS

ECTS credits: 5
Hours per week: 2 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VIII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Subject Description: The course includes studying of the basic physical phenomena in the environment, including the Distribution and properties of the water, structure and energy balance of the atmosphere, heat, electromagnetic, noise and aerosol-pollutions.

Course aims: The students in physics have to receive ground knowledge about using the contemporary physical Methods in the monitoring of the environment.

Pedagogical Methods: Lectures, laboratory, homework, tutorials.

Preliminary Requirements: Basic knowledge in General Physics – parts mechanics, molecular physics, thermodynamics and electricity.

Assessment: Written examination. Some intermediate tests conduct through the semester.

Registration for the course: by request at the end of the current semester.

Registration for the Exam: coordinated with the lecturer and Students Service Department.

NANOTECHNOLOGIES

ECTS credits: 5
Hours per week: 2 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written exam
Course Status: Optional course
Semester: VIII

Methodological guidance:
Department of Mathematics and Physics,
Faculty: Natural Sciences & Mathematics

Subject Description: The program contains materials for basic data on the nanoscale state of substances, experimental methods for their preparation, important methods for characterizing their nanoscale state is their unique physical properties, which they exhibit compared to bulk materials.
The practical classes consist in the students getting acquainted with the basic experimental methods for obtaining and researching nano materials and the methods for researching their main characteristics.

Specific Goals of the Subject: The aim of the course is for students to acquire knowledge of basic concepts in the field of nanotechnology and research methods of nanoscale materials.

Teaching Methods: lectures, tutorials, individual student's work

Requirements/Prerequisites: General knowledge in mathematical methods of physics and analysis

Evaluation Method: Evaluation defined by a written exam and current control of the laboratory exercises taken certain gravity. Some intermediate tests conduct through the semester.

Registration for the course: by request at the end of the current semester.

Registration for the Exam: coordinated with the lecturer and Students Service Department.