SOUTH-WEST UNIVERSITY „NEOFIT RILSKI“
2700 Blagoevgrad, 66 Ivan Michailov str.
e-mail: info@swu.bg
http://www.swu.bg

INFORMATION PACKAGE

/ECTS/

FIELD OF HIGHER EDUCATION: **4. NATURAL SCIENCES, MATHEMATICS AND INFORMATICS**

PROFESSIONAL FIELD: **4.1. PHYSICS SCIENCES**

SPECIALTY: **PHYSICS**

QUALIFICATION CHARACTERIZATION

OF SPECIALTY **“PHYSICS”**

EDUCATIONAL AND QUALIFICATION DEGREE: **BACHELOR OF SCIENCE**

PROFESSIONAL QUALIFICATION: **PHYSICIST**

PERIOD OF STUDY: **4 YEARS (8 SEMESTERS)**

FORM OF TRAINING: **REGULAR**

The specialty “Physics” with educational and qualification degree “Bachelor of science” is a classic academic specialty with a period of 4 years training and is designed to prepare professionals of professional field 4.1. Physics sciences with professional qualification Physicist, who know to apply physics in research and wide range of applied activities. Students who have completed the degree “Bachelor of science” receive theoretical and applied knowledge of basic physical and mathematical disciplines, which enables them to good professional career and opportunity to continue their education in the educational and qualification degree “Master’s degree”. The curriculum of the Bachelor’s degree is developed in accordance with the state requirements for the specialty, consistent with the European norms for the respective education's degree. The curriculum contains courses that are divided into three categories – compulsory, elective and facultative. They give students the opportunity through the choice of courses to receive theoretical and applied knowledge in modern physical fields and their application in other sciences and in manufacturing.

Purpose of the specialist

Physicists specialists are ready to work in testing laboratories, in laboratories and quality control centers, with devices and tools for automation in energetics, with laser technics and technologies, in laboratories and units in biotechnology, in the food-taste industry, in laboratories for the protection of aerosol air pollution, in experimental stations in agriculture and agroecology, in scientific institutes and laboratories in the field of physical sciences and related sciences (chemistry, biology, geology, etc.) that use physical methods.

The positions that can occupy the physicists specialists according to the National classification of occupations and positions are following: Physicist; Physicist, atomic physics; Physicist, electricity and magnetism; Physicist, electronics; Physicist, mechanics; Physicist, molecular physics; Physicist, optics; Physicist, theoretical physics; Physicist, thermodynamics; Physicist, heat physics; Physicist, physics of semiconductors; Physicist, solid state physics; Physicist, medical radiological physics; Physicist, medical sanitary physics.

Competences of the specialist

The students that are graduated the specialty Physics possess the necessary knowledge and skills to conducting experimental and theoretical research in contemporary and perspective directions of fundamental and applied physics, to work with devices and equipment for applied research, to organize complex research and manufacturing in different fields of physics, natural sciences and sectors of the economy that use physical methods.

CURRICULUM

FIELD OF STUDY: **"PHYSICS"**

(Adopted in 2008, updated 2021)

First Year			
First Semester	ECTS credits	Second Semester	ECTS credits
Compulsory Courses		***Compulsory Courses***	
Linear Algebra and Analytic Geometry	7,0	Mathematical Analysis II part	7,5
Mathematical Analysis I part	7,0	Fundamentals of the Computer Technique and Technologies	7,5
Mechanics	8,0	Molecular Physics and Thermodynamics	9,0
Laboratory practicum in Mechanics	4,0	Laboratory practicum in Molecular Physics and Thermodynamics	4,0
Foreign Language I	2,0	Foreign Language II	2,0
Sport	2,0		
	Total: 30		Total: 30
Second Year			
Third Semester	ECTS credits	Fourth Semester	ECTS credits
Compulsory Courses		***Compulsory Courses***	
Electricity and Magnetism	8,0	Optics	8,0
Laboratory practicum in Electricity and Magnetism	4,0	Laboratory practicum in Optics	4,0
Mathematical Methods in Physics part I	7,0	Mathematical Methods in Physics part II	7,0
Magnetic phenomena and materials	5,0	Theoretical Mechanics	7,0
General Metrology	4,0	Radio Physics part I	4,0
Sport	2,0		
	Total: 30		Total: 30
Third Year			
Fifth Semester	ECTS credits	Sixth Semester	ECTS credits
Compulsory Courses		***Compulsory Courses***	
Atomic Physics	9,0	Nuclear Physics	8,0
Laboratory practicum in Atomic Physics	4,0	Laboratory practicum in Nuclear Physics	3,0
Astronomy and Astrophysics	5,0	Optoelectronics and Optical Communications	5,0
Electrodynamics	5,0	Quantum Mechanics	5,0
Radio Physics part II	5,0	Condensed Matter Physics	5,0
Sport	2,0	Nanotechnology	4,0
	Total: 30		Total: 30
Fourth Year			
Seventh Semester	ECTS credits	Eighth Semester	ECTS credits
Compulsory Courses		***Optional Courses***	
Laser Technique	8,0	***(Students choose four or five courses***	
Sport	2,0	***(20 credits) from the second group)***	
Optional Courses		**Second group**	
(Students choose four courses from the first group)		Ecology	5,0
First group		Environmental Physics	5,0
Preparing the Physical Experiment and Processing of Experimental Data	5,0	Electromagnetic pollution	5,0
Measurement of Physical Quantities	5,0	Educational practice in institutes of BAS	5,0
History of physics	5,0	Fundamentals of biophysics	5,0
Physical Methods in Medicine	5,0	Protection in Extreme Confitions	5,0
Interaction of Radiation with Matter	5,0	Practice in Astronomy	5,0
Spectral Analysis	5,0	**Graduation** – written state exam in physics or defense of diploma thesis	10,0
	Total: 30		Total: 30

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

DESCRIPTIONS OF THE COURSES

LINEAR ALGEBRA AND ANALYTIC GEOMETRY

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

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

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; to obtain knowledge and skills for application of the analytic apparatus for research of geometric objects.

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

MATHEMATICAL ANALYSIS I PART

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

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

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.

MECHANICS

ECTS credits: 8.0
Hours per week: 3 Lec. + 2 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.

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.

MATHEMATICAL ANALYSIS II PART

ECTS credits: 7,5
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 of Mathematics and Natural Sciences

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

FUNDAMENTALS OF THE COMPUTER TECHNIQUE AND TECHNOLOGIES

ECTS credits: 7,5
Weekly workload: 2 Lec. + 2 Sem.+ 0 Lab.
Form of assessment: Current assessment
Statute of the course: Compulsory
Semester: II

Departments involved:
Department of Mathematics and Physics,

Faculty of Mathematics and Natural Sciences

Annotation: The course "Fundamentals of the Computer Technique and Technologies" is included as compulsory course in the specialty curriculum "Physics". It is studied from students studying at educational and qualification degree "Bachelor".

The course "Fundamentals of the Computer Technique and Technologies" is with total workload 45 hours laboratory exercises. The students' self-study is 135 hours.

Teaching on the course "Fundamentals of the Computer Technique and Technologies" has theoretic-applied character.

Current control of the students' educational achievements is carried out during the semester in the hours of laboratory exercises.

Course content:

1. Introduction to databases.
2. Introduction to Microsoft Office Access 2010. Creating databases.
3. Creating tables in databases.
4. Data input in tables of databases.
5. Providing and maintaining the data integrity in databases.
6. Creating links between tables in databases.
7. Creating queries in databases.
8. Creating forms in databases.
9. Creating controls in forms and subforms to the forms in databases.
10. Creating reports in databases.
11. Creating macros in databases.
12. Creating switchboard in databases.
13. Creating indexes in tables of databases.
14. Application of the databases.

Teaching methods and evaluation: To conduct the laboratory exercises is used the material base of the department of Physics (computer laboratory). The laboratory exercises are conducted in groups. Each student has workplace. Students work individually and they perform the practical tasks, which are described in the methodological guidelines and discussed in advance with the assistant. The laboratory exercise is considered done after presentation and defense of the performance of assigned tasks.

Certification of the semester get students who have done all laboratory exercises and who have received an evaluation of the current control at least "Satisfied 3" (D).

Teaching on the course "Fundamentals of the Computer Technique and Technologies" ends with a current assessment. The current assessment is the evaluation of the current control that is conducted during the laboratory exercises.

MOLECULAR PHYSICS AND THERMODYNAMICS

ECTS credits: 9.0 **Hours per week:** 3 Lec. + 2 Sem. + 0 Lab.
Form of assessment: Written exam **Course Status:** Obligatory course
Semester: II

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

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 AND THERMODYNAMIC

ECTS credits: 4.0 **Hours per week:** 0 Lec. + 0 Sem. + 3 Lab.
Form of assessment: Current assessment **Course Status:** Obligatory course
Semester: II

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

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.

FOREIGN LANGUAGE II

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

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

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.

ELECTRICITY AND MAGNETISM

ECTS credits: 8.0
Hours per week: 3 Lec. + 2 Sem.+ 0 Lab.
Evaluation Method: Written examination
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 4
Hours per week: 3 Lab.
Evaluation Method: Current semester grade.
Status of the Subject: Compulsory
Semester: III

Methodological guidance:
Department of Mathematics and Physics,
Faculty of 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.

MATHEMATICAL METHODS IN PHYSICS – PART I

ECTS credits: 7.0
Workload per week: 2 Lec. + 2 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.

MAGNETIC PHENOMENA AND MATERIALS

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

Methodological guidance:
Department of Mathematics and Physics,
Faculty of 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.

GENERAL METROLOGY

ECTS credits: 4,0
Weekly workload: 2 Lec. + 1 Sem. + 0 Lab.
Form of assessment: Written exam
Statute of the course: Compulsory
Semester: III

Departments involved:
Department of Mathematics and Physics,
Faculty of Mathematics and Natural Sciences

Annotation: The course "General Metrology" is included as compulsory course in the specialty curriculum "Physics". It is studied from students studying at educational and qualification degree "Bachelor".

The course "General Metrology" is with total workload 45 hours, which includes 30 hours lectures and 15 hours 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 laboratory exercises. Teaching on the course ends with a written exam.

Course content:

1. Introduction to general metrology. Historical development and significance of metrology.
2. Parts of metrology.
3. Normative documents in metrology.
4. Physical quantities and units of measurement.
5. Standards.
6. Precision and Errors.
7. Measuring instruments. Main characteristics.
8. Basic measurements in metrology.
9. Metrological control of the measuring instruments.
10. Standardization and certification in metrology.

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 laboratory exercises is used the laboratory "General Metrology". The laboratory exercises are conducted in groups. Students work in subgroups of 2–3 persons at workplace and they perform the practical tasks, which are described in the methodological guidelines and discussed in advance with the assistant. After each conducted laboratory exercise students prepare protocol. The laboratory exercise is considered done after submission and defense of the relevant protocol. Certification of the semester get students who have done all laboratory exercises, who have submitted and defended the relevant protocols and who have received an evaluation of the current control at least "Satisfied 3" (D).

Teaching on the course "General Metrology" 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 (40 %) and from the current control (60 %).

OPTICS

ECTS credits: 8.0
Evaluation Method: Written examination
Semester: IV
Type of presentation: 3 Lec. +2 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
Hours per week: 0 Lec./ 0 Sem./ 3 Lab.
Evaluation Method: Current semester grade.
Status of the Subject: Compulsory
Semester: IV

Methodological guidance:
Department of Mathematics and Physics,
Faculty of 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.

MATHEMATICAL METHODS IN PHYSICS – PART II

ECTS credits: 7.0
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: Written exam
Course Status: Obligatory course
Semester: IV

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

Annotation: Students should acquire:

1. The basic theoretical concepts of the studying mathematical apparatus;
2. The methods for solving of linear first-degree partial differential equations and linear second-degree partial differential equations from hyperbolic, parabolic and elliptic kind;
3. The structural elements of the mathematical modeling as a method of theoretical cognition, based on the partial differential equations;
4. The methods for integrating of analytic functions.

Course content: The main topics in the course are:

- First degree partial differential equations
- Linear second degree partial differential equations from hyperbolic, parabolic and elliptic kind
- Wave equation, heat equation, Laplace's and Poisson's equations
- Analytic functions and applications.

Technology training and assessment:
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.

THEORETICAL MECHANICS

ECTS credits: 7
Workload per week: 2 Lec. + 2 Sem. + 0 Lab.
Evaluation Method: Written examination
Course Status: Compulsory course
Semester: IV

Methodological guidance:

Department of Mathematics and Physics,
Faculty of Natural Sciences and 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.

RADIOPHYSICS – I PART

ECTS credits: 4.0 **Workload per week:** 2 Lec. + 0 Sem.+ 1 Lab.
Evaluation Method: Written examination **Course Status:** Compulsory course
Semester: IV

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

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.

ATOMIC PHYSICS

ECTS credits: 9.0 **Workload per week:** 3 Lec. + 1 Sem. + 2 Lab.
Evaluation Method: Written examination **Course Status:** Compulsory course
Semester: V

Methodological guidance:
Department of Mathematics and Physics,

Faculty of Natural Sciences & Maths

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.

LABORATORY PRACTICUM IN ATOMIC PHYSICS

Semester: 5 semester
Cours Tipe: laboratory exercises
Hours per week/FS/SS: 2 laboratory hours per week/SS
ECTS credits: 4 credits

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

Status of the Subject: Obligatory course

Subject Description: The obligatory discipline "Laboratory Practicum in Atomic Physics" 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: Students acquire basic knowledges required about Atomic and Molecular Physics. Material is selected depending of the specificity of the specialty.

Teaching Methods: Laboratory exercises with elaboration of laboratory tasks and compilation of the respective protocols. From a methodological point of view, the material is grouped into sections, following the logical sequence from quantum mechanical theory to atomic physics.

Requirements/Prerequisites: in General Physics and Maths.

Evaluation Method: Evaluation defined by current assessment and current control of the laboratory 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.

ASTRONOMY AND ASTROPHYSICS

ECTS credits: 5,0
Weekly workload: 3 Lec. + 1 Sem. + 0 Lab.
Form of assessment: Written exam
Statute of the course: Compulsory
Semester: V

Departments involved:
Department of Mathematics and Physics,
Faculty of Mathematics and Natural Sciences

Annotation: The course "Astronomy and Astrophysics" is included as compulsory course in the specialty curriculum "Physics". 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 45 hours lectures and 15 hours seminars. The students' self-study is 105 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 %).

ELECTRODYNAMICS

ECTS credits: 5.0
Workload per week: 2 Lec. + 2 Sem. + 0 Lab.
Evaluation Method: Written examination
Statute of the Subject: Compulsory
Semester: V

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

RADIOPHYSICS – II PART

ECTS credits 5.0
Hours per week: 2 Lec./ 1 Lab.
Evaluation Method: Written examination. Some intermediate tests conduct through the semester.
Status of the Subject: Compulsory
Semester: V

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

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

Subject Description: Course "Radio physics" 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, as well as basic characteristics of electromagnetic waves.

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.

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

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

NUCLEAR PHYSICS

ECTS credits: 8.0 **Workload per week:** 3 Lec. + 2 Sem.+ 0 Lab.
Evaluation Method: Written examination **Statute of the Subject:** Compulsory
Semester: VI

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

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.

LABORATORY PRACTICUM IN NUCLEAR PHYSICS

Semester: 6 semester
Cours Tipe: laboratory exercises
Hours per week/FS/SS: 2 laboratory hours per week/SS
ECTS credits: 3 credits

University/Faculty/Department: SWU "Neofit Rilsky"-Blagoevgrad; 66 Ivan Mihailov Blvd./ Natural Sciences & Mathematics/ Mathematics and Physics

Status of the Subject: Obligatory course

Subject Description: The obligatory discipline "Laboratory Practicum in Nuclear Physics" 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: Students acquire basic knowledges required about Atomic and Molecular Physics. Material is selected depending of the specificity of the speciality.

Teaching Methods: Laboratory exercises with elaboration of laboratory tasks and compilation of the respective protocols. 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. Parts of topics with practical importance are directed to the laboratory classes.

Requirements/Prerequisites: Basic knowledge in Atomic Physics & Maths.

Evaluation Method: Evaluation defined by current assessment and current control of the laboratory 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.

OPTOELECTRONICS AND OPTICAL COMMUNICATIONS

ECTS credits: 5.0
Type of presentation: 3 Lec. + 0 Sem. + 1 Lab.
Evaluation Method: Written examination
Status of the Subject: Compulsory
Semester: VI

Methodological guidance:
Department of Mathematics and Physics,
Faculty of 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.

QUANTUM MECHANICS

ECTS credits: 5.0 **Workload per week:** 2 Lec. +2 Sem. + 0 Lab.
Evaluation Method: Written examination **Statute of the Subject:** Compulsory
Semester: VI

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

Annotation: 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.

Course content: 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.

Pedagogical Methods and type of evaluation: Lectures and 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.

CONDENSED MATTER PHYSICS

ECTS credits: 5,0 **Weekly workload:** 3 Lec. + 0 Sem. + 1 Lab.
Form of assessment: Written exam **Statute of the course:** Compulsory
Semester: VI

Departments involved:
Department of Mathematics and Physics,
Faculty of Mathematics and Natural Sciences

Annotation: The course "Condensed Matter Physics" is included as compulsory course in the specialty curriculum "Physics". It is studied from students studying at educational and qualification degree "Bachelor".

The course "Condensed Matter Physics" is with total workload 60 hours, which includes 45 hours lectures and 15 hours laboratory exercises. The students' self-study is 120 hours.

Current control of the students' educational achievements is carried out during the semester in the hours of laboratory exercises.

Teaching on the course ends with a written exam.

Course content:

1. Model of condensed matter. Main types condensed matter.
2. Chemical bonds. Types. Energy of chemical bond.
3. Geometric properties of the crystal lattice.
4. Defects in the crystal lattices.
5. Condition of electrons in atoms with many electrons and in the crystal.
6. Elastic properties of condensed matter.
7. Magnetic properties of condensed matter.
8. Dielectric properties of condensed matter.
9. Macroscopic polarization of solid states.
10. Optical properties of condensed matter.
11. Superconducting properties of condensed matter.

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 laboratory exercises is used the laboratory "Condensed Matter Physics". The laboratory exercises are conducted in groups. Students work in subgroups of 2–3 persons at workplace and they perform the practical tasks, which are described in the methodological guidelines and discussed in advance with the assistant. After each conducted laboratory exercise students prepare protocol. The laboratory exercise is considered done after submission and defense of the relevant protocol. Certification of the semester get students who have done all laboratory exercises, who have submitted and defended the relevant protocols and who have received an evaluation of the current control at least "Satisfied 3" (D).

Teaching on the course "Condensed Matter Physics" 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 (40 %) and from the current control (60 %).

NANOTECHNOLOGY

ECTS credits: 4,0
Weekly workload: 2 Lec. + 0 Sem. + 1 Lab.
Form of assessment: Written exam
Statute of the course: Compulsory
Semester: VI

Departments involved:
Department of Mathematics and Physics,
Faculty of Mathematics and Natural Sciences

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.

LASER TECHNIQUE

ECTS credits 8
Hours per week: 2 Lec./ 2 Lab.
Evaluation Method: Written examination. Some intermediate tests conduct through the semester.
Status of the Subject: Compulsory
Semester: VII

University: SWU "Neofit Rilsky"-Blagoevgrad; 66, Ivan Mihailov Blvd.
Faculty: Natural Sciences & Mathematics
Department: Mathematics and Physics

Annotation: The course aims to familiarize students with the most modern light sources - lasers, which having some properties as coherence and great power and demonstrate their application in science and technology**.**

Subject Description: The course considers the physical basics of laser technique and the principle of action of the most common laser sources. The physical principles of amplification and generation of light based on induced radiation are discussed. The course also describes laser resonators, principles of operation of gas and solid-state lasers as well as some tunable laser sources.

Pedagogical Methods: Educational literature on Quantum electronics and Laser systems and printed materials on the topics given by lecturer.

PREPARING THE PHYSICAL EXPERIMENT AND PROCESSING OF EXPERIMENTAL DATA

ECTS credits: 5
Evaluation Method: Written examination
Semester: VII
Workload per week: 2 Lec. + 0 Sem.+ 2 Lab.
Statute of the Subject: Elective course

Methodological guidance:
Department of Mathematics and Physics,

Faculty of Natural Sciences and Mathematics

Subject Description: The program contains material about the current state of experimental physics, which in turn requires the use of methods of analysis of measurement results. Practical classes consist in the development of programs, realizing basic procedures for data analysis. Examples are concerned with data from specific experiments, but the methods have a much broader scope.

Specific Goals of the Subject: The course aims to equip students with knowledge about the basic methods for the processing of data in order for them to be able to use them in the analysis of specific experiments.

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.

MEASUREMENT OF PHYSICAL QUANTITIES

ECTS credits: 5 **Workload per week:** 2 Lec. + 0 Sem. + 2 Lab.
Evaluation Method: Written examination **Statute of the Subject:** Elective course
Semester: VII

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

Subject Description: The course "Measurement of Physical Quantities" is included as elective course in the specialty curriculum "Physics". It is studied from students studying at educational and qualification degree "Bachelor".

The course "Measurement of Physical Quantities" is with total workload 60 hours, which includes 30 hours lectures and 30 hours laboratory exercises. The students' self-study is 90 hours.

Current control of the students' educational achievements is carried out during the semester in the hours of laboratory exercises. Teaching on the course ends with a written exam.

Course content:

1. Role, place and importance of the measurements in physics..
2. International system of units SI.
3. Precision and errors.
4. Presentation of the results from measurement of physical quantities.
5. Electromechanical devices for measurement of physical quantities.

6. Electronic analog devices for measurement of physical quantities.
7. Electronic digital devices for measurement of physical quantities.
8. Computerized systems for measurement of physical quantities.
9. Methods and tools for measurement electrical physical quantities.
10. Methods and tools for measurement non-electrical physical quantities.

Specific Goals of the Subject:
Students to acquire basic knowledge and to form competencies in the discipline " Measurement of Physical Quantities ".

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 laboratory exercises is used the laboratory “Measurement of Physical Quantities”. The laboratory exercises are conducted in groups. Students work in subgroups of 2–3 persons at workplace and they perform the practical tasks, which are described in the methodological guidelines and discussed in advance with the assistant. After each conducted laboratory exercise students prepare protocol. The laboratory exercise is considered done after submission and defense of the relevant protocol. Certification of the semester get students who have done all laboratory exercises, who have submitted and defended the relevant protocols and who have received an evaluation of the current control at least “Satisfied 3” (D).

Requirements/Prerequisites: Knowledge of General Physics and Mathematics

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.

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

HISTORY OF PHYSICS

ECTS credits: 5 **Workload per week:** 2 Lec. + 2 Sem. + 0 Lab.
Evaluation Method: Written examination **Statute of the Subject:** Elective course
Semester: VII

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

Subject Description: The subject "History of Physics" is included as an elective in the curriculum of the specialty "Physics". It is studied by students studying in the educational qualification degree "Bachelor". The course "History of Physics" has a total workload of 60 hours, of which 30 hours of lectures and 30 hours of seminars. Extracurricular activities for students are 90 hours. The training in the discipline ends with a written exam,

Course content:

1. The emergence of physics.
2. Development of physics in the Middle Ages.
3. Development of physics during the Renaissance (XV-XVI centuries).
4. Formation and development of classical physics in the seventeenth century.
5. Development of physics in the eighteenth century as an independent science.
6. Development of physics in the first half of the nineteenth century.
7. Development of physics in the second half of the nineteenth century.
8. Revolutionary discoveries of physics in the period 1890-1912.
9. Development of physics in the first half of the twentieth century.
10. History and development of physics in Bulgaria. Bulgarian discoveries and famous physicists.

Training and assessment technology: The lectures are held in a lecture hall equipped with the necessary equipment - computer and 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. Certification of the semester is given to students who have received a grade of current control minimum "Medium H".
The course "History of Physics" ends with a written exam on the content. The final grade is formed only if the student has received a grade from the written exam at least "Medium H". When preparing the final grade, the grades from the written exam (40%) and the current control (60%) are taken into account.

PHYSICAL METHODS IN MEDICINE

ECTS credits: 5.0 **Workload per week:** 2 Lec. + 0 Sem. + 2 Lab.
Evaluation Method: Written examination **Statute of the Subject:** Elective course
Semester: VII

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

Subject Description: The principles and applications of basic diagnostic and therapeutic techniques are considered. The knowledge is built on the lessons learned from the general, basic courses studied in previous semesters of the bachelor's program, and the most widely used modern methods are mainly considered. The multifaceted application of physical knowledge, methods and equipment in medicine is shown. The biophysical bases of the therapeutic action of electromagnetic waves in their impact at the cellular, tissue, organ and systemic levels on living organisms are presented.

Specific Goals of the Subject: The aim of the course is for students to acquire lasting knowledge of the basic principles on which modern medical devices operate, their capabilities for diagnosis and treatment and advantages over traditional means. The course demonstrates the direct practical application of the laws of physics in medicine and biology and shows the relationship between theory and practice. In this way, the aim is to form a way of thinking that perceives natural phenomena as interconnected and interdependent processes.

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.

INTERACTION OF RADIATION WITH THE MATTER

ECTS credits 5.0
Hours per week/ semester: 2 Lec./ 2 Lab.
Evaluation Method: Written examination. Some intermediate tests conduct through the semester.
Status of the Subject: Eligible
Semester: VII

University: SWU "Neofit Rilsky"-Blagoevgrad; 66, Ivan Mihailov Blvd.
Faculty: Natural Sciences & Mathematics
Department: Mathematics and Physics

Annotation: The students acquire basic knowledges about high-energy fluxes (HEFs), such as electron and photon beams and use it for welding, heat treatment, surface modification, fabrication of wear- and corrosion-resistant coatings, etc.

Subject Description: Introduction. Generation of electron and photon beams. Interaction of electronic and photon beams with materials. Nonlinear effects. Heat transfer during processing of materials with lasers. Welding of materials, heat treatment, alloying of metals and alloys with lasers. Plasma production. Biological effects of laser radiation.

Pedagogical Methods: Praxis Assessments A & Written final exam upon the lecture course.

SPECTRAL ANALYSIS

Semester: VII
Hours (weekly): 2 hours lectures, 2- hours exercise
Course Type: Lectures
ECTS credits: 5.
Course status: Optional

Short Description: The students will obtain basic knowledge on some of main instrumental methods for description of various organic compounds and functional groups. Application of the methods for qualitative and quantitative analysis is given for various compounds. The students will be study and considered the main characteristic frequencies and resonance signals of the various compounds and interpretation of the obtained results.

Course Aims: The aim of the course is to give students knowledge on FAAS, UV-, IR-, Raman, NMR- and ICP-MS spectral method and approaches to identification of various

compounds. The lab exercises should give students knowledge and skillfulness to carry out analysis.

Teaching Methods: Lectures are illustrated with examples for solving problems related to interpretation of various spectra of complicated samples. For lectures presentation multimedia PC system are used.
Requirements: Knowledge in chemistry, physics, mathematics and et…

Registration for the course: A request by students at the end of the previous term

Exam: Test, course work and final written exam

Registration for the exam: Coordination with lecturer and Students Service Department.

ECOLOGY

ECTS credits: 5.0 **Workload per week:** 2 Lec. + 0 Sem. + 2 Lab.
Evaluation Method: Written examination **Statute of the Subject:** Elective course
Semester: VII

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

Short Description: The course "Ecology" focuses on basic concepts, approaches and concepts in ecology as an interdisciplinary science that combines biological, physical and social sciences and is closely related to environmental protection.
During the training students get acquainted with the object, subject, tasks and research methods in ecology, with the main environmental factors - abiotic, biotic and anthropogenic; with the concept of the limiting action of environmental factors and the adaptations of organisms to them; with the composition, structure, development and productivity of biological macrosystems - populations, biocenoses, ecosystems; with the cycle of substances and the flow of energy in ecosystems; with the essence and organization of the biosphere, with the concept of the ecosphere.

Course Aims: Students to gain basic knowledge of the use of modern physical methods for monitoring and control of the environment.

Requirements: Basic knowledge of the courses in General Physics - Mechanics, Molecular Physics, Thermodynamics and Electromagnetism.

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.

Note: The lecture course could be suitable for students of other natural sciences

ENVIRONMENTAL PHYSICS

Semester: 8 semester
Cours Tipe: Lectures and laboratory exercises
Hours per week/FS/SS: 2 lecture hours, 2 laboratory/FS

ECTS credits: 5.0 credits
University/Faculty/Department: SWU "Neofit Rilsky" - Blagoevgrad; 66 Ivan Mihailov Blvd./ Natural Sciences & Mathematics/ Mathematics and Physics

Status of the Subject: Elective course

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.

ELECTROMAGNETIC POLLUTION

ECTS credits: 5.0 **Workload per week:** 2 Lec. + 1 Sem. + 1 Lab.
Evaluation Method: Written examination **Statute of the Subject:** Elective course
Semester: VIII

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

Subject Description: The program contains materials on the main electromagnetic radiation, the important quantitative relationships between quantities and generally accepted models to explain the more important phenomena in the field of electromagnetism.
The practical classes consist in acquainting students with the basic processes in electromagnetic radiation and experimental methods for its measurement, its impact on biological objects and its damage.

Specific Goals of the Subject: The aim of the course is for students to acquire knowledge of basic concepts in the field of electromagnetic radiation and pollution and methods for reducing the harmful effects of electromagnetic waves. The results of the overall acquisition of knowledge are manifested further in the learning process.

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.

EDUCATIONAL PRACTICE IN INSTITUTES OF BAS

CTS credits: 5 **Workload per week:** 0 Lec. + 0 Sem. + 4 Lab.
Evaluation Method: Written examination **Statute of the Subject:** Elective course
Semester: VIII

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

Subject Description: The course introduces students to the basics of practical methods in physics. The principles and applications of the basic practices in physics for obtaining, characterizing and studying materials in the field of solid state physics, microwave technology and nanotechnology, laser and nuclear technology are considered. The knowledge is built on the lessons learned from the general basic courses studied in previous semesters of the bachelor's program, considering mainly the most widely used modern physical methods. The multifaceted application of physical knowledge, methods and apparatus for characterization of materials is shown.

Specific Goals of the Subject: The aim of the course is for students to acquire lasting knowledge of the basic principles on which modern tools for obtaining and characterizing materials work. The course demonstrates the direct practical application of the laws of physics in experimental processes and shows the relationship between theory and practice. In this way, the aim is to form a way of thinking that perceives natural phenomena as interconnected and interdependent processes.

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.

FUNDAMENTALS OF BIOPHYSICS

ECTS credits: 5,0
Weekly workload: 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: Written exam
Statute of the course: Elective
Semester: VIII

Departments involved:
Department of Mathematics and Physics,
Faculty of Mathematics and Natural Sciences

Annotation: The course "Fundamentals of biophysics" is included as elective course in the specialty curriculum "Physics". It is studied from students studying at educational and qualification degree "Bachelor".

The course "Fundamentals of biophysics" is with total workload 60 hours, which includes 45 hours lectures and 15 hours seminars. The students' self-study is 90 hours.

Teaching on the course "Fundamentals of biophysics" 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. Introduction to Biophysics.
2. Biothermodynamics.
3. Biomechanics.
4. Biological and artificial membranes.
5. Transport of substances through biomembranes.
6. Electrical properties of cells and tissues.
7. Nanotechnologies in Biophysics.

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 "Fundamentals of biophysics" 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 %).

PROTECTION IN EXTREME CONDITIONS

ECTS credits: 5.0
Weekly hours: 0 Lec. + 2 Sem. + 2 Lab.
Form of assessment: exam
Status of the discipline: elective
Semester: VIII

Methodical guide:
Department: Mathematics and Physics,
Faculty of Natural Sciences and Mathematics

Annotation: Natural disasters such as earthquakes, fires, floods, hurricanes and others are extremely dangerous to humans, as they occur suddenly, develop rapidly and affect vast areas. In the event of natural disasters, people's normal way of life is severely 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 limit values / Chernobyl - 1986, etc./. Moreover, radiation is the most powerful mutagenic and carcinogenic factor for humans. In severe accidents in nuclear reactors, even of medium power, the consequences for humans and the environment are unpredictable. Terrorist attacks have also shown that every 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 places where a larger number of people are concentrated. The goals and objectives of the course are for students to acquire knowledge of the basic principles of proper action in earthquakes, fires, floods, hurricanes and more. The main ways and means for organizing and conducting rescue operations in the areas of destruction. Methods and means for providing first aid to injured people, etc.

Course content:
Topic 1. Basic principles for correct actions of people in the event of earthquakes.
Topic 2. Ways and means for organizing and conducting rescue operations in areas of strong and catastrophic earthquakes. Manual and mechanized methods and tools.
Topic 3. Basic methods and tools for providing first aid to people in earthquakes.
Topic 4. Ways and means to protect people from floods.
Topic 5. Methods and means for protection of people in case of hurricanes.
Topic 6. Protection of people in the event of blizzards, avalanches, etc.
Topic 7. Occurrence of fires. Toxic substances formed during fires.
Topic 8. Ways and means to protect and rescue people from burning buildings.
Topic 9. Methods and tools for first aid to people from burns and thermal shock.
Topic 10. Ways and means for extinguishing fires.
Topic 11. Protection of people in the event of major accidents and contamination with toxic substances.
Topic 12. .Methods and means for protection of people in case of severe accidents at the NPP.
Topic 13. Ways and means for protection and decontamination of food and water in case of contamination with radioactive substances.
Topic 14. Basic principles for correct actions in the event of terrorist attacks.
Training and assessment technology:
a) For classroom employment: The main methods used for teaching students are discussion talks using video system and computer configuration, practical demonstrations with technical means of various methods and means of protecting people from natural disasters, severe accidents, rendering first aid to the injured, etc.
b) For extracurricular activities: To expand the knowledge of the discipline, students at their request prepare papers, using the information array of libraries, solve test tasks on a given topic, practice with technical means of first aid, prepare hand tools for protection and OPP, the best participate in competitions at regional and national level for first aid, etc.

PRACTICE IN ASTRONOMY

ECTS credits: 5,0
Weekly workload: 0 Lec. + 0 Sem. + 4 Lab.
Form of assessment: Current assessment
Statute of the course: Elective
Semester: VIII

Departments involved:
Department of Mathematics and Physics,
Faculty of Mathematics and Natural Sciences

Annotation: The course "Practice in Astronomy" is included as elective course in the specialty curriculum "Physics". It is studied from students studying at educational and qualification degree "Bachelor".

The course "Practice in Astronomy" is with total workload 60 hours laboratory exercises. The students' self-study is 90 hours.

Teaching on the course "Practice in Astronomy" has theoretic-applied character.

Current control of the students' educational achievements is carried out during the semester in the hours of laboratory exercises.

Course content: Conducting laboratory exercises (observations and research) in astronomy at the National Astronomical Observatory „Rozhen".

Teaching methods and evaluation: To conduct the laboratory exercises is used the material base of the National Astronomical Observatory "Rozhen". The laboratory exercises are conducted in groups. Students perform the practical tasks. The laboratory exercise is considered done after presentation and defense of the performance of assigned tasks.

Certification of the semester get students who have done all laboratory exercises and who have received an evaluation of the current control at least "Satisfied 3" (D).

Teaching on the course "Practice in Astronomy" ends with a current assessment. The current assessment is the evaluation of the current control that is conducted during the laboratory exercises.