



SOUTH-WEST UNIVERSITY „NEOFIT RILSKI“

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INFORMATION PACKAGE

/ECTS/

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

PROFESSIONAL FIELD: **4.1 PHYSICS SCIENCES**

SPECIALITY: **OPTICAL TECHNOLOGIES**

QUALIFICATION CHARACTERIZATION OF SPECIALTY “OPTICAL TECHNOLOGIES”

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

PROFESSIONAL QUALIFICATION: **PHYSICIST-OPTICIAN**

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

FORM OF TRAINING: **REGULAR**

The bachelor program of “Optical Technologies” has duration of 4 years and is designed to prepare professionals of Professional Division “Natural sciences” with qualification name “physicist-optician” who knows how to apply physics in research and a wide range of applications activities. Students who have completed the degree “Bachelor” receive theoretical and applied knowledge of basic physical and mathematical disciplines, which enables them to good career, also continue their education in the educational qualifications “Master's Degree”. The curriculum of the degree “Bachelor” is designed in accordance with the requirements for specialty agreed with European standards for the level of training. The curriculum contains courses, divided into three categories - mandatory, optional and elective courses that give students the opportunity by electivity courses to receive theoretical and applied knowledge of modern physics departments and their application in other sciences and manufacturing.

Specialist who graduate from the program „Optical Technologies“ are prepared to work in the field of contemporary optical technologies like optoelectronics, spectral analysis, optical methods for control of different environmental factors, lidar technologies, etc. Special attention during the education is paid on laser technologies, interaction between laser radiation and matter, laser treatment of materials, laser methods for creation of nanoparticles and others. Graduates also acquire significant knowledge and skills in the field of contemporary communication systems and especially in optical communications as well as in the newest technologies for optical recording and storage of information. Graduates can work in high-tech companies, test laboratories, scientific institutes and laboratories in professional division Physics and related sciences (Chemistry, Biology and Geology) that use optical methods and technologies.

CURRICULUM

FIELD OF STUDY: “OPTICAL TECHNOLOGIES”

(Adopted in 2008, updated 2021)

First Year			
First Semester	ECTS credits	Second Semester	ECTS credits
<u>Compulsory Courses</u>		<u>Compulsory Courses</u>	
Linear Algebra and Analytic Geometry	7,0	Mathematical Analysis II part	7,5
Mathematical Analysis I part	7,0	Fundamentals of the Computer	7,5
Mechanics	8,0	Technique and Technologies	
Laboratory practicum in Mechanics	4,0	Molecular Physics and Thermodynamics	9,0
Foreign Language I	2,0	Laboratory practicum in Molecular	
Sport	2,0	Physics and Thermodynamics	4,0
		Foreign Language II	2,0
	Total: 30		Total: 30
Second Year			
Third Semester	ECTS credits	Fourth Semester	ECTS credits
<u>Compulsory Courses</u>		<u>Compulsory Courses</u>	
Electricity and Magnetism	8,0	Optics	8,0
Laboratory practicum in Electricity and		Laboratory practicum in Optics	4,0
Magnetism	4,0	Mathematical Methods in Physics part II	7,0
Mathematical Methods in Physics part I	7,0	Theoretical Mechanics	7,0
Magnetic phenomena and materials	5,0	Radio Physics part I	4,0
General Metrology	4,0		
Sport	2,0		
	Total: 30		Total: 30
Third Year			
Fifth Semester	ECTS credits	Sixth Semester	ECTS credits
<u>Compulsory Courses</u>		<u>Compulsory Courses</u>	
Atomic Physics	9,0	Nuclear Physics	8,0
Laboratory practicum in Atomic Physics	4,0	Laboratory practicum in Nuclear	
Astronomy and Astrophysics	5,0	Physics	3,0
Electrodynamics	5,0	Optoelectronics and Optical	
Radio Physics part II	5,0	Communications	5,0
Sport	2,0	Quantum Mechanics	5,0
		Condensed Matter Physics	5,0
		Nanotechnology	4,0
	Total: 30		Total: 30
Fourth Year			
Seventh Semester	ECTS credits	Eighth Semester	ECTS credits
<u>Compulsory Courses</u>		<u>Optional Courses</u>	
Laser Technique	8,0	<u>(Students choose four or five courses</u>	
Sport	2,0	<u>(20 credits) from the second group)</u>	
<u>Optional Courses</u>		Second group	5,0
<u>(Students choose four courses from the</u>		Holographic control methods	
<u>first group)</u>		Radioisotope tools for measuring control	5,0
First group		and automation	
Geometrical Optics	5,0	Practicum on optical methods in biology	5,0
Optical components and devices	5,0	and medicine	
Optical methods for monitoring of		Laser interaction with matter	5,0
parameters of the environment	5,0	Laser materials processing	5,0
Optical methods in medicine	5,0	Educational practice in institutes of BAS	5,0
Spectral methods for diagnostic in		Practicum on optical technologies	5,0
biology and medicine	5,0		
Spectral Analysis	5,0		
Measurement of Physical Quantities	5,0		
Preparing the Physical Experiment and		Graduation – written state exam in	
Processing of Experimental Data	5,0	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 combinatorial 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 of Mathematics and Natural Sciences

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 of Mathematics and Natural Sciences

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 give 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 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.

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 Riemann integral, and their applications for finding areas 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

Methodological guidance:

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 give students a necessary minimum basic knowledge about the main macroscopic physical phenomena in the field of 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 during the semester. Some intermediate tests conducted 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 give students a necessary minimum basic knowledge about the main macroscopic physical phenomena in the field of 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 during the semester.

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 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.

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

Type of presentation: 3 Lec. +2 Sem. +0 Lab.

Evaluation Method: Written examination

Status of the Subject: Compulsory

Semester: IV

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. + 2 Sem. + 0 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

Form of assessment: Written exam

Semester: V

Weekly workload: 3 Lec. + 1 Sem. + 0 Lab.

Statute of the course: Compulsory

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 oscillator, potential well. Approximate methods: perturbation theory, Hartree-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.

GEOMETRICAL OPTICS

ECTS credits 5.0

Hours per week: 2 Lec./ 2 Sem.

Evaluation Method: Written examination. Some intermediate tests conduct through the semester.

Status of the Subject: Eligible

Semester: 7

University: SWU "Neofit Rilsky"-Blagoevgrad; 66, Ivan Mihailov Blvd.

Faculty: Natural Sciences & Mathematics

Department: Mathematics and Physics

Annotation: The course on geometric optics introduces students to classical methods for calculating optical systems. It aims first to present the basic laws of geometrical optics and secondly to present the principle of operation of the main optic elements.

Subject Description: The course describes the general principles of propagation of light in optical components such as lenses and mirrors. The basic laws of geometrical optics as the law of rectilinear propagation of light, the laws of refraction and reflection at the boundary of two dielectric, total internal reflection. On this basis are outlined basic formulas describing the propagation of light beams in the main optical elements - thin and real (thick) lens, convex and concave spherical mirror.

Pedagogical Methods: Lectures are visualized by demonstrations. During the seminar classes students solve varied problems on optics.

OPTICAL COMPONENTS AND DEVICES

ECTS credits 5.0

Hours per week: 2 Lec./ 2 Sem.

Evaluation Method: Written examination. Some intermediate tests conduct through the semester.

Status of the Subject: Eligible

Semester: 7

University: SWU “Neofit Rilsky”-Blagoevgrad; 66, Ivan Mihailov Blvd.

Faculty: Natural Sciences & Mathematics

Department: Mathematics and Physics

Annotation: The course on Optical components and devices introduces students to classical methods for calculating optical systems. It aims first to present the basic laws of geometrical optics and secondly to present the principle of operation of the main optic elements.

Subject Description: The course describes the general principles of propagation of light in optical components such as lenses and mirrors. The basic laws of geometrical optics as the law of rectilinear propagation of light, the laws of refraction and reflection at the boundary of two dielectric, total internal reflection. On this basis are outlined basic formulas describing the propagation of light beams in the main optical elements - thin and real (thick) lens, convex and concave spherical mirror.

Pedagogical Methods: Lectures are visualized by demonstrations. During the seminar classes students solve varied problems on optics.

OPTICAL METHODS FOR MONITORING OF PARAMETERS OF THE ENVIRONMENT

Semester: 7 semester

Cours Tipe: Lectures and laboratory exercises

Hours per week/FS/SS: 2 lecture hours, 2 laboratory hours per week/SS

ECTS credits: 5 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 gives basic knowledge for physical parameters in the environment, their physical characteristics, parameters necessary for an impact assessment. Practical classes enabling students to research experimental basic physical phenomena and their application.

Specific Goals of the Subject: The course aims at acquainting students with physical environmental parameters, with the methods for evaluation and remedies from their impact.

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

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

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.

OPTICAL METHODS IN MEDICINE

Semester: 7 semester

Cours Tipe: Lectures and laboratory exercises

Hours per week/FS/SS: 2 lecture hours, 2 laboratory hours per week/SS

ECTS credits: 5 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 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.

SPECTRAL METHODS FOR DIAGNOSTIC IN BIOLOGY AND MEDICINE

Semester: 7 semester

Hours (weekly): 2 hours lectures, 2- hours exercise

Course Type: Lectures

ECTS credits: 5.

Department: Chemistry, Faculty of Natural Sciences and Mathematics.

Course status: Optional

Short Description: The curriculum of the course Spectral Methods of Diagnosis includes lectures and laboratory exercises related to basic methods of diagnosis which are characterized by a wide variety of principles and areas of application. The main theoretical bases and practical applications for and the related skills and competencies for practical application are considered.

Course Aims: The main goal of the course is to give the necessary theoretical and practical preparation of students for the possibilities and prospects of the used diagnostic methods, some of which are classic, others more innovative, which allows for the simultaneous application of physical methods in practice.

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 physics, mathematics, spectroscopy 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.

SPECTRAL ANALYSIS

Semester: VII

Hours (weekly): 2 hours lectures, 2- hours exercise

Course Type: Lectures

ECTS credits: 5.

Department: Chemistry, Faculty of Natural Sciences and Mathematics.

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.

MEASUREMENT OF PHYSICAL QUANTITIES

Semester: VII

Cours Tipe: Lectures and laboratory exercises

Hours per week/FS/SS: 2 lecture hours + 2 laboratory hour per week/FS

ECTS credits: 5 credits

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

Statute of the Subject: Elective

Subject Description: The course “Measurement of Physical Quantities” is included as elective course in the specialty curriculum. 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.

PREPARING THE PHYSICAL EXPERIMENT AND PROCESSING OF EXPERIMENTAL DATA

Semester: VII

Cours Type: Lectures and laboratory exercises

Hours per week/FS/SS: 2 lecture hours + 2 laboratory hour per week/FS

ECTS credits: 5 credits

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

Statute of the Subject: Elective

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

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.

HOLOGRAPHIC CONTROL METHODS

ECTS credits 5

Hours per week: 3 Lec./ 1 Lab.

Evaluation Method: Written examination. Some intermediate tests conduct through the semester.

Status of the Subject: Eligible

Semester: 8

University: SWU “Neofit Rilsky”-Blagoevgrad; 66, Ivan Mihailov Blvd.

Faculty: Natural Sciences & Mathematics

Department: Mathematics and Physics

Annotation: The course aims to equip students with lasting knowledge of the fundamental principles on which the modern holographic operating systems, their capabilities for optical recording of information control capabilities and advantages over traditional measuring devices. The course demonstrates the direct practical application of the laws of optics and shows the relationship between theory and practice. It aims at developing a way of thinking, perceiving natural phenomena as interconnected and mutually determining processes.

Subject Description: The course "Holographic control methods" introduces students to the fundamentals of holography. It aims on the one hand to present the principles of recording and playback optical holograms and on the other to explain the capabilities of holographic interferometry for precision control and detection of small manufacturing defects.

Pedagogical Methods: Lectures are visualized by demonstrations. During the seminar classes students solve varied problems on optics.

RADIOISOTOPE TOOLS FOR MEASURING, CONTROL AND AUTOMATION

Semester: VIII

Cours Tipe: Lectures and laboratory exercises

Hours per week/FS/SS: 3 lecture hours, 1 laboratory hour per week/SS

ECTS credits: 5 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: Physical fundamentals of radioisotope technique. Fundamentals of dosimetry.

Radioisotope instruments. Applicability of radioisotope technology in industry. Features of the system design of radioisotopes automation. Basic concepts of Radiation Safety.

Specific Goals of the Subject: Students acquire basic knowledges about phenomena and specifics of using radioisotope equipment for measuring, control and automation in practice. 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.

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

Requirements/Prerequisites: Basic knowledge in Nuclear Physics, Maths & Dosimetry.

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.

PRACTICUM ON OPTICAL METHODS IN BIOLOGY AND MEDICINE

ECTS credits 5

Hours per semester: 60 Lab.

Evaluation Method: Written examination. Some intermediate tests conduct through the semester.

Status of the Subject: Eligible

Semester: 8

University: SWU “Neofit Rilsky”-Blagoevgrad; 66, Ivan Mihailov Blvd.

Faculty: Natural Sciences & Mathematics

Department: Mathematics and Physics

Annotation: The course aims to equip students with lasting knowledge of the fundamental principles upon which operate modern medical devices based on optical systems, their capabilities for diagnosis and treatment. The course demonstrates the direct practical application of the laws of optics in medicine and biology and shows the relationship between theory and practice.

Subject Description: This practicum introduces students to the fundamentals of optical polarimetry and practical use of optical methods and technologies in biology and medicine. The course discusses the principles and applications of basic optical diagnostic and therapeutic techniques and presents the biophysical basis of the therapeutic effect of optical interactions and their effects at the cellular, tissue, organ and system level on living organisms.

Pedagogical Methods: Demonstrations and laboratory classes

LASER INTERACTION WITH 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: 8

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.

LASER MATERIALS PROCESSING

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: 8

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 its for welding, heat treatment, surface modification, fabrication of wear- and corrosion-resistant coatings, etc.

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

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

EDUCATIONAL PRACTICE IN INSTITUTE OF BAS

Semester: VIII

Cours Tipe: Laboratory exercises

Hours per week/FS/SS: 4 laboratory hour per week/SS

ECTS credits: 5 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 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: 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.

PRACTICUM ON OPTICAL TECHNOLOGIES

ECTS credits 5.0

Hours per week/ semester: 4 Lab.

Evaluation Method: Written examination..

Status of the Subject: Eligible

Semester: 8

University: SWU "Neofit Rilsky"-Blagoevgrad; 66, Ivan Mihailov Blvd.

Faculty: Natural Sciences & Mathematics

Department: Mathematics and Physics

Subject Description: The discipline "Practicum on Optical Technologies" is included as an elective in the curriculum of the specialty "Optical Technologies". It is studied by students studying for a Bachelor's degree. The discipline "Practicum on Optical Technologies" has a total of 60 hours of laboratory (practical) exercises. The extracurricular employment of students is 90 hours. The training in the discipline "Practicum on Optical Technologies" has a theoretical and applied nature, taking into account the specifics of the specialty "Optical Technologies". The course "Practicum on Optical Technologies" has input links with training in "Optics", "Laser Technology", "Optoelectronics and Optical Communications", "Interaction of laser radiation with matter" and others. The initial connections are with the studied specialized academic disciplines, included in the curriculum of the specialty.

Specific Goals of the Subject: The course "Practicum on Optical Technologies" aims to acquire students' knowledge of optical technologies and to form practical skills and competencies for working with optical devices and instruments, for observation and research of various physical processes, for processing, presentation, analysis and interpretation of the obtained experimental results, etc.

The laboratory exercises included in the curriculum are conducted in real conditions in the Physical Institutes of the Bulgarian Academy of Sciences.

The expected results in the study on the course "Practicum on Optical Technology" are students to learn about the various optical instruments and apparatus and to form in them practical skills and competencies for processing, presentation, analysis and interpretation of experimental results and more.

Pedagogical method: exercises and extracurricular work