SOUTH-WEST UNIVERSITY „NEOFIT RILSKI“
2700 Blagoevgrad, 66 Ivan Michailov str.
tel: +359/73/88 55 01, fax: +359/73/88 55 16
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**

CODE: 06.52.4.10

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**

Annotation

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: **„PHYSICS“**

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	8,0
Mathematical Analysis I part	7,0	Fundamentals of the Computer	6,0
Mechanics	12,5	Technique and Technologies	
Foreign Language I	2,0	Molecular Physics and Thermodynamics	12,5
Sport	1,5	Foreign Language II	2,0
		Sport	1,5
	Total: 30		Total: 30
Second Year			
First Semester	ECTS credits	Second Semester	ECTS credits
Compulsory Courses		***Compulsory Courses***	
Electricity and Magnetism	11,5	Optics	10,0
Mathematical Methods in Physics – part I	10,0	Mathematical Methods in Physics – part II	8,5
Applied Thermotechnics	7,0	Theoretical Mechanics	7,0
Sport	1,5	Discreet Optimization	3,0
		Sport	1,5
	Total: 30		Total: 30
Third Year			
First Semester	ECTS credits	Second Semester	ECTS credits
Compulsory Courses		***Compulsory Courses***	
Atomic Physics	9,0	Nuclear Physics	8,5
Condensed Matter Physics	6,0	Optoelectronics and Optical	5,5
Electrodynamics	8,0	Communications	
Radio Physics	3,5	Quantum Mechanics	7,5
General Metrology	3,5	Astronomy and Astrophysics	5,5
		Energy Efficiency & Energy Management	3,0
	Total: 30		Total: 30
Fourth Year			
First Semester	ECTS credits	Second Semester	ECTS credits
Compulsory Courses		***Optional Courses***	
Laser Technique	6,0	***(Students choose four or five courses (20 credits) from the second group)***	
Optional Courses		**Second group**	
(Students choose four courses from the first group)		Holographic methods of control	5,0
First group	6,0	Radioisotope tools for measuring, control and automation	5,0
Geometrical Optics		Practicum on optical methods in biology	
Optical methods for monitoring of parameters of the environment	6,0	and medicine	5,0
		Interaction of laser radiation with matter	5,0
Optical methods in medicine	6,0	Laser materials processing	5,0
Spectral diagnostic methods in biology and medicine	6,0	Legal protection of intellectual property	5,0
		Practicum in Optical Technologies	3,0
Spectral Analyse	6,0	Language Culture	2,0
Measurement of Physical Quantities	6,0		
Preparing the Physical Experiment and Processing of Experimental Data	6,0	**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
Form of assessment: exam
Semester: I

Hours per week: 2 + 2 + 0
Course Status: Compulsory course

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

Lecturer:
Prof. Dr. Iliya Dimitrov Gyudzhenov
e-mail: iliadgl@swu.bg

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

References:
Basic Titles

1. A. Borisov, Il. Guidzhenov, Linear Algebra and Analytic Geometry. University Press, South-West University "Neofit Rilski", Blagoevgrad, 1999 /in Bulgarian/.
2. A. Borisov, Il. Guidzhenov, Il. Dimitrova. "Linear Algebra". University Press, South-West University "Neofit Rilski", Blagoevgrad, 2009 /in Bulgarian/.
3. A. Borisov. M. Kacarska. "Handbook on Linear Algebra and Analytic geometry". University Press, South-West University "Neofit Rilski", Blagoevgrad, 1996 /in Bulgarian/.
4. K. Yordzhev, Il. Dimitrova, A. Markovska, Il. Gyudzhenov. Variants for Examinations on Linear Algebra and Analytic Geometry, University Press, South-West University "Neofit Rilski", Blagoevgrad, 2007 /in Bulgarian/.
5. K. Denecke, K. Todorov. "Lectures on Linear Algebra". University Press, South-West University "Neofit Rilski", Blagoevgrad, 1992 /in Bulgarian and German/.
6. M. Aslanski, B. Giurov. "Handbook on Linear Algebra". University Press, South-West University "Neofit Rilski", Blagoevgrad, 1999 /in Bulgarian/.
7. K. Dochev, D. Dimitrov. "Linear Algebra". Sofia, 1977 /in Bulgarian/.
8. D. Dimitrov. "Collections of Problems on Linear Algebra". Sofia, 1978 /in Bulgarian/.
9. A. Kurosh. "Course on Algebra". Sofia, "Nauka i izkustvo", 1967 /in Bulgarian and Russian/

Additional Titles

1. D.K. Fadeev, I.S. Sominski. "Handbook on Algebra". Moscow, "Nauka", 1968 /in Russian/.
2. I.V. Proskuriakov. "Handbook on Linear Algebra". Moscow, "Nauka", 1967 /in Russian/.
3. V.A. Ilin, E.G. Pozniak. "Linear Algebra". Moscow, "Nauka", 1984 /in Russian/.

Mathematical Analysis I part

ECTS credits: 7,0
Form of assessment: exam
Semester: I

Hours per week: 2 + 2 + 0
Course Status: Compulsory course

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

Lecturers:
Assoc. Prof. D-r. Vassil Grozdanov
assist. prof. Dr. Anka Markovska

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.

References:

A. Basic Titles

1. V. Grozdanov, Mathematical analysis, first psrt , Publishing house “Neophit Rilsky” Blagoevgrad, 2015.
2. V. A. Ilin, V. A. Sadovnichi, B. H. Sendov, Mathematical Analysis, V. 1 and 2, Sofia, Science and Art, 1989.
3. I. Prodanov, N. Hadjivanov, I. Chobanov, Collection of problems of Differential and Integral Calculation, Sofia, Science and Art, 1976.
2. E. Varbanova, Lectures on Mathematical Analysis – I, Publishing house of Technical university Sofia, Sofia, 2009.
3. V. Grozdanov, K. Jordjev, A. Markovska, Methodological conduire for solving of problems of Mathematical Analysis – I, Publishing house “Neophit Rilsky” Blagoevgrad, 2012.

B. Additional Titles:

1. S. M. Nikol'skii, Course of Mathematical Analysis, V. 1 and 2, Moskow, Science, 1973.
2. L. D. Kudrjavcev, Mathematical Analysis, V. 1 and 2, Moskow, Science, 1976.

Mechanics

ECTS credits: 12.5 **Workload per week:** 3 + 1 + 3
Form of assessment: Written exam **Course Status:** Obligatory course
Semester: I

Department in charge of the education:
Department of Physics
Faculty: Natural Sciences & Mathematics

Lecturer:
Assoc. Prof. Radost Vassileva, Ph.D.
Phone: 0888 64 77 44, e-mail: r_vassileva@swu.bg

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.

References:

Basic titles:

1. Максимов, М. *Основи на физиката – част I*. София, Булвест – 2000, 2010.
2. С. А. Тошев, И. Баев, М. Маринов, Л. Бончев. *Физика*. ДИ „Наука и изкуство”, София, 1987.
3. М. Надолийски, З. Пейков. *Учебник по физика*. УАСГ, София, 2011.
4. И. В. Савельев. *Курс общей физики*, том.1. „Наука”, Москва, 1988.
5. Ив. Амов. *Инженерна физика*. ВПИ – Благоевград, 1991.

Additional titles:

1. А. Детлаф, Б. Яворский. *Курс физики*. Высшая школа, Москва, 1989.
2. Фейнман Р., Р. Лейтон, М. Сэндс. *Файманови лекции по физика*, том 7. „Мир”, Москва.
3. Цв. Сарийски, Т. Мишонов. *Критични явления и преходи*. София, ДИ „Наука и изкуство”, 1988.

Foreign Language I

ECTS credits: 2,0
Evaluation: ongoing assessment
Semester: I

Hours per week: 0 + 2 + 0
Course status: Compulsory

Lecturer:
Assist. Prof. Bilyana Georgieva, PhD
bilianag@swu.bg
Department: Electrical Engineering, Electronics and Automatics
Faculty: Faculty of Engineering

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: 8,0
Form of assessment: exam
Semester: II

Hours per week: 2 + 2 + 0
Course Status: Compulsory course

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

Lecturers:
Associete Professor Visil Grozdanov, Ph.D.
Assistant Professor Anka Markovska, Ph.D.

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

References:
1. Yaroslav Tagamlitski – Differential Calculus, Nauka and Izkustvo Publishing House, Sofia, 1971 (in Bulgarian).
2. Yaroslav Tagamlitski – Integral Calculus, Nauka and Izkustvo Publishing House, Sofia, 1978 (in Bulgarian).
3. V. A. Ilin, V.A. Sadovnichi, B.H. Sendov – Mathematical Analysis, Vol. 1, Vol.2, Nauka and Izkustvo Publishing House, Sofia, 1989 (in Bulgarian).
4. I. Prodanov, N. Hadjiivanov – Problem book in Differential and Integral Calculus, Nauka and Izkustvo Publishing House, Sofia, 1976 (in Bulgarian).
5. E. Varbanova, Lectures on Mathematical Analysis – I, Publishing house of Technical university Sofia, Sofia, 2009.
6. V. Grozdanov, K. Jordjev, A. Markovska, Methodological conduire for solving of problems of Mathematical Analysis – I, Publishing house “Neophit Rilsky” Blagoevgrad, 2012.

Fundamentals of the Computer Technique and Technologies

ECTS credits: 6,0
Weekly workload: 0 + 0 + 3
Form of assessment: Current assessment
Statute of the course: Compulsory
Semester: II

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

Lecturer:
Chief Assistant Professor Gergana Kalpachka, PhD
e-mail: kalpachka@swu.bg

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.

References:

1. **Bangia, R.** Computer fundamentals and information technology. New Delhi: Firewall Media, 2008.
2. **Brookshear, G., D. Brylow.** Computer Science: An Overview (12th Edition). Boston, Pearson, 2014.
3. **Elmasri, R., S. Navathe.** Fundamentals of Database Systems. Pearson, 2015.
4. **Laplante, P.** Encyclopedia of Computer Science and Technology. CRC Press, 2016.
5. https://products.office.com/bg-bg/access

Molecular Physics and Thermodynamics

ECTS credits: 12.5
Workload per week: 3 + 1 + 3
Form of assessment: Written exam
Course Status: Obligatory course
Semester: II

Department in charge of the education:
Department of Physics
Faculty: Natural Sciences & Mathematics

Lecturer:
Assoc. Prof. Radost Vassileva, Ph.D.
тел.: 0888 64 77 44, e-mail: r_vassileva@swu.bg

Annotation:
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.

Course content:
The main topics of the course are:

- 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.

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.

References:

Basic titles:

1. Maksimov, M. Bases of Physics – Part I. Sofia, Bulvest – 2000, 2010. (in Bulgarian).
2. Gramatikov, P. Physics – I. Blagoevgrad, SWU “Neofit Rilski”, 2009. (in Bulgarian).
3. http://www.e-booksdirectory.com
   - **Joseph M. Powers. Lecture Notes on Thermodynamics –University of Notre Dame, 2010.**
   - **J. B. Tatum. Heat and Thermodynamics** , 2008.
   - **Eric Bertin. Introduction to Statistical Physics , ENS Lyon, 2010.**

Additional Titles:

1. H. Young, R. Freedman. University Physics N.Y., Addison-Wesley Publishers Co, 2000.
2. Hans Kroha. **Thermodynamics and Statistical Physics** , 2005.

Foreign Language II

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

Lecturer:
Assist. Prof. Bilyana Georgieva, PhD
bilianag@swu.bg
Department: Electrical Engineering, Electronics and Automatics
Faculty: Faculty of Engineering

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: 11.5
Type of presentation: 3 + 1 + 3
Evaluation Method: Written examination
Status of the Subject: Compulsory
Semester: III

Methodological guidance:
Physics Department
Faculty of Natural Sciences & Mathematics

Lecturer:
Assoc. Prof. Luben Mihov Ivanov, Ph.D.
тел.: 0882 988 712, e-mail: mihovli@swu.bg

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

Literature:
1. Ivanov L.M., General physics II part; N. Rilski Univ., Blagoevgrad, 2010.
2. Ivanov L.M., Electricity and magnetism; N. Rilski Univ., Blagoevgrad, 2011.
3. Lalov I. Electrical phenomena, Kl. Ohridski Univ., Sofia, 1997.
4. B. Crowell., “Electricity and Magnetism”, Wiley, 1998.

Mathematical Methods in Physics – part I

ECTS credits: 10.0
Form of assessment: Written exam
Semester: III

Workload per week: 3 + 3 + 0
Course Status: Obligatory course

Department in charge of the education
Department of Physics
Faculty: Natural Sciences & Mathematics

Lecturer:
Assoc. Prof. Radost Vassileva, Ph.D.
тел.: 0888 64 77 44, e-mail: r_vassileva@swu.bg

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.

References:

Basic titles:

1. Пушкаров, Д. Математични методи на физиката – част I. Благоевград, ЮЗУ „Неофит Рилски", 1993.
2. D.I.Pushkarov – "**Mathematical Methods of Physics**", Bahcesehir University, Istanbul, 2009.

Additional titles:

1. Христов, Хр. Математични методи на физиката. Наука и изкуство, 1980.
2. http://www.e-booksdirectory.com
   - Ray M. Bowen, C.-C. Wang. **Introduction to Vectors and Tensors Volume 2: Vector and Tensor Analysis**, **2008.**
   - Norbert Euler. **A First Course in Ordinary Differential Equations**, 2015.
   - Marcel B. Finan. **A Second Course in Elementary Ordinary Differential Equations** , 2006.

Applied Thermotechnics

ECTS credits: 7.0
Workload per week: 2 + 0 + 2
Evaluation Method: Written examination
Statute of the Subject: Compulsory course
Semester: III

Methodological guidance:
Physics Department
Faculty of Natural Sciences & Maths

Lecturer:
Assoc. Prof. Svetoslav Kolev, PhD
e-mail: svet_kolev@swu.bg

Annotation:
The subject is a compulsory course studied by students to acquire a Bachelor degree on Physics. The students acquire basic knowledges required about Heat & Mass Transfer, Thermal power stations and Thermotechnics. 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:
Thermal motors and machines. Organic fuels. Processes and products of combustion. Industrial and power boilers. Heat exchangers. Thermal power stations. Basics of the Building Physics. District heating. Energy efficiency and environmental protection.

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 the Methods point of view material is arranged from Thermal motors and machines via Building Physics to the Energy efficiency and environmental protection. Practical topics are directed to the laboratory classes.
The course is completed by a written examination. Some intermediate tests are conducted through the semester.

References (all in Bulgarian)**:**
1. Gramatikov P. Lectures on Applied Thermal Engineering; N. Rilski Univ., Blagoevgrad, 2012.
2. Dimitrov A. Modern heating technology and energetics; Sofia, 2011.
3. Hadjigenova N. Thermal part of TPP, Tehnika, Sofia, 1979.

Optics

ECTS credits: 10.0
Type of presentation: 3+1+3
Evaluation Method: Written examination
Status of the Subject: Compulsory
Semester: IV

Methodological guidance:
Physics Department
Faculty of Natural Sciences & Mathematics

Lecturer:
Assoc. Prof. Luben Mihov Ivanov, Ph.D.
тел.: 0882 988 712, e-mail: mihovli@swu.bg

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.

Literature:
1. Ivanov L.M., General physics II part; N. Rilski Univ., Blagoevgrad, 2010.
2. Ivanov L.M., Electricity and magnetism; N. Rilski Univ., Blagoevgrad, 2011.
3. Lalov I. Electrical phenomena, Kl. Ohridski Univ., Sofia, 1997.
4. B. Crowell., "Electricity and Magnetism", Wiley, 1998.

Mathematical Methods in Physics – part II

ECTS credits: 8.5
Workload per week: 3 + 3 + 0
Form of assessment: Written exam
Course Status: Obligatory course
Semester: IV

Department in charge of the education:
Department of Physics
Faculty: Natural Sciences & Mathematics

Lecturer:
Assoc. Prof. Radost Vassileva, Ph.D.
тел.: 0888 64 77 44, e-mail: r_vassileva@swu.bg

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.

References:

Basic titles:

1. Пушкаров, Д. Математични методи на физиката. София, Проф. Марин Дринов, 1996.
2. Христов, Хр. Математични методи на физиката. Наука и изкуство, 1980.
3. D.I. Pushkarov – "**Mathematical Methods of Physics**", Bahcesehir University, Istanbul, 2009.

Additional titles:

1. Димитрова, К., П. Паскалев. Методическо ръководство за решаване на задачи по висша математика – трета част. Архимед, 2008.
2. http://www.e-booksdirectory.com
   - William W. Symes. **Partial Differential Equations of Mathematical Physics**, Rice University, 2006.
   - A.D.R. Choudary, Saima Parveen, Constantin Varsan. **Partial Differential Equations: An Introduction**, arXiv, 2010.
   - Marcel B. Finan**. A First Course of Partial Differential Equations in Physical Sciences and Engineering,** Arkansas Tech University, 2009.
   - Matthias Beck, Gerald Marchesi, Dennis Pixton. **A First Course in Complex Analysis**, San Francisco State University, 2007
   - W. W. L. Chen. **Introduction to Complex Analysis**, Macquarie University, 2008.

Theoretical Mechanics

ECTS credits: 7
Workload per week: 2 + 3 + 0
Evaluation Method: Written examination
Statute of the Subject: Compulsory course
Semester: IV

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

Lecturer:
Assoc. Prof. Ralitsa Stanoeva, PhD
e-mail: rstanoeva@swu.bg

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.

Discreet Optimization

ECTS credits: 3.0
Form of exam: Exam
Semester: IV semester

Hours per week: 2 + 1 + 0
Course Status: Obligatory course

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

Lecturer:
Assoc. Prof. Nikolay Kitanov, PhD
e-mail: nkitanov@swu.bg

Annotation:
Students should obtain basic knowledge in Mathematical modeling in discrete structures and skills for solving optimization problems for graphs and networks.

Short Description:
In this course are considered some elements of the following main topics:

- Introduction in graph theory (essential concepts and definitions, modeling with graphs and networks, data structures for networks and graphs, computational complexity, heuristics).
- Tree algorithms (spanning tree algorithms, variations of the minimum spanning tree problem, branchings and arborescences).
- Shortest-path algorithms (types of shortest-path problems and algorithms, shortest-paths from a single source, all shortest-path algorithms, the k- shortest-path algorithm, other shortest-paths).
- Maximum-flow algorithms (flow-augmenting paths, maximum-flow algorithm, extensions and modifications, minimum-cost flow algorithms, dynamic flow algorithms).
- Matching and assignment algorithms (introduction and examples, maximum-cardinality matching in a bipartite graph, maximum-cardinality matching in a general graph, maximum-weight matching in a bipartite graph, the assignment problem).
- The chinest postman and related arc routing problems (Euler tours and Hamiltonian tours, the postman problem for undirected graphs, the postman problem for directed graphs).
- The traveling salesman and related vertex routing problems (Hamiltonian tours, basic properties of the traveling salesman problem, lower bounds, optimal solution techniques, heuristic algorithms for the TSP).
- Location problems (classifying location problems, center problems, median problems).
- Project networks (constructing project networks, critical path method, generalized project networks).

Teaching and assessment technology:
Teaching Methods: lectures, tutorials, individual student's work
Assessment: three homework D1, D2, D3; two tests K1 and K2 (course project); written exam
Final evaluation: $= 0{,}2 .(\frac{\mathbf{D}1+\mathbf{D}2+\mathbf{D}3}{3}) + 0{,}5 .(\frac{\mathbf{K}1+\mathbf{K}2}{2}) + 0{,}3$ (exam)

References:

1. Ив.Мирчев, "Графи. Оптимизационни алгоритми в мрежи", Благоевград, 2001 г.
2. Ив.Мирчев, "Математическо оптимиране", Благоевград, 2000 г.
3. Minieka, E., Optimization Algorithms for Networks and Graphs, Marcel Dekker, Inc., New York and Basel, 1978 (Майника, 3. Алгоритми оптимизации па сетях и графах, М., "Мир", 1981).
4. Christofides, N., graph Theory. An Algorithmic approach, Academic Press lnc /London/ Ltd. 1975, 1997 /Кристофидес, Н. Теория графов.Алгоритмический подход, М., "Мир", 1978/.
5. Simon Harris, James Ross, Fundamentals of Algorithms, Alex-Soft, 2006.
6. Herbert Schild, JAVA 2: Programmer's Guide, SoftPres, 2007.

Atomic Physics

ECTS credits: 9.0
Workload per week: 3 + 1 + 2
Evaluation Method: Written examination
Statute of the Subject: Compulsory course
Semester: V

Methodological guidance:
Physics Department
Faculty of Natural Sciences & Maths

Lecturer:
Assoc. Prof. Ralitsa Stanoeva, PhD
e-mail: rstanoeva@swu.bg

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.

References (all in Bulgarian):
1. Gramatikov P. Atomic Physics; N. Rilski Univ., Blagoevgrad, 2007.
2. Minkova A. Atomic Physics, Romina, Sofia, 2000.
3. Balabanov N., M. Mitrikov. Atomic Physics, Kl. Ohridski Univ., Sofia, 1991.

Condensed Matter Physics

ECTS credits: 6,0
Weekly workload: 3 + 0 + 1
Form of assessment: Written exam
Statute of the course: Compulsory
Semester: V

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

Lecturer:
Chief Assistant Professor Gergana Kalpachka, PhD
e-mail: kalpachka@swu.bg

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 (60 %) and from the current control (40 %).

References:

1. **Altland, A., B. Simons.** Condensed Matter Field Theory. Cambridge University Press, 2006.
2. **Chaikin, P., T. Lubensky.** Principles of Condensed Matter Physics. Cambridge University Press, 2000.
3. **Marder, M.** Condensed Matter Physics. John Wiley and Sons, 2010.
4. **Sander, L.** Advanced Condensed Matter Physics. New York, Cambridge University Press, 2009.

Electrodynamics

ECTS credits: 8
Workload per week: 2 + 3 + 0
Evaluation Method: Written examination
Statute of the Subject: Compulsory course
Semester: V

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

Lecturer:
Assoc. Prof. Ralitsa Stanoeva, PhD
e-mail: rstanoeva@swu.bg

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.

Radio Physics

ECTS credits: 3.5
Evaluation Method: Written examination
Semester: V

Type of presentation: 2 + 0 + 1
Status of the Subject: Compulsory

Methodological guidance:
Physics Department
Faculty of Natural Sciences & Mathematics

Lecturer:
Assoc. Prof. Luben Mihov Ivanov, Ph.D.
тел.: 0882 988 712, e-mail: mihovli@swu.bg

Annotation:
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.

Subject Description:
he course can be divided into two modules. The first examines electromagnetic oscillations in electrical circuits. The basic concepts and idealized elements of the electrical circuits are introduced. The processes of loss, accumulation and transformation of the electrical energy in the elements of the electric circuits during the flow of sinusoidal current are considered. Various methods for calculating circuitry have been considered. Emphasis is placed on resonance circuits, resonance of voltage and resonance currents. The second part is devoted to the study of electromagnetic waves. The properties of electromagnetic waves are based on Maxwell's theory of electromagnetic field. It is shown that flat monochromatic waves are a solution of Maxwell's equations. The main properties of the electromagnetic wave electromagnetic field electromagnetic waves and the orthogonally of the electric and magnetic vector are presented. Polarization and energy of electromagnetic waves are considered.

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

Literature:
1. Alfred A. Ghirardi, Radio Physics Course: An Elementary Radio Text Book for Students, Set Builders and Servicemen, Radio Design Publishing Company, California University, 2008.
2. Фархи С., С. Папазов. Теоретична електротехника, ч. 1, 2 и 3. С., Техника, 1988, 1990, 1992.
3. B. Crowell., “Electricity and Magnetism”, Wiley, 1998.

General Metrology

ECTS credits: 3,5
Weekly workload: 2 + 0 + 1
Form of assessment: Written exam
Statute of the course: Compulsory
Semester: V

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

Lecturer:
Chief Assistant Professor Gergana Kalpachka, PhD
e-mail: kalpachka@swu.bg

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 (60 %) and from the current control (40 %).

References:

1. **Додова, М.** Метрология – минало и настояще. С., Нова звезда, 2017.
2. **Кирий, А., А. Асенов.** Измерване на топлинни, хидравлични и механични величини. С., ТУ, 2006.
3. **Радев, Х.** Метрология и измервателна техника. Т. 1. С., Софттрейд, 2008.
4. **Радев, Х.** Метрология и измервателна техника. Т. 2. С., Софттрейд, 2010.
5. **Радев, Х.** Метрология и измервателна техника. Т. 3. С., Софттрейд, 2012.
6. **Станчев, Т., Г. Георгиев.** Електрически измервания. Русе, УИ „Ангел Кънчев“, 2011.
7. **Трендафилов, Г.** Основи на електроизмервателната техника. Габрово, УИ „Васил Априлов“, 2000.

Nuclear Physics

ECTS credits: 8.5
Workload per week: 3 + 1 + 2
Evaluation Method: Written examination
Statute of the Subject: Compulsory course
Semester: VI

Methodological guidance:
Physics Department
Faculty of Natural Sciences & Maths

Lecturer:
Assoc. Prof. Ralitsa Stanoeva, PhD
e-mail: rstanoeva@swu.bg

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.

References:
1. Gramatikov P. Nuclear Physics with elements of Radiation Protection and Dosimetry, N. Rilski Univ., Blagoevgrad, 2008 (in Bulgarian).
2. Slavov B. Introduction in theoretical Nuclear Physics, St.. Kl. Ohridski, Sofia, 2009 (in Bulgarian).
3. Balabanov N. Nuclear Physics, Plovdiv, 1998 (in Bulgarian).
4. Rakobolyskaya Y. Nuclear Physics, Moscow Univ., 1971 (in Russian).

Optoelectronics and Optical Communications

ECTS credits: 5.5
Evaluation Method: Written examination
Semester: VI

Type of presentation: 3 + 0 + 1
Status of the Subject: Compulsory

Methodological guidance:
Physics Department
Faculty of Natural Sciences & Mathematics

Lecturer:
Assoc. Prof. Luben Mihov Ivanov, Ph.D.
тел.: 0882 988 712, e-mail: mihovli@swu.bg

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.

Literature:
1. Govind Agrawal, Fiber optic communication systems, 4th edition, Weley Interscience Publication, 2011.
2. Warren Hioki, Telecommunications, second edition, Prentice Hall, New Jersey, 1995.

Quantum Mechanics

ECTS credits: 7.5
Workload per week: 2 + 3 + 0
Evaluation Method: Written examination
Statute of the Subject: Compulsory course
Semester: VI

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

Lecturer:
Assoc. Prof. Ralitsa Stanoeva, PhD
e-mail: rstanoeva@swu.bg

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.

Astronomy and Astrophysics

ECTS credits: 5,5
Form of assessment: Written exam
Semester: VI

Weekly workload: 3 + 1 + 0
Statute of the course: Compulsory

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

Lecturer:
Chief Assistant Professor Gergana Kalpachka, PhD
e-mail: kalpachka@swu.bg

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 %).

References:

1. **Carroll, B., D. Ostlie.** An Introduction to Modern Astrophysics. MA, Pearson Addison-Wesley, 2007.

2. **Choudhuri, A.** Astrophysics for Physicists. Cambridge University Press, 2010.

3. Encyclopedia of Astronomy and Astrophysics. Vol. 1–4. Editor in Chief: Paul Murdin. Institure of Physics Publishing, 2001.

4. **Karttunen, H., P. Kröger, H. Oja, M. Poutanen, K. Donner (Eds.).** Fundamental Astronomy. Springer, 2007.

5. **Kitchin, C.** Astrophysical Techniques. Bristol and Philadelphia, IOP Publishing Ltd., 2003.

Energy Efficiency & Energy Management

ECTS credits: 3.0
Workload per week: 2 + 0 + 0
Evaluation Method: Written examination
Statute of the Subject: Compulsory course
Semester: VI

Methodological guidance:
Physics Department
Faculty of Natural Sciences & Maths

Lecturer:
Assoc. Prof. Svetoslav Kolev, PhD
e-mail: svet_kolev@swu.bg

Annotation:
The subject is a compulsory course studied by students to acquire a Bachelor degree on Physics. Students acquire basic knowledge about methods and decisions of effective use and management of energy and energy audits in industry. 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:
Energy and sustainable development. Energy Efficiency business. Basic principles of Energy Management. Energy Audit. Energy management in industry. CHP technologies. Energy efficiency and environmental protection.

Pedagogical Methods and type of evaluation:
Basic knowledge on General Physics, Mathematics and Thermal Physics are needed. Lectures are visualised by demonstrations and laboratory tasks performance during the laboratory classes. From the Methods point of view material is arranged from Thermal motors and machines via Building Physics to the Energy efficiency and environmental protection. Practical classes are not included.
The course is completed by a written examination. Some intermediate tests are conducted through the semester.

References:
1. Guide to Energy Efficiency and Energy Management (ed. Pl. Gramatikov); OP "Competitiveness" program "Energy Efficiency and Green Economy" (BEECIFF), MEET, 2012. (in Bulgarian).
2. Kaloianov N., D. Baev, D. Doukov. Energy management in small and medium enterprises, a practical guide. http://www.ems-textile.eu/files/Energy_Management_Manual_BG.pdf (in Bulgarian).
3. Turner W. C. Energy Management Handbook, Fairmont Press Inc., 2001.
4. Stum K., R. Mosier, T. Haasl, W. Pletz. Energy Management Systems, A Practical Guide, USA-EPA, 1997.

Laser Technique

ECTS credits: 6.0
Evaluation Method: Written examination
Semester: VII

Type of presentation: 2 + 0 + 2
Status of the Subject: Compulsory

Methodological guidance:
Physics Department
Faculty of Natural Sciences & Mathematics

Lecturer:
Assoc. Prof. Luben Mihov Ivanov, Ph.D.
тел.: 0882 988 712, e-mail: mihovli@swu.bg

Annotation:
The course on laser technology presents the basic physical ideas of quantum electronics and gives a description of the principle of action of the most common laser sources. Physical principles of amplification and light generation based on induced radiation are also considered. Also, the open laser resonators, the principles of action of gas and solid-state lasers, and some convertible laser sources are also considered.

Subject Description:
The course can be divided into two parts. The first part deals with the general principles of laser technology. They are valid for all laser systems. This section discusses induced and spontaneous transitions, Einstein's coefficients, coherence of induced radiation, width and shape of spectral lines, absorption and enhancement of active laser environments, saturation of amplification, generation of laser radiation, open resonators, resistivity of laser resonators , Q-modulation and fashion synchronization. The second part describes the principle of operation of the main laser sources. The most popular gas and solid-state lasers are considered. The laser lasers describe the principle of action of the helium-neon laser, the nitrogen laser, the argon laser and the carbon dioxide laser. The solid state lasers include the ruby laser, the neodymium laser as well as the semiconductor lasers.

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.

Literature:
1. Н.В.Карлов, „Лекции по квантовой електроники”, Москва, Наука, 1980.
2. М. Ненчев, С. Салтиел. „Лазерна техника“, УИ „Св. Климент Охридски“ 1994.
3. Peter W. Milonni, Joseph H. Eberly, „Laser Physics“, Wiley, 2010, ISBN 978-0-470-38771-9.
4. Orasio Svelto, “Principles of Lasers” Fifth edition, Springer, 2010, ISBN 978-1-4419-1301-2.

Geometrical Optics

Title Geometrical Optics	**No** First group eligible №1	**Semester** VII
Type of presentation Lectures/ Seminars/Laboratory classes	**Hours per week)/ semester** 2 Lec./ 2 Sem./ 0 Lab.	**ECTS credits** 6.0

Lecturer: Assoc. Prof. Luben Mihov Ivanov Ph.D.

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

Status of the Subject: Eligible

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.

Specific Goals of the Subject: 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.

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

Preliminary Requirements: Basic knowledge in Optics and Mathematics.

Subsidiary Materials: Educational literature on Geometrical optics and printed materials on the topics given by lecturer.

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

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

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

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: 6 credits
Lecturer: Assoc. Prof. Ralitsa Stanoeva, PhD

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

Title Optical methods in medicine	**No** First group eligible №4	**Semester** VII
Type of presentation Lectures/ Seminars/Laboratory classes	**Hours per week)/ semester** 2 Lec./ 0 Sem./ 2 Lab.	**ECTS credits** 6.0

Lecturer: Assoc. Prof. Luben Mihov Ivanov Ph.D.

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

Status of the Subject: Eligible

Subject Description: The course 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.

Specific Goals of the Subject:
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.

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

Preliminary Requirements: Basic knowledge in Optics and Mathematics.

Subsidiary Materials: Educational literature on Medical physics and Optics and printed materials on the topics given by lecturer.

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

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

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

Spectral diagnostic methods in biology and medicine

Title Spectral diagnostic methods in biology and medicine	**No** First group eligible №5	**Semester** VII
Type of presentation Lectures/ Seminars/Laboratory classes	**Hours per week)/ semester** 2 Lec./ 0 Sem./ 2 Lab.	**ECTS credits** 6.0

Lecturer: Assoc. Prof. Luben Mihov Ivanov Ph.D.

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

Status of the Subject: Eligible

Subject Description: The course 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.

Specific Goals of the Subject:
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.

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

Preliminary Requirements: Basic knowledge in Optics and Mathematics.

Subsidiary Materials: Educational literature on Medical physics and Optics and printed materials on the topics given by lecturer.

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

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

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

Spectral analysis

Semester: 7 th
Hours (weekly): 2 hours lectures, 2- hours exercise
Course Type: Lectures
ECTS credits: 6.
Lecturer: Assoc. Prof. Atanas Chapkanov, PhD
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.
References (Bibliography):

Basic:

1. St. Spasov, M. Arnaudov, Application of spectroscopy in organic chemistry, Scien. Sofia, 1978.
2. G. Krischen, D. O'Reily, Instrumental Analysis (Bulgarian translation), ed. P. Bonchev, Sv. Kl. Ohridski, 1998
3. P. Shrajner, P. Fusson, D. Keptin, T. Morrill, "Identification of organic compounds"(in Russian), Moscow, 1983.
4. J. B. Lambert, E. P. Mazola. NMR_Spectroscopy. Pearson Eduaction Inc., 2001.

Additional:

5. H. Willard, L. Merritt, J. Dean, and F. Settle, Instrumental Methods of Analysis, 7th edition, van Nostrand Co., New York 1992. QD 79.I5.W54.
6. Eberhard Breitmaier. Structure Elucidation By NMR In Organic Chemistry: A Practical Guide. John Wiley & Sons, Ltd., 2002.

Measurement of Physical Quantities

ECTS credits: 6,0
Weekly workload: 2 + 0 + 2
Form of assessment: Written exam
Statute of the discipline: Elective
Semester: VII

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

Lecturer:
Chief Assistant Professor Gergana Kalpachka, PhD
e-mail: kalpachka@swu.bg

Annotation:

The discipline „Measurement of Physical Quantities“ is included as elective discipline in the specialty curriculum „Applied optical technologies“. It is studied from students studying at educational and qualification degree „Bachelor“.

The discipline „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 120 hours.

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

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).

Teaching on the discipline „Measurement of Physical Quantities“ ends with a written exam on the educational content. Final evaluation is formed only if the student has received an evaluation of the written exam at least „Satisfied 3“ (D). In forming of the final evaluation are reported the evaluations from the written exam (60 %) and from the current control (40 %).

References:

1. **Кирий, А., А. Асенов.** Измерване на топлинни, хидравлични и механични величини. С., ТУ, 2006.
2. **Радев, Х.** Метрология и измервателна техника. Т. 1, 2. С., Софттрейд, 2008, 2010.
3. **Радев, Х.** Метрология и измервателна техника. Т. 3. С., Софттрейд, 2012.
4. **Русев, Д., Б. Матраков, В. Туренков.** Електрически измервания. С:, Техника, 2000.
5. **Стоянов, И., Б. Николова, Г. Николов.** Компютърно-базирани измервателни системи. С., ТУ, 1997.
6. **Трендафилов, Г.** Основи на електроизмервателната техника. Габрово, УИ „Васил Априлов“, 2000.

Preparing the physical experiment and processing of experimental data

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: 6 credits
Lecturer: Assistant Prof. Ralitsa Stanoeva, PhD

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

Status of the Subject: Elective course

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. The last exercise is practiced shaping of already processed data in the publication.

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 methods of control

Title	**No**	**Semester**
Holographic methods of control	Second group eligible №1	VIII
Type of presentation	**Hours per week)/ semester**	**ECTS credits**
Lectures/ Seminars/Laboratory classes	3Lec./ 0 Sem./ 1 Lab.	5.0

Lecturer: Assoc. Prof. Luben Mihov Ivanov Ph.D.

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

Status of the Subject: Eligible

Subject Description: The course "Holographic methods of control" 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.

Specific Goals of the Subject: 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. Thus aims at developing a way of thinking, perceiving natural phenomena as interconnected and mutually determining processesл.

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

Preliminary Requirements: Basic knowledge in Optics and Mathematics.

Subsidiary Materials: Educational literature on Geometrical optics and printed materials on the topics given by lecturer.

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

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

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

Radioisotope tools for measuring, control and automation

Title Radioisotope tools for measuring, control and automation	**No** Elective course, № 2	**Semester** VIII
Type of presentation Lectures/ Laboratory classes	**Hours per week)/ semester** 3 Lec./ 1 Lab.	**ECTS credits** 5.0

Lecturer: Assoc. Prof. Ralitsa Stanoeva, Ph.D.

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

Status of the Subject: Elective

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.

Pedagogical Methods: 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 Radiation to Radiation Safety. Parts of topics with practical importance are directed to the laboratory classes.

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

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

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

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

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

Practicum on optical methods in biology and medicine

Title Practicum on optical methods in biology and medicine	**No** Second group eligible №3	**Semester** VIII
Type of presentation Lectures/ Seminars/Laboratory classes	**Hours per week)/ semester** 0 Lec./ 0 Sem./ 4 Lab.	**ECTS credits** 5.0

Lecturer: Assoc. Prof. Luben Mihov Ivanov Ph.D.

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

Status of the Subject: Eligible

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.

Specific Goals of the Subject:
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.

Pedagogical Methods: Demonstrations and laboratory classes.

Preliminary Requirements: Basic knowledge in Optics and Mathematics.

Subsidiary Materials: Educational literature on Medical physics and Optics..

Evaluation Method: Current controlл.

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

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

Interaction of laser radiation with matter

Semester: VIII
Type of presentation: Lectures and Praxis
Hours per week AS / SS: 2 Lecture hours / 2 Praxis / SS
ECTS Credits: 5

Lecturer: Prof. Petar Petrov, PhD, D Sc
Assistant Prof. Darina Kaicheva

Department: Physics Department; Phone: +359887946199; E-mail: pitiv@ie.bas.bg

Course Status: Elective course in the Physics Science B.Sc. Curriculum

Short Description: Introduction.
Course Aims: 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.

Teaching Methods: Lectures and Praxis. From the point of view material is arranged HEFs understanding these processes from both scientific and applied point of view.

Requirements/Prerequisites: Basic knowledge on General Physics & Mathematics.

Evaluation Method: Praxis Assessments A & Written final exam upon the lecture course.
Rating = 0,2.A+ 0,8 (Exam)

Inscribing for tuition: By request at the end of the previous semester.

Inscribing for exam: Agreement with the lecturer and the Students Service Department

References:

1. N.N. Rykalin, A.A. Uglov, A.G. Zuev, A.N. Kokora, “Laser and electron-beam treatment of materials”, Moscow, Mashinostroene Publishers, (1985) 495 pages (in Russian).
2. V. Michailov, V Karhin, P. Petrov, “Baisic of welding”, Stroitelstvo, 197p, (2012). (in Bulgarian)
3. G. Mladenov “Electron and ion beam technologies”, Marin Drinov, 387 p., (2009). (in Bulgarian)

Abbreviation:

AS: Autumn Semester
SS: Spring Semester

Laser materials processing

Semester: VIII
Type of presentation: Lectures and Praxis
Hours per week AS / SS: 2 Lecture hours / 2 Praxis / SS
ECTS Credits: 5

Lecturer: Prof. Petar Petrov, PhD, D Sc
Assistant Prof. Darina Kaicheva

Department: Physics Department; Phone: +359887946199; E-mail: pitiv@ie.bas.bg

Course Status: Elective course in the Physics Science B.Sc. Curriculum

Short Description: Introduction.
Course Aims: 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.

Teaching Methods: Lectures and Praxis. From the point of view material is arranged HEFs understanding these processes from both scientific and applied point of view.

Requirements/Prerequisites: Basic knowledge on General Physics & Mathematics.

Evaluation Method: Praxis Assessments A & Written final exam upon the lecture course.
Rating = 0,2.A+ 0,8 (Exam)

Inscribing for tuition: By request at the end of the previous semester.

Inscribing for exam: Agreement with the lecturer and the Students Service Department

References:

4. N.N. Rykalin, A.A. Uglov, A.G. Zuev, A.N. Kokora, “Laser and electron-beam treatment of materials”, Moscow, Mashinostroene Publishers, (1985) 495 pages (in Russian).
5. V. Michailov, V Karhin, P. Petrov, “Baisic of welding”, Stroitelstvo, 197p, (2012). (in Bulgarian)
6. G. Mladenov “Electron and ion beam technologies” ,Marin Drinov, 387p , (2009). (in Bulgarian)

Abbreviation:

AS: Autumn Semester
SS: Spring Semester

LEGAL PROTECTION OF INTELLECTUAL PROPERTY

Title LEGAL PROTECTION OF INTELLECTUAL PROPERTY	**No** Elective course, № 6, II group	**Semester** VIII
Type of presentation Lectures/ Seminars	**Hours per week)/ semester** 3 Lec./ 1 Sem.	**ECTS credits** 5.0

Lecturer: Kiril Tsvetanov Iliev, Ph.D.

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

Status of the Subject: Elective course.

Subject Description: The subject of the lectures is to review the essence of intellectual property and its place in the national legal system, and the intangible nature of the objects of intellectual property. The need for adequate and timely protection of intellectual property and the different types of legal protection for the different objects of intellectual property and its need of protection.

Specific Goals of the Subject: The students acquire basic knowledge regarding the basic categories of intellectual property and the forms of its legal protection - criminal laws, civil and administrative laws, etc.

Pedagogical Methods: Lectures and Seminars on Metrology. From the Methods point of view material is arranged and set in the norm of article 2, paragraph 7 of the Convention establishing the World Intellectual Property Organization (K WIPO), namely the primary research on the subject of the regulation of intellectual property, and then the methods of effectively protecting these objects to protection against unfair competition, and all other rights resulting from the intellectual activity in the industrial, scientific, literary and artistic areas.

Preliminary Requirements: Basic knowledge of the government law practices and economic development of the country.

Subsidiary Materials: Educational literature on Legal protection of intellectual property and printed materials on the topics given by lecturer.

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

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

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

Language Culture

ECTS: 2
Form of assessment: exam
Semester: VIII

Weekly classes: L-0; S-0; E-2, IL-2
Course type: Select

Course coordinating department:
Department of Bulgarian language
Philological Faculty

Lecturer:
Prof. Antoni Stoilov, PhD
e-mail: antony100@swu.bg
тел.: 0894 426 026

Annotation

Students learn spelling and pronouncing rules in modern Bulgarian.

Course content

Rules for writing titles and subtitles. Rules for writing capital letters. Rules for merged, semi-merged and separate writing of nouns, adjectives, numerals, adverbs and complex prepositions . Rules for writing a comma. Rules for writing variable **Я**. Rules for writing articles. Syntactic agreement. Rules of the utterance verb endings of the definite articles and prepositions.

Teaching and grading methods

Practical classes.

Written exam. Students need to eliminate spelling and punctuation errors in a text. Grading is done according to a specific scale.