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**

MASTER PROGRAMME: **ENERGY MANAGEMENT AND SUSTAINABLE ENERGY DEVELOPMENT**

QUALIFICATION CHARACTERIZATION

OF MASTER PROGRAMME: **ENERGY MANAGEMENT AND SUSTAINABLE ENERGY DEVELOPMENT**

EDUCATIONAL AND QUALIFICATION DEGREE: **MASTER**

PROFESSIONAL QUALIFICATION: **PHYSICIST, ENERGY MANAGEMENT AND SUSTAINABLE ENERGY DEVELOPMENT**

DURATION: **2 YEARS (4 SEMESTERS)**

FORM OF TRAINING: **REGULAR**

The Master's program in “Energy Management and Sustainable Energy Development” with a study period of 4 semesters is intended for students with an acquired educational and qualification degree “*Bachelor*”/ “*Master*” in specialties in other professional fields from the field of *Natural Sciences, Mathematics and Informatics* and the field of *Technical Sciences*.

Master program on *“Energy Management and Sustainable Energy Development”* educates qualified professionals with knowledge for specific characteristics of different types of energy, for possible methods of reducing losses in its transformation, about methods and techniques to improve energy efficiency and environmental protection. Students are educated on principles of effective management of energy costs (*Energy Management*), role and working methods of energy service companies with guaranteed results (so-called *ESCO companies*) and to carry out investigation on energy efficiency of industrial plants (*Energy Audit*).

Graduate students can work as professionals and managers in energy, infrastructure and utility companies, as experts, managers and consultants in the public administration and NGO's, in divisions of the Sustainable Energy Development Agency (SEDA), in laboratories for environmental protection, base stations for environmental monitoring, in companies performing energy audits and using unconventional energy sources. They may occupy positions of an expert in scientific organization, a physicist, designer of energy installations, head of laboratory, research associate, assistant and lecturer at research institutes and universities after successfully passing competition.

CURRICULUM

(Adopted in 2014, updated 2021)

First year

First semester	ECTS credits	Second semester	ECTS credits
Obligatory disciplines		***Obligatory disciplines***	
Applied mathematics	5	Fundamentals of the computer technique and technologies	6
Mathematical methods of physics	5		
Mechanics	5	Molecular physics	6
Electricity and magnetism	5	Optics	6
Atomic physics	5	Nuclear physics	6
Astronomy and astrophysics	5	Theoretical physics	6
	Total 30		Total 30

Second year

Third Semester	ECTS credits	Fourth Semester	ECTS credits
Obligatory disciplines		***Obligatory disciplines***	
Energy efficiency	6	Energy policies and sustainable energy development	5
Energy management	6	Elective discipline group II	5
Elective discipline group I	6	Elective discipline group II	5
Elective discipline group I	6	State graduation examination in physics or Diploma theses	15
Elective discipline group I	6		
Elective disciplines group I		***Elective disciplines group II***	
Specialized software for energy efficiency		Renewable energy sources	
Solar architectures		Materials and processes in high-energy fluxes processing	
Electricity market		Photovoltaic conversion of solar energy	
Physical processes in nuclear power plants		Energy and ecological problems	
Applied thermal engineering		Energy-saving technologies	
Physical methods in environmental research			
	Total 30		Total 30

TOTAL FOR TWO YEARS: 120 CREDITS

DESCRIPTIONS OF THE COURSES

APPLIED MATHEMATICS

ECTS credits: 5 credits
Hours per week: 2 lecture hours, 2 tutorial hours per week
Assessment method: Examination
Course Status: Obligatory
Semester: I
Department: Informatics

Course Description: The course includes:

- basic **numerical methods** of Mathematical Analysis (approximation of functions by interpolation and the least suqres data fitting, numerical differentiation, numerical quadrature), of Algebra (solving nonlinear equations and systems of linear equations) and of Ordinary Differential equations (Cauchy problem for ordinary differential equations of I order and boundary problem for ordinary differential equations of order II);
- basic concepts and results of combinatorics and **Theory of Probability** (random events, probability, random variables, probability distributions, basic characteristics of random variables, basic results of theory of probability).

Course Objectives: Students should obtain basic knowledge about numerical methods and theory of probability and mathematical statistics.
Teaching Methods: lectures, tutorials and lab exercises
Requirements/Prerequisites: Mathematical Analysis, Linear Algebra, Analytic Geometry, Differential Equations.
Assessment: written final exam covering problems /omitted in case the average grade of two current problem tests is higher than Very Good 4.50/ (grade weight is 30 %) and theory on two topics (grade weight is 30 %); two homework (grade weight is 20 %) and two projects (grade weight is 20 %)
Registration for the course: not necessary
Registration for the exam: coordinated with the lecturer and Student Service Department

MATHEMATICAL METHODS IN PHYSICS

ECTS credits: 5.0
Hours per week: 2 Lectures + 2 Seminar
Assessment: exam
Course Status: Obligatory course
Semester: I
Department of Mathematics and Physics
Faculty: Natural Sciences & Mathematics

Specific Goals of the Course: the course aims at introducing some of the aspects of the theory of partial differential equations and the basis of vector and tensor analysis. The course focuses on physical aspect of basic mathematical notions and methods for the solving of important types of problems in order to clarify the possibility to practically apply the knowledge acquired in the course.

Short Description: Main topics to be considered:
- First degree partial differential equations
- Linear second degree partial differential equations from hyperbolic, parabolic and elliptic kind

- Wave equation, heat equation, Laplac's and Poisson's equations
- Vector and Tensor Analysis

Pedagogical Methods and Assessment: The course includes lectures, seminars, consultations, course assignments and tests. Evaluation is made on the basis of term and final tests based on the contents of the lectures and the seminars. Only students who have positive evaluation mark on the term tests are allowed to take the final test. The students with high term evaluation marks varying between 5.00 and 5.50 only have to take theoretical exam, those who have term evaluation mark between 5.50 - 6.00 do not have to take the final exam and are given an excellent final mark for the course. The course grade (CG) is only assigned to students who have passed successfully and with a positive marks both their term and final tests. The final course grade is calculated with the help of the following formula:

CG = 0.6 X Term test results + 0.4 X Final test result

MECHANICS

ECTS credits: 5.0
Hours per week: 2 Lectures + 1 Sem. + 1 Lab.
Assessment: exam
Course Status: Obligatory course
Semester: I
Department of Mathematics and Physics
Faculty: Natural Sciences & Mathematics

Subject Description: The course considers classical mechanics phenomena. It starts with kinematics and dynamics of point particle and system of point particles. The Newtonian principles of dynamics are considered in details. Particular attention is paid to motion in inertial and noninertial frames of reference, laws of conservation of energy and momentum, gravitation, such phenomena as mechanics harmonic oscillatory motions and waves. In addition the basic principles of the special theory of relatively and fluids mechanics are present.

Specific Goals of the Subject: The university course "Mechanics" is aimed to ensure basic knowledge on mechanics phenomena as a foundation of the physics. Receiving this grounding the students are getting ready for others special courses studying during the next years. Laboratory classes give the students practical skills for physics observations.

Pedagogical Methods: Lectures are visualized by demonstrations. During the seminar classes students solve varied problems on optics. Parts of topics with practical importance are directed to the laboratory classes.

Preliminary Requirements: Basic knowledge in Physics and Mathematics.

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

Evaluation Method: Written examination and additional conversation with the lecturer upon course topics. Some intermediate tests conduct through the semester.

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

ELECTRICITY AND MAGNETISM

ECTS credits: 5.0
Hours per week: 2 Lec/ 1 Sem/ 1 Lab
Assessment: exam
Course Status: Obligatory course
Semester: I
University/Faculty/Department: SWU "Neofit Rilsky"-Blagoevgrad; 66, Ivan Mihailov Blvd./ Natural Sciences & Mathematics/ Mathematics and Physics

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 concern questions of movement of the electrical parts in electric and magnetic fields.

Specific Goals of the Subject: Students acquire knowledge about Electromagnetism, Optics, Quantum Mechanics, Modern Atomic and Nuclear Physics. Material is selected depending of the specificity of the speciality. For that reason some specific topics are presented in details. Parts of topics with practical importance are directed to the laboratory classes.

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.

Preliminary Requirements: Basic knowledge in Physics and Mathematics.

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 and subsequent conversation with the lecturer. Some intermediate tests conduct through the semester.

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

ATOMIC PHYSICS

Semester:1 semester
Cours Tipe: Lectures, seminars and laboratory exercises
Hours per week/FS/SS: 2 lecture hours, 1 seminar hour and 1 laboratory hour per week/SS
ECTS credits: 5 credits
Status of the Subject: Compulsory course
University/Faculty/Department: SWU "Neofit Rilsky"-Blagoevgrad; 66 Ivan Mihailov Blvd./ Natural Sciences & Mathematics/ Mathematics and Physics

Subject Description: Introduction to Atomic and Molecular Physics. Structure of the Atom. The Bohr Model. Atomic Orbitals. Hydrogen Atom. One and Two Electron Atoms. Interaction of Atoms

with Electromagnetic Radiation, External Electric and Magnetic Fields. Fine and Hyperfine Structure. Xray Spectra. Zeeman Effect. Balmer Series. Photoelectric Effects. The Periodic Table. The Nature of Chemical Bonds. Molecular Geometry. Intermolecular Interactions.

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. For that reason some specific topics are presented which are not included in the Physics programme for non-physical students.

Teaching Methods: Lectures are visualised by demonstrations and laboratory tasks performance during the laboratory classes. Exercises and case studies are decided at seminars. 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.

Requirements/Prerequisites: in General Physics and Maths.

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

Registration for the course: Not necessary.

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

ASTRONOMY AND ASTROPHYSICS

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

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

Annotation: The course "Astronomy and Astrophysics" is included as compulsory course in the specialty curriculum. The course "Astronomy and Astrophysics" is with total workload 45 hours, which includes 30 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 (40 %) and from the current control (60 %).

FUNDAMENTALS OF THE COMPUTER TECHNIQUE AND TECHNOLOGIES

ECTS credits: 6
Weekly workload: 2 + 0 + 2
Form of assessment: Current assessment
Statute of the course: Compulsory
Semester: II

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

Annotation: The course "Fundamentals of the Computer Technique and Technologies" is included as compulsory course in the specialty curriculum. 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 written exam.

MOLECULAR PHYSICS

ECTS credits: 6.0
Hours per week: 2 Lectures + 1 Sem. + 1 Lab.
Assessment: exam
Course Status: Obligatory course
Semester: II
Departments involved:
Department of Mathematics and Physics,
Faculty of Natural Sciences and Mathematics

Subject Description: The course is basic in the physical education and has two parts in the general physics – thermodynamics and molecular physics. They continues one semester and ends with an examination. The course combines the fondation of the reversible thermodynamics, statistical and thermodynamical treatment of its basic values, surface tension, viscosity difusion, physical acustics and elements of nonreversible thermodynamics.

Specific Goals of the Subject: The course gives to the students minimal knowledge required about the basic macroscopic physical phenomena in the region of the thermodynamics and molecular physics. The pracrical appliation of the knowledges is the object of treatment in the seminars and laboratory.

Pedagogical Methods: Lectures visualized by physical demonstrations, seminars with decision of physical problems, laboratory classes. Some of the lectures are in a multimedia form.

Preliniuary Requirements: Basic Knowledge in mathematical analysis.

Subsidiary Materials: Educational literature on general physics (parts molecular physics and thermodynamics), printed materials on the some topics, given wy the lectures to the students.

Evaluation Methods: Every part ends with written and oral examination. The results from the test examination during lectures, seminars and laboratory take place in the full evaluation.

Inscribing for tuition: Not necessary.

Inscribing for exam: Agreement with the lecturer.

Note: The lecture course is convenient for Students of Physical, Chemistry and other natural and technical sciences.

OPTICS

ECTS credits: 6.0
Hours per week: 2 Lec/ 1 Sem/ 1 Lab
Assessment: exam
Course Status: Obligatory course
Semester: II
University/Faculty/Department: SWU "Neofit Rilsky"-Blagoevgrad; 66, Ivan Mihailov Blvd./ Natural Sciences & Mathematics/ Mathematics and Physics

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**.**

Specific Goals of the Subject: Students acquire knowledge about general phenomena and laws of light wave propagation. The course gives a base for others special courses such as Quantum electronics and Optical communication.

Pedagogical Methods: Lectures are visualized by demonstrations. During the seminar classes students solve varied problems on optics. Parts of topics with practical importance are directed to the laboratory classes.

Preliminary Requirements: Basic knowledge in Physics and Mathematics.

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

Evaluation Method: Written examination and additional conversation with the lecturer upon course topics. 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.

NUCLEAR PHYSICS

Semester: II
Type of presentation: Lectures / Laboratory classes
Hours per week / AS / SS: 2 Lecture hours / 1 Seminar hour /1 Laboratory hour / SS
ECTS credits: 6
Department: Mathematics and Physics Department
Course Status: Compulsory course

Short 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. Elementary particles.

Course Aims: The students acquire basic knowledges required about Nuclear 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 nonphysical students.

Teaching Methods: The lectures are visualised by demonstrations and laboratory tasks performance during the laboratory classes. Exercises and case studies are decided at seminars. 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.

Requirements / Prerequisites: Basic knowledge in General Physics and Mathematics.

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

Registration for the course: Not necessary.

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

Theoretical physics

Semester: 2 semester
Cours Tipe: Lectures and tutorials
Hours per week/FS/SS: 2 lecture hours, 1 tutorial hours per week/SS
ECTS credits: 6 credits
Department: Department of Mathematics and Physics
Course Status: Obligatory course

Short Description: The course deals with standard material of theoretical physics from the following areas: mechanics, electrodynamics, quantum mechanics, statistical physics and thermodynamics but adapted to students with a serious mathematical background who have not graduated a bachelor course in physics.

Course Aims: The course aims at giving fundamentals knowledge in theoretical Physics and to serve as a foundation for courses in theoretical physics, quantum electronics, astrophysics and other special courses.

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

Requirements/Prerequisites: General knowledge in mathematical Analysis

Assessment Current evaluation at seminars and final written examination with discussion upon the end of the course.

Registration for the Course: by request at the end of the current semester (when is not obligatory course).

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

ENERGY EFFICIENCY

ECTS credits: 6 credits
Assessment method: Examination
Semester: III
Hours per week: 2 Lec. + 2 Sem. +0 Lab.
Course Status: Obligatory

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

Annotation: The purpose of the course is for students to acquire knowledge about the main goals and application of measures to increase energy efficiency in industrial enterprises and their successful implementation.

Course Aims: The purpose of the course is for students to acquire knowledge about the main goals and application of measures to increase energy efficiency in industrial enterprises and their successful implementation.

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

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.

ENERGY MANAGEMENT

ECTS credits: 6 credits
Assessment method: Examination
Semester: III
Hours per week: 2 Lec. + 2 Sem. +0 Lab.
Course Status: Obligatory

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

Annotation: The course aims to acquire knowledge on the main problems of energy systems and renewable energy sources and solutions for efficient use of energy. The course introduces students to the main physical aspects and technology of energy efficiency and energy cost management - energy management. The place of renewable energy sources in the overall energy balance, the physical and technical features of these sources, the use of energy-efficient equipment and devices are examined.

Course Aims: The aim of the course is for students to acquire knowledge about the main objectives and application of measures for implementing energy management in industrial enterprises.

Pedagogical Methods: Lectures, laboratory, homework, tutorials

Subsidiary Materials: Educational literature on Particle Physics.

Evaluation Method: Written examination. 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.

ENERGY POLICIES AND SUSTAINABLE ENERGY DEVELOPMENT

ECTS credits: 6 credits
Hours per week: 2 Lec. + 2 Sem. +0 Lab.
Assessment method: Examination
Course Status: Obligatory
Semester: IV

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

Subject Description: The discipline "Energy policies and sustainable energy development" is mandatory for students of the specialty with a total schedule of 60 hours, of which 30 hours of lectures and 30 hours of exercises and 90 hours of extracurricular activities. The discipline aims to acquaint students with energy policies, as well as with the impact of energy consumption on the environment.

Course aims: To introduce students with the European and Bulgarian regulations on energy efficiency.

Pedagogical Methods: Lectures, exercises, homework, tutorials.

Preliminary Requirements: Fundamental Physics, Energy efficiency, Energy Management.

Assessment: Written examination. 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.

SPECIALIZED SOFTWARE FOR ENERGY EFFICIENCY

Semester: 3 semester
Course Type: lectures and laboratory exercises
Hours per week FS/SS: 2 lectures hours and 2 laboratory hours per week /FS
ECTS credits: 6 credits
University/Faculty/Department: SWU "Neofit Rilsky"- Blagoevgrad; 66 Ivan Mihailov Blvd./ Natural Sciences & Mathematics/ Mathematics and Physics
Course Status: Optional Course

Subject Description: The course introduces students to the basic physical aspects and technology of renewable energy sources. Here students are given the opportunity to master specialized software for energy efficiency, computer simulations of photovoltaic systems (FVS) and FVS monitoring in real-time.

Course Objectives: Students should obtain fundamental knowledge and skills related to the basics of the visual programing and related technologies.

Teaching Methods: lectures and laboratory exercises

Requirements/Prerequisites: Basic knowledge and skills to renewable energy sources and specialized software for energy efficiency.

Assessment: written final exam

Registration for the Course: by request at the end of the previous academic year

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

SOLAR ARCHITECTURES

ECTS credits: 6,0
Weekly workload: 2 Lec. + 2 Sem. + 0 Lab.
Form of assessment: Written exam
Statute of the course: Elective
Semester: III

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

Description of Subject: Solar Energy. Thermal solar applications. Passive solar systems. Types of passive solar systems. Direct passive solar systems. Efficient building orientation and form. Indirect Passive solar systems.

Specific goals of Subject: Students will acquire knowledge for modern building technologies and practical experience to use this system.

Pedagogical methods: Lectures will be visualized by tables, slides and presentations. In seminar exercises a real computer application will be observed and simple examples will be developed.

Preliminary requirements: Basic knowledge in heat physics and mechanics.

Help Materials: Lectures disposed in Internet (Web site of department), copies of teaching materials and publications.

Assessment: Examination upon the lecture material. During the semester there are interim tests.

ELECTRICITY MARKET

ECTS credits: 6 credits
Hours per week: 2 Lec. + 2 Sem. + 0 Lab.
Assessment method: Examination
Course Status: Obligatory
Semester: III

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

Subject Description: The discipline "Electricity market" is elective for the major. It provides basic knowledge for understanding the complex operation of the power system. A major result of the restructuring of the electricity industry is the electricity market, which is a mechanism for the exchange of electricity between different consumers, entities or different countries. It is built on the basis of its predecessor disciplines - General Physics, Energy Efficiency, Energy Management.

Course aims: The students in physics have to receive ground knowledge about understanding the complex workings of the energy system and electricity markets.

Pedagogical Methods: Lectures, laboratory, homework, tutorials.

Preliminary Requirements: Basic knowledge in General Physics, Energy Efficiency, Energy Management, Energy Policies and Sustainable Energy Development.

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

Registration for the course: By request at the end of the previous semester.

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

PHYSICAL PROCESSES IN NUCLEAR POWER PLANTS

Semester: 3 semester
Cours Tipe: Lectures and laboratory exercises
Hours per week/FS/SS: 2 lecture hours, 2 laboratory/FS
ECTS credits: 6.0 credits
University/Faculty/Department: SWU “Neofit Rilsky” - Blagoevgrad; 66 Ivan Mihailov Blvd./ Natural Sciences & Mathematics/ Mathematics and Physics
Status of the Subject: Elective course

Subject Description: Nuclear reactions by neutrons. Delay and diffusion of neutrons. Physical basics of nuclear reactors. Nuclear reactors' theory. Critical (geometry and material) reactor's parameters. Migration of neutrons. Kinetics of nuclear reactors. Types of nuclear reactors. Reactors regulation. Reactor's biological radiation protection. Nuclear power stations. Emergency situations and specific requirements to Nuclear power stations.

Course aims: Students acquire basic knowledges about basic processes and parameters of the modern nuclear power stations. Special attention is paid to the PWR-440 and PWR-1000 reactors**.**

Pedagogical Methods: Lectures, laboratory, homework, tutorials.

Preliminary Requirements: Basic knowledge on General, Atomic, Nuclear and Thermal Physics.

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

Registration for the course: By request at the end of the previous semester.

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

APPLIED THERMAL ENGINEERING

Semester: III
Type of presentation: Lectures and Praxis
Hours per week: 2 Lecture hours / 2 Praxis
ECTS Credits: 6
Department: Department of Mathematics and Physics
Course Status: Elective course

Short Description: 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.

Course Aims: The students acquire basic knowledges about methods of reception, transformation, transfer and use of heat, as well as with principles of action of the heat and of the thermal installations.

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

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.

PHYSICAL METHODS IN ENVIRONMENTAL RESEARCH

Semester: 3 semester
Cours Tipe: Lectures and laboratory exercises
Hours per week/FS/SS: 2 lecture hours, 2 laboratory/FS
ECTS credits: 6.0 credits
Department: Mathematics and Physics
Status of the Subject: Elective course

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

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

Pedagogical Methods: Lectures, laboratory, homework, tutorials.

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

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

Registration for the course: Not necessary.

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

RENEWABLE ENERGY SOURCES

Semester: 4 semester
Cours Tipe: Lectures and laboratory exercises
Hours per week: 2 lecture hours, 2 laboratory
ECTS credits: 5.0 credits
Department: Mathematics and Physics
Status of the Subject: Elective course

Subject Description: The course introduces students to the basic physical aspects and technology of radiant energy conversion. The general energy resources of the earth and the place of solar energy in the general energy balance, the physical and technical features of the elements for the utilization of solar energy, as well as some general problems of energy as a main branch of the economy are considered. Attention is paid to the most important theoretically and practically problems related to the use, transfer and accumulation of solar energy, energy saving and the protection of the environment from harmful effects related to the production and consumption of energy.

Course aims: The aim of the course is for students to become familiar with the physical principles of solar energy conversion and its use for the production of electrical energy. They should receive information about the resource possibilities and prospects for the development of various technologies and the possibilities for their use in the domestic and industrial sectors.

Pedagogical Methods: Lectures, laboratory, homework, tutorials.

Preliminary Requirements: Knowledge from courses in General Physics, Atomic and Nuclear Physics, etc.

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

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

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

MATERIALS AND PROCESSES IN HIGH-ENERGY FLUXES PROCESSING

ECTS credits 5,0
Hours per week: 2 Lec./ 0 Sem./ 2 Lab.
Evaluation Method: Written examination. Some intermediate tests conduct through the semester.
Status of the Subject: Elective
Semester: IV
University: SWU "Neofit Rilsky"-Blagoevgrad; 66, Ivan Mihailov Blvd.
Faculty: Natural Sciences & Mathematics
Department: Mathematics and Physics

Annotation: The course deals with the use of high-energy fluxes (HEF) such as electron and photon beams for various technological applications. The theoretical foundations and practical application of various technological methods of welding, heat treatment, surface modification, preparation of wear-resistant and corrosion-resistant coatings with HEF are studied.

The teaching material has been selected in accordance with the intended syllabus, and within a reasonable compromise between theoretical and applied material, priority is given to the applied

side of the topics covered. The mathematical apparatus is appropriate to the level of preparation of the students at the Master's level.

Subject Description: The course deals with the basic processes of the action of HEF on materials. The processes of formation of electron and photon beams as well as their characteristics are considered. The technological processes of materials processing with HEF are described in detail.

Pedagogical Methods: Lectures illustrated by demonstrations and practical exercises.

PHOTOVOLTAIC CONVERSION OF SOLAR ENERGY

Semester: 4 semester
Cours Tipe: Lectures and laboratory exercises
Hours per week/FS/SS: 2 lecture hours, 2 laboratory/FS
ECTS credits: 5.0 credits
Department: Mathematics and Physics
Status of the Subject: Elective course

Subject Description: This course is not obligatory course with general loading of 60 hours in fact 30 lecture hours and 30 hours exercises. The course purpose is to introduce the student with physical bases of the photovoltaic converting as well as with the possibilities of the photovoltaic effect's practical realizations

Course aims: Students will acquire knowledge for modern solar technologies and practical experience to use this system.

Pedagogical Methods: Lectures, laboratory, homework, tutorials.

Preliminary Requirements: Fundamental Physics, Mathematic Methods Physics, Quantum Mechanics and Quantum Electronics.

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

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

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

ENERGY AND ECOLOGICAL PROBLEMS

Semester: 4 semester
Cours Tipe: Lectures and laboratory exercises
Hours per week/FS/SS: 2 lecture hours, 2 laboratory/FS
ECTS credits: 5.0 credits
Department: Mathematics and Physics
Status of the Subject: Elective course

Subject Description: Introduction. Thermal motors and machines. Organic fuels. Processes and products of combustion. Industrial and power boilers. Thermal and Nuclear power plants. Basics of the Building Physics. Energy efficiency and environmental saving. Kyoto Protocol and Energy Efficiency Act.

Course aims: The students acquire basic knowledges about methods of effective output, transformation, transfer and use of energy from conventional and alternative sources, as well as with methods for environmental protection and legislative framework for that.

Pedagogical Methods: Lectures, laboratory, homework, tutorials.

Preliminary Requirements: Fundamental Physics and Mathematics.

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

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

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

ENERGY-SAVING TECHNOLOGIES

Semester: 4 semester
Cours Tipe: Lectures and exercises
Hours per week/FS/SS: 2 lecture hours, 2 exercises /FS
ECTS credits: 5.0 credits
Department: Mathematics and Physics
Status of the Subject: Elective course

Subject Description: The course introduces students to specialized knowledge of the use of energy-saving technologies in the domestic and industrial sectors. The general energy resources of the earth and the place of solar energy in the general energy balance, the physical and technical features of the elements for the utilization of solar energy, as well as some general problems of energy as a main branch of the economy are considered. Attention is paid to the most important theoretically and practically problems related to the use, transfer and accumulation of solar energy, energy saving, by increasing the efficiency of the technologies used and reducing energy technologies by applying energy-saving measures in the main areas of the economy (transport, industry, services and households) and the protection of the environment from harmful effects related to the production and consumption of energy.

Course aims: The aim of the course is for students to get information about the resource possibilities and prospects for the development of various technologies and the possibilities for their use in the domestic and industrial sectors.

Pedagogical Methods: Lectures, exercises, homework, tutorials.

Preliminary Requirements: Basic knowledge in General Physics, Energy Efficiency, Energy Management, Energy Policies, Sustainable Energy Development, etc.

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

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

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