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: **1 YEAR (2 SEMESTERS)**

FORM OF TRAINING: **REGULAR**

The Master's program in “Energy Management and Sustainable Energy Development” with a study period of 2 semesters is intended for students with an acquired educational and qualification degree “*Bachelor*”/ “*Master*” in specialties in the professional field of *Physical Sciences* and in specialties *Physics and Mathematics*, *Chemistry and Physics* from the professional field of *Pedagogy of Education in ... .*

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***	
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 ONE YEAR: 60 CREDITS

DESCRIPTIONS OF THE COURSES

ENERGY EFFICIENCY

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

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
Hours per week: 2 Lec. + 2 Sem. +0 Lab.
Assessment method: Examination
Course Status: Obligatory
Semester: I

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: I

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: 1 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: I

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: I

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: 1 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: I
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: 1 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: 2 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: II
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: 2 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: 2 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: 2 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.