QUALIFICATIONAL CHARACTERISTIC

SPECIALITY : **PHYSICS**
MASTER PROGRAMME: **CONTEMPORARY ENERGY SOURCES AND ENVIRONMENT PRESERVATION**
EDUCATIONAL QUALIFICATION DEGREE: **MASTER**
PROFESSIONAL QUALIFICATION : **MASTER IN PHYSICS**
DURATION : **2 SEMESTERS**
FORM : **REGULAR**

The master program "Contemporary energy sources and environment preservation" with duration of 2 semesters is appropriate for students with an acquired educational-qualificational degree "bachelor" of physics. The qualificational characteristics defines the professional profile and realization of specialist with educational-qualificational degree "master" of physics, as well as the requirements towards the students during their preparation. The curriculum of the master program was developed in line with state educational requirements and European educational norms and trends. It consists of obligatory, optional and elective disciplines that dive theoretical and applied knowledge in modern areas of physics and its application in other sciences, and in production.

SPECIALIST PROFILE

The master program in "Contemporary energy sources and environment preservation" prepares for work in environmental laboratories, epidemiological inspection, environment monitoring stations, companies that use alternative energy resources, research institutions (in relation to physics, chemistry, biology, geology) that use physical methods of environment monitoring and control. The master degree allows the graduates to be employed as specialists in research organizations, physicist, designers of solar installations, chief of laboratory, researcher, assistant professor and lecturer in higher schools after an admission examination.

REQUIREMENTS TOWARD SPECIALIST PREPARATION

Following "Contemporary energy sources and environment preservation" master program the students acquire fundamental and specialized knowledge in the area of physical problems of environments, ecology, cosmic physics, biophysics, alternative energy resources, photoelectronics, biophysical methods of environmental control, radioecology, solar energy, etc. During their studies the students acquire also theoretical and applied knowledge and skills in microprocessors, computer architecture, computer modeling and WEB design, communication and information technologies.
The students should have skills that allow them to work in laboratories for complex environmental monitoring.

CURRICULUM

First year			
First semester	ECTS (credits)	**Second semester**	ECTS (credits)
Physical methods in environmental research Chemical methods in environmental research Elective discipline group I Elective discipline group I Elective discipline group I	6 6 6 6 6	Ecological expertises Elective discipline group II Elective discipline group II State graduation examination in physics or Diploma theses	5 5 5 15
Elective disciplines group I Modern computer techolnogies Visual programming Applied informatics Specialised foreign language preparation Passive solar systems (Solar architecture) Applied biophysics		**Elective disciplines group II** Modern methods in aerocosmic and environmental research Photovolatic conversion of solar energy Laser methods in environmental research Energy production and ecological problems Philosophical problems of physics	
	Total 30		Total 30

TOTAL FOR ONE YEAR: 60 CREDITS

COURSES DESCRIPTION

Physical Methods in Environmental Research

ECTS credits: 6 credits **Hours per week: 2 lecture hours, 2 laboratory hours**
Assissment method: Examination Course Status: Obligatory
Semester: I

Methodical leadership:
Department of Physics
Faculty of Natural Sciences &Mathematics

Annotation:
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. The students in physics have to receive ground knowledge about using the contemporary physical methods in the monitoring of the environment.

Course contents:
Modern physical problems in the protection and control of environmental parameters.
Distribution and properties of water on the globe, and in living organisms. Water balance in the hydrosphere.

Anomalies in the physical properties of water and their importance for the energy balance of the earth and the development of living organisms.
Structure of water - models. Spectral properties of different ranges. Spectrum of the energy distribution of the intermolecular bonds in water and method for obtaining it.
Ionization of water - pH and pK. Water as a solvent. Acid rains and their neutralization.
Physical methods for activation of water. Activation of water by turbulent motion, motion in a gradient magnetic field and by electrolysis through a membrane filter.
Aerosols and pollutions on atmosphere. Physical properties and methods of studying aerosols
Atmospheric Optics. Basic optical phenomena and methods for their study. Optical absorption and scattering. Lidar systems.
Spectrum of solar radiation. Laws of thermal radiation. Photovoltaic inverters on solar energy. Water and wind sources of energy. Bioenergy.
Anthropogeneous sources of energy. Heat sources on based of natural fuels. Nuclear sources. Hydrogen Energy.
Transport of pollutions in the atmosphere and hydrosphere. Diffusion, hydrodynamic transmission turbulence.
Spectroscopy of the environment. Atomic, molecular, Raman spectroscopy and X-ray. Global approach for monitoring on pollutions of the upper atmosphere by artificial satellites on Earth.
Radioactive contaminations of the environment. Radiation monitoring of the atmosphere, earth, water sources and biological species.
Noise pollution of the environment. Sound level, monitoring, problems for the noise insulation.
Impact of noise on the human psyche. Psycho-physical mechanism of sound pollution.

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.

The students' extra-curriculum activity represents the preparation and presentation of a scientific experimental research; conducting physical studies; testing

Help Materials:

1. E.Bocker, R.Van Gondelle, Enviromental Phisics, John Wiley and Sons, N.Y., 1996.
2. Д.Митчел, Д.Смит, Аквametрия, Химия, Москва, 1986.
3. А.Хргиан, Физика атмосферы, Изд. Московского у-та, Москва, 1986.
4. А.Грицков, Фотометрия, Спектрофотометрия, Колориметрия, изд.СУ, София,2000.
5. Г. Василев, Химия и опазване на околната среда, УИ „Св. Климент Охридски", София, 2007.

Assessment:

The **assessment** of the students' results is done accordingly to the ECTS. The final rating is formed at the end of the course on the basis of the rating of a written test on all topics mentioned above, on the basis of the rating of the student's routine control and on the basis of the rating of the student's extra-curriculum activity in the following ratio.

Chemical Methods for Environmental Investigations

Course Title: Chemical Methods for Environmental Investigations
Semester: I
Course Type: Lectures and tutorials
Hours per week/FS/SS: 2 lecture hours, 2 tutorial hour per week/SS
ECTS Credits: 6

Department: Department of Chemistry

Course Status: Obligatory course in the Master program in physics

Short Description: Topics of the course: Main steps in analytical procedures using instrumental analytical methods, relative and absolute methods, calibration, and basic metrological characteristics of the instrumental analytical methods. In a systematic way are introduced most common spectral, magneto-chemical and chromatographic methods for analysis.

Course Aims: Students should obtain basic knowledge and practical skills in most commonly used instrumental methods for analysis of composition of the various objects. Physical basis, advantages and limitations of the studied analytical methods are also presented.

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

Requirements/Prerequisites: Standard requirements for attendance of the Master program "Physics"

Assessment: laboratory tutorial mark L; final test T and exam E

Rating: = 0.2 x [**L**] + 0.5 x [**T**] + 0.3 x [**E**]

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

References:

1. *Analytical Chemistry*. Editors: R. Kellner, J.-M. Mermet, M. Otto, H. Widmar, WILEY-VCH, Venheim.
2. Г. Крисчън, Дж. О'Рейли. *Инструментален анализ*. Унив. Изд. "Св. Кл. Охридски", София, 1998.
3. D. Harvey. *Modern Analytical Chemistry.* Mc Graw-Hill Higher Education, 2000.
4. А. Хайнц, Г. Райнхард. *Химия и околна среда.* Унив. Изд. "Св. Кл. Охридски", София, 2000.
5. И. Тинсли. *Поведение химических загрязнителей в окружающей среде.* Мир, Москва, 1982.
6. Werner Stumm, Ed. *Global Chemical Cycles and Their Alterations by Man*. Dahlem Konferenzen, Berlin, 1976.
7. C. Goldman, A. Horne. *Limnology.* McGraw-Hill, New York, 1983.

Modern Computer Technologies

Subject **Modern Computer Technologies**	**No 3**	**Semester** **1 semester**
Type of lecture Lectures/Seminars	**Hours (Week) / semester** 2 L / 2S / Winter semester	**Credits** 6.0

University/Faculty/Department: SWU "Neofit Rilski", Blagoevgrad, Ivan Michailov 66/ Mathematics & Natural Science Faculty "Computer systems and technologies"

Status of the Subject: Optionally Subject

Description of Subject:

- Main conception of modern computer technolgies.
- Architecture and basic components of computers.
- Modern technologies in microprocesor and memory equipment.
- New preipherical components in modern computers.
- Software technologies for modern computers

Specific goals of Subject:
Students will acquire knowledge for modern compurer technologies and how 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 electronic shemes and logical mathematics.

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.

Note: Lection course is useful for students of all natural science specialties.

Visual programing

Subject **Visual programing**	**No 4**	**Semester** **1 semester**
Type of lecture Lectures/Seminars	**Hours (Week) / semester** 2 L / 2S / Winter semester	**Credits** 6.0

University/Faculty/Department: SWU "Neofit Rilski", Blagoevgrad, Ivan Michailov 66/ Mathematics & Natural Science Faculty "Computer systems and technologies"

Status of the Subject: Optionally Subject

Description of Subject:

- Programming languages (objective and visual) and different tools for dynamic visual programming technique.
- Using the database in visual applications and object oriented anguaget technologies.
- Delphi programming environment.
- Database in Delphi.
- .Net and J2EE conception for developing the Web applications.

Specific goals of Subject:
Students will acquire knowledge for modern software technologies and how 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 computer programming and logical mathematics.

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.

Applied Informatics

Title: Applied Informatics
Semester: 1st semester
Type of Course: lectures and labs
Hours per week – 2 lectures + 2 labs per week
Credits Numbers: 6.0
Department: Informatics
Course Status: Elective course from the physics Curriculum.
Course description: The course is providing basic knowledge in development of algorithms, their programming using particular programming language and running and testing of the programs under certain operation system. The structure and the main operational principles of the computer systems are given. The means and accuracy of information presentation are also

considered. Some of the key classes of algorithms and data structures are studied. The main techniques of the structural approach of programming and their application using C++ programming language are introduced. The aim of the course is to teach the students with the techniques in development of algorithms and programs using C++ programming language.
Objectives:
Basic objectives and tasks:

- The students give knowledge for algorithm thinking;
- to give knowledge for Data structures, that can process with computer;
- to give knowledge for methods and skills in programming.
- to give knowledge for syntax of a program language (C++);
- to give knowledge for good style in programming;
- to give knowledge for basic principles when develop applications

Methods of teaching: lectures, tutorials, projects, other methods
Pre- requirements: Basic knowledge in Mathematic.
Exam: Written examination and discussion at the end of the semester, individual tasks and the general student's work during the semester.
Registration for the Course: A request is made by students at the end of the current semester
Registration for the Exam: Coordinated with the lecturer and the Student Service Office
References:

1. Магдалина Тодорова *Програмиране на C++. Част I,* Сиела, 2002.
2. Cay S. Horstmann *Computing Consepts with C++ Essentials*, John Wiley & Sons, 1999.
3. Steve Donovan *C++ by Example.* Que/Sams,2002.
4. Христо Крушков *Програмиране на C++*. Пловдив, Макрос, 2006.
5. Herbert Schildt *Teach Yourself C++*, McGraw-Hill, 1998.
6. Брайън Овърленд *C++ на разбираем език.* АлексСофт, 2003.
7. Преслав Наков, Панайот Добриков *Програмиране = ++ алгоритми.* София, 2005.

Specialized preparation in a foreign language

Course Title: Specialized preparation in a foreign language

Semester: 1. (winter) semester

Course type: Seminars, out-of-class work

Hours per week: 4 seminar hours

ECTS credits: 6 credits

University/Faculty/Department: Sowthwest University "Neophit Rilsky", Blagoevgrad, 66 bul. Ivan Michailov, Science and Mathematics Faculty, Department of Physics

Statute of the discipline in the curriculum: Optional

Description of the discipline: The discipline "Specialized preparation in a foreign language" is constructed as a necessary component of the whole preparation of future physicists with a master degree. The course aims at broadening of the foreign language preparation by enriching it with general and special science vocabulary and showing the ways of its specific uses in different texts – abstracts, articles, announcements, monographs, textbooks in physics.

Course objectives: The main objective of the course is the students, to enrich their science vocabulary, to acquire some basic skills to comprehend and interprete different scientific texts, and to know how they are prepared.

Teaching methods: Seninars, individual student out-of-class work

Requirements/Prerequisites: Basic knowledge of English

Assessment: Permanent control, written test.

Registration for the course: It is necessary to apply in the administrative department during the previous semester

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Solar architecture

Subject **Solar architecture**	**No 7**	**Semester** **1 semester**
Type of lecture Lectures/Seminars	**Hours (Week) / semester** 2 L / 2S / Winter semester	**Credits** 6.0

Lecturer: Assoc. Prof. Dr. Stanko Vladimirov Shtrakov

University/Faculty/Department: SWU "Neofit Rilski", Blagoevgrad, Ivan Michailov 66/ Mathematics & Natural Science Faculty "Computer systems and technologies"

Status of the Subject: Optionally Subject

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.

Note: Lection course is useful for students of all natural science specialties.

APPLIED BIOPHYSICS

Course Title: **APPLIED BIOPHYSICS**
Semester**:** **I**
Type of presentation**:** **Lectures and Seminars**
Hours per week AS / SS**:** **2 Lecture hours / 2 Laboratory Classes / AS**
ECTS Credits**:** **65**

Department**: Physics Department;**
Course Status: **Elective course in the Physics Science M.Sc. Curriculum**

Short Description**: The thermodynamic approach at study of alive systems. Entropy of alive Nature. Basics of non-equilibrium Thermodynamics. Thermodynamics and information. Phase transitions. Chemical bonds. Fractal structures and scales. Biopolymer Physics. Biomembranes. Unique anomalous properties of Water. Solitons. Radioecology.**

Course Aims**: To acquaint the students with basic physical problems, approaches and methods at study of self-organisation of the Matter and interaction of alive organisms with radiation.**

Teaching Methods**: Lectures and Seminars with decision of theoretical and practical tasks. From methodical point of view the material is arranged from the thermodynamic approach at study of alive systems via Biopolymer Physics to the basic problems of Radioecology..**

Requirements/Prerequisites**: Basic knowledge on Molecular, Atomic and Nuclear Physics.**

Evaluation Method**: Defence of the Labs Protocols L; Two intermediate tests K_1 and K_2 conduct through the semester; Written final exam upon the lecture course.**

Rating**:** $= 0{,}2 .L + 0{,}2.\left(\frac{K_1 + K_2}{2}\right) + 0{,}6$ **(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. **Gramatikov P. S. *Theoretical Biophysics*, Blagoevgrad, 1998 (in Bulgarian).**
2. **Ivanov I. T. *Textbook on Medical and Biological Physics*, Alfa Market, St. Zagora, 2008, (in Bulgarian).**
3. **Marinov M, *Biophysics*, Sofia, 2003, (in Bulgarian).**
4. **Kicheva J. Manual of Medical Physics and Biophysics, GRPI-MON, Sofia, 2002, (in Bulgarian).**
5. **Florov R. J. *Thermodynamics of Biosystems*, BAS Publ. Hous, Sofia, 1988 (in Bulgarian).**

Abbreviation:
AS**: Autumn Semester**
SS**: Spring Semester**

Ecological expertises

ECTS credits: 6 credits **Hours per week: 2 lecture hours, 2 laboratory hours**
Assessment method: Examination Course Status: Elective
Semester: II

Methodical leadership:
Department of Physics
Faculty of Natural Sciences &Mathematics

Annotation:

The purpose of the course **"Environmental Expertises"** is to give students in "**Modern energy sources and environmental protection**" – "Master" degree basic knowledge of regulations, requirements and approaches to the creation and functioning of effective activities for the preparation of environmental investigations, expertise and assessments.

Students acquire skills to analyze and evaluate the needs of information for the environmental components and the necessity of correct activities for the environmental assessments.

Special attention is given to the aims and objectives of sampling in the environmental management systems (EMS) structure, units and scope of their activities; obligations and information requirements and record keeping of various activities in the management of companies (in terms of conservation environment).

The course **"Environmental Expertises"** provides students with the knowledge and opportunities to participate in teams in developing systems and management plans for environmental protection, plans and programs for the development of strategic environmental assessment (SEA), a report on assessment of the environmental impact assessment (EIA) and other environmental investigations, depending on the specific needs and in compliance with environmental requirements.

Course contents:

№	**TOPIC**	Horaium (hours)
	A) LECTURE	
1.	Nature and characteristics of environmental assessments	2
2.	Types of environmental assessments. Classification. Basic principles.	2
3.	Regulatory framework and requirements for preparation of environmental assessments.	2
4.	Consistency in the environmental assessments preparation. Requirements and quality control.	2
5.	Consultations in the environmental assessments preparation. Necessity. Rights and obligations.	2
6.	Strategic environmental assessments. Purpose. Basic requirements.	2
7.	Environmental expertise. Purpose. Applicability.	2
8.	Environmental impact assessment (EIA). Purpose.	2
9.	Requirements for the environmental assessment experts. Rights and obligations.	2
10.	Requirements for the assessment of environmental impact. Nature and characteristics.	2
11.	Degrees of the environment impacts. Essence. Principles of determination.	2
12.	Public discussion of the environmental assessment reports. Basic	2

	requirements. Procedures.	
13.	Environmental assessment of transboundary plans and programs. Features and requirements.	2
14.	EU policy to improve environmental assessments.	2
15.	Problems in the environmental assessments preparation. Reasons. Approaches for correction and decisions.	2
	All:	**30**
	B) EXERCISES	
1.	*Sample of content and scope of environmental assessment and environmental impact assessment report.*	3
2.	*Justification and structure of consulting assistance.*	3
3.	*Analysis of the requirements in the preparation of environmental assessments.*	3
4.	*Approaches in determining the degree of environmental impact.*	4
5.	*Requirements for the behavior of environmental assessment experts.*	3
6.	*Preparing the main sections of the EIA report and evaluation of quality*	4
7.	*Analysis of environmental violations and approaches for evaluation.*	3
8.	*Role play - public discussion of the environmental assessment report. Organization, conduct and results.*	4
9.	*Samples for classification of the problems with preparing of the environmental assessment reports.*	3
	All:	**30**
	Total:	**60**

Teaching Methods and Assessment:

During the semester students undertake a periodic review by assigning tasks to individual work by analyzing the results of the completed environmental investigations, expertise and assessments, including proposing solutions to emerging problems in their implementation.

Criterion for assessing the degree of implementation of tasks (coursework, research paper, presentation, etc.), Taking into account the levels of competence, analytical skills, ability to aggregate data and proposing solutions, etc.

Works are discussed and protected together with the other students who participate in the evaluation. The activities of all students are accounted for as an additional argument for the exam, or individual sections of the content of the course.

The assessment is carried out of sixth-form system, depending on the task as follows:

Excellent	6	- over 89%
Very good	5	to 70% - 89%
Good	4	to 45% - 69%
Average	3	to 30% - 44%
Poor	2	- below 30%

For unusual activity of a student in the educational process (100% fulfillment of the tasks of the current control, active participation in proper methodological discussion of lecture material) it is possible to exempt from semester exams.

The share of current control weighting is 50%, taking into account differences in the relative weight of coursework, essays or presentations (usually between 70% and 30%).

Until the exam is allowed only students who have met the requirements of the Regulations for the educational activities of SWU "Neofit Rilski", and have met the

requirements for mastering the course content set in their auditorium and individual employment and overall assessment of the current control is at least Average (3).

The examination process includes a written exam topics (at least two) of the content of the course syllabus distributed in advance. The relative weight of the total test score is 50%.

The assessment is carried out in six-point scale, according to Law of higher education and Ordinance № 21 of the Ministry of education and science – (30.09.2004).
Credits are awarded only if the total score is equal to or higher than the average (3), according to the system of accumulation and transfer of credits.

REFERENCES

1. Glasson J., R.Therivel, An.Chadwick (2011). Introduction To Environmental Impact Assessment (Natural and Built Environment Series). Routledge. ISBN-10: 0415664705.
2. Lawrence D.P. (2003). Environmental Impact Assessment: Practical Solutions to Recurrent Problems. Publisher:Wiley-Interscience.
3. Marriott B. (1997). Environmental Impact Assessment: A Practical Guide. McGraw-Hill Professional; ISBN-10: 0070404100.
4. Methods of Environmental Impact Assessment (2009). Morris **P.**, R.Therivel **(eds.)** Routledge.
5. Morris P. (2008). Methods of Environmental Impact Assessment. Publisher: Built Environment.
6. Perdicoulis A., Br.Durning, L.Palframan (Eds) (2012). Furthering Environmental Impact Assessment: Towards a Seamless Connection Between EIA and EMS. Edward Elgar Publishing Ltd. ISBN-10: 0857933272.
7. Schmidt M., J.Glasson, L.Emmelin (2008). Standards and Thresholds for Impact Assessment. Publisher: Springer Berlin.
8. Tromans St., K. Fuller (2003). Environmental Impact Assessment: Law and Practice. Publisher: LexisNexis UK. ISBN-10: 0406959544.
9. Wathern P. (eds.) (1988) Environmental Impact Assessment. Theory and practice. Routledge.

Modern methods for examination of aerospace and natural environment

ECTS credits: 5 credits
Hours per week: 2 lecture hours, 2 lab. hours
Assisment method: Examination
Course Status: Elective
Semester: II

Methodical leadership:
Department of Physics
Faculty of Natural Sciences &Mathematics

Short Description:

The aerospace and natural environment is closely related, because of the continuous solar- terrestrial interactions. The Sun as a main source of energy gives serious influence on: litho-, magneto-, atmo-, hydro- and biosphere of the Earth, which destiny is determined of the going global processes of changes and also of the possible and occasional interactions with other small celestial objects.

The particles and the photons of the cosmic background are main carriers of information for the parameters of the aerospace environment, explored with satellite and also with ground based instruments.

The atmosphere and going in it transport processes are in close relation with the aerozol transfer of radionuclides, heavy and toxic metals and chemical pollutions.

The content of ozone, radon and carbon dioxide is of essential significance for the global climatic changes at the Earth. The influence of the cosmic background on the changes of some meteorological parameters is noticeable.

The importance of the radioecology in the complex monitoring and control of the environment is undisputable. All this subjects closely related each other into an integrated *noisy* information system, are the main source of information for the parameters of the aerospace and natural environment, whish could be obtained by solving this complex inverse problems.

Teaching Methods: lectures, practical exercises, individual student's work

Requirements/Prerequisites: Physics, Mathematical Analysis

Assessment: written terminal examination.

Two homeworks (marks D1, D2) and two written tests (marks K1, K2) are rated for continuous assessment during the semester. Only students with average rating from the continuous assessment greater than 3 are allowed to go on a examination.

The mark at the terminal examination (Exam) has the main weight in the final rating.

Rating = $0{,}05 .(\frac{D1+D2}{2}) + 0{,}15 .(\frac{K1+K2}{2}) + 0{,}8\ (Exam)$

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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

References:

1. Murzin, V. S. , Introduction in Cosmic Rays Physics, Moscow, Atomizdat , 1979
2. Dorman, L. I. , Variations of Galactic Cosmic Rays, Moscow University Publishing House, 1975

Photovoltaic conversion of solar energy

Subject **Photovoltaic conversion of solar energy**	**No 5**	**Semester** **2 semester**
Type of lecture Lectures/Seminars	**Hours (Week) / semester** 2 L / 2S /Summer semester	**Credits**

University/Faculty/Department: SWU "Neofit Rilski", Blagoevgrad, Ivan Michailov 66/ Mathematics & Natural Science Faculty "Physics"

Status of the Subject: Optional Subject

Description of Subject:

1. Physical principles of solar energy conversion. Photovoltaic conversion of solar energy.

2. Introducing in technology for photovoltaic panels. Thin layers. Semiconductor materials.
3. Electricity generation in photovoltaic elements. Energy efficiency of photovoltaic converters.
4. Materials for photovoltaic panels. Silicon – amorphous and crystal structure. Photovoltaic converters based on organic materials.
5. I – V diagram of Photovoltaic elements. Experimental and testing equipment for PV.
6. Solar PV Installations. Photovoltaic controllers (inverters).
7. Application of PV elements. Link with the conventional electricity net.
8. Ecological problems in solar energy applications.

Specific goals of Subject:
Students will acquire knowledge for modern solar 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 mathematics and physics.

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

LASER METHODS IN INVESTIGATION OF ENVIRONEMENT

Semester: II
Type of presentation: Lectures and Laboratory classes
Hours per week AS / SS: 2 Lecture hours / 2 Laboratory hour / SS
ECTS Credits: 5

Department: Physics Department; Phone: +359/73/8889137

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

Short Description: The course considers laser methods in study of pollutions in atmosphere, and laser diagnostics in investigation of bioactivity of water medium, rivers and sea. Modern laser methods are presented in study of components of natural media and their protecting. Structure of nature is studied to determine main ecological reserves.

Teaching 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 course.

The students extra-curriculum activity represents the preparation of a scientific experimental research; conducting physical studies; testing.

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

Evaluation Method: The assessment of the students` results is done accordingly to the ECTS. The final rating is formed at the end of the course on the basis of the rating of a written test on all topics mentioned above, on the basis of the rating of the student`s routine control and using the rating of the student`s extra-curriculum activity in the following ratio.

Final grade calculation is done by using a 6-point rating scale: the rating 6 equals level A on ETCS; the rating 5 equals level B on ETCS; the rating 4 equals level C on ETCS; the rating 3 equals level D on ETCS; the rating 2 equals level E on ETCS.

Inscribing for tuition: By request at the end of the previous semester.
Inscribing for exam: Agreement with the lecturer and the Students Service Department

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ENERGETICS AND ECOLOGICAL PROBLEMS

Course Title: ENERGETICS AND ECOLOGICAL PROBLEMS
Semester: II
Type of presentation: Lectures and Laboratory classes
Hours per week AS / SS: 2 Lecture hours / 2 Laboratory hour / SS
ECTS Credits: 5
Department: Physics Department
Course Status: Elective course in the Physics Science B.Sc. Curriculum

Short 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 knowledge 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.

Teaching Methods: Lectures and Laboratory classes. From the Methods point of view material is arranged from Conventional & Alternative Energy Sources via Energy efficiency and environmental protection to the legislative framework for that.

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

Evaluation Method: Defence of the Labs Protocols L; Two intermediate tests K_1 and K_2 conduct through the semester; Written final exam upon the lecture course.

Rating: $= 0{,}2.L + 0{,}2.\left(\frac{K_1 + K_2}{2}\right) + 0{,}6\ (\text{Exam})$

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. Girardet H. & M. Mendonca. *A Renewable World – Energy, Ecology, Equality*, Green Books Ltd, UK, 2009.
2. Saxena A. B. *Textbook of Energy, Environment, Ecology and Society*, New Age Int., 2011.
3. Hadjigenova N. P. *Thermal Part of TPP*, Technics, Sofia, 1979 (in Bulgarian)
4. Anderson B. *Solar Energy*, Strojizdat, Moscow, 1982 (in Russian)
5. *Energy Efficiency Act*, St. Gazette, Sofia, March 05, 2004 (in Bulgarian)

Philosophical problems of physics

Course Title: Philosophical problems of physics
Semester: 2 semester

Course type: Lectures, seminars, out-of-class work

Hours per week: 2 lecture hours + 2 seminar hour

ECTS credits: 5 credits

University/Faculty/Department: Sowthwest University "Neophit Rilsky", Blagoevgrad, 66 bul. Ivan Michailov, Science and Mathematics Faculty, Department of Physics

Statute of the discipline in the curriculum: Optional

Description of the discipline: The discipline "Philosophy of physics" is constructed as a necessary component of the whole preparation of future physicists with a master degree. The course content aims at philosophical rationalization of scientific discoveries referring the historical path of the physical science, the struggle of ideas that brought to its development and progress, its crucial discoveries, and turning points.

Course objectives: The main objective of the course is the students, to think over the place of the physical science in the common context of knowledge and intellectual development. The notion of science as a product and as a process as well, will promote the formation of a more integral scientific picture of nature, of own scientific world view.

Teaching methods: lectures, seminars, individual student out-of-class work

Requirements/Prerequisites: General physics course

Assessment: course work and its discussion, written examination.

Registration for the course: It is necessary to apply in the administrative department during the previous semester