Final exam program

on discipline **"Physics and technics of energy savings and renewable energetics"** for 1st course doctoral students for specialty "6D060400 – Physics"

The proposed program for the discipline **"Physics and technics of energy savings and renewable energetics"** is made according to the discipline's syllabus. The program determines the requirements for the levels of mastering the academic discipline, to which the student should be capable of learning: describe acquired knowledge (specifically) and it's understanding; interpret an understanding of the overall structure of the study field and the relations between its elements (specifically); generalize new knowledge in the context of basic knowledge, interpret its contents; create educational and social interaction and cooperation in the group; explain the solution of the problem, its importance; classify criticism and to criticize; decide to work in a team; combine the role of taken course in the implementation of individual learning paths. The system of descriptor verbs must be used during the formation of competences; design active and interactive methods which are recommended to ensure deeper understanding and learning of educational material; achieve learning outcomes of the course.

The aim of the course: to develop to doctoral students in environmental knowledge and the complexity of research related to new directions of energy saving and energy production of ecological orientation.

At the exam, students will be asked two theoretical questions (33 points each) and one practical question 34 point).

Exam questions:

1.	Describe the absorption of sunlight in the materials	Lecture № 3
2.	Characterize the method for calculating the thermal circuit temperature conditions of heat detectors	Lecture № 1
3.	Analyze the method for calculating the thermal circuit temperature regimes receivers of radiant energy	Lecture № 1
4.	Describe the photoelectric effect - a quantum phenomenon	Lecture № 2
5.	Give definition and describe photoelectric Effects	Lecture № 2
6.	Give definition and describe the spectral characteristics of solar radiation	Lecture № 3
7.	Explain energy components of solar radiation , solar exposure assessment	Lecture № 3
8.	Describe geothermal energy	Lecture № 4
9.	Give the classification of the physical principles of solar thermal energy converters	Lecture № 4
10.	Explain conversion of solar thermal energy into mechanical energy	Lecture № 4
11.	Explain conversion of solar energy into thermal energy	Lecture № 5
12.	Explain conversion of solar thermal energy into chemical energy	Lecture № 6
13.	Give the physical properties and characteristics of semiconductors	Lecture № 7
14.	Give definition of semiconductor photodetectors	Lecture № 7
15.	Describe characteristics of solar cells	Lecture № 8
16.	Explain use of water resources and wind energy	Lecture № 10
17.	Describe principles of energy devices based on photosynthesis	Lecture № 10
18.	Decsribe principles of power devices based on biofuels	Lecture № 9
19.	Give definition and describe features and biofuels	Lecture № 9
20.	Describe ecological problems of non-conventional energy sources	Lecture № 1
21.	Explain environmental problems of the use of renewable energy sources	Lecture № 1
22.	Explain the use of biofuels for energy purposes	Lecture № 13
23.	Decsribe thermochemical processes	Lecture № 9
24.	Give definition and describe reflection and refraction of light at the interface between air and the conductive medium	Lecture № 9
25.	Give definition and describe photovoltaic effects in thin and thick p-n junction	Lecture № 9
26.	Decsribe physical features of the contacts metal - semiconductor and heterojunction	Lecture № 10
27.	Decsribe direct conversion of heat energy	Lecture № 10
28.	Explain using the energy of ocean currents	Lecture № 10
29.	Analyze types of power plants based on the use of ocean currents	Lecture № 10

30.	Give definition and describe power of the tidal currents and tidal water rise	Lecture № 10
31.	Describe surface wave energy converters	Lecture № 10
32.	Explain tidal energy converters upgrades of water	Lecture № 11
33.	Give definition and describe heat high thermal water	Lecture № 11
34.	Desrcibe features of use of highly mineralized water sources	Lecture № 11
35.	Give definition and describe thermal regime of the Earth's crust	Lecture № 12
36.	Describe energy use of air masses , map and strength of the winds in different regions of the globe	Lecture № 12
37.	Give definition and describe loss of wind turbines . The theory of the real wind turbine	Lecture № 10
38.	Explain the classical theory of an ideal wind turbine	Lecture № 10
39.	Give the classification of wind turbines on the principle of operation	Lecture № 10
40.	Give the classification of heat accumulators . Pumping and heat exchange environment	Lecture № 14
41.	Describe solar collectors	Lecture № 14
42.	Describe concentrating solar collector	Lecture № 14
43.	Explain structures and materials of solar cells	Lecture № 15
44.	Analyze the problem of the interaction energy and the environment	Lecture № 15
45.	Give definition and describe adiabatic process in gases	Lecture № 15

Evaluation and attestation policy

Criteria-based evaluation:

Assessment of learning outcomes in correlation withdescriptors (verification of competence formation during midterm control andexaminations).

Summative evaluation:

evaluation of the presence and activity of the work in the classroom; assessment of the assignment, independent work of students, (project/casestudy/ program/...)

The formula for calculating the final grade.

$$\text{Final grade for the discipline} = \frac{\text{IC1} + \text{IC2}}{2} \cdot 0{,}6 + 0{,}1\text{MT} + 0{,}3\text{FC}$$

Below are the minimum estimates in percentage terms:

95% - 100%: A	90% - 94%: A-	85 % - 89%: B
80% - 84%: B	75% - 79%: B-	70% - 74%: C+
65% - 69%: C	60% - 64%: C-	55% - 59%: D+
50% - 54%: D-	0% -49%: F	

LITERATURES

1. Aitken, Donald W. (2010). Transitioning to a Renewable Energy Future, International Solar Energy Society, January, 54 pages.
2. Lovins, Amory (2011). Reinventing Fire: Bold Business Solutions for the New Energy Era, Chelsea Green Publishing, 334 pages.
3. Makower, Joel, and Ron Pernick and Clint Wilder (2009). Clean Energy Trends 2009, Clean Edge.
4. HM Treasury (2006). Stern Review on the Economics of Climate Change, 575 pages.
5. International Energy Agency (2007). Renewables in global energy supply: An IEA facts sheet, OECD, 34 pages.

INTERNET-RESOURCES:

1. REN21 (2008). Renewables 2007 Global Status Report, Paris: REN21 Secretariat, 51 pages.
2. REN21 (2009). Renewables Global Status Report: 2009 Update, Paris: REN21 Secretariat.
3. REN21 (2010). Renewables 2010 Global Status Report, Paris: REN21 Secretariat, 78 pages.
4. United Nations Environment Programme and New Energy Finance Ltd. (2007).
5. Global Trends in Sustainable Energy Investment 2007: Analysis of Trends and Issues in the Financing of Renewable Energy and Energy Efficiency in OECD and Developing Countries, 52 pages.

6. World watch Institute and Center for American Progress (2006).American energy: The renewable path to energy security, 40 pages.