

Al-Farabi Kazakh National University  
Faculty of Theoretical and Nuclear Physics  
Department of Theoretical and Nuclear Physics



APPROVED by  
Dean of Faculty  
Davletov A.E.  
" 09 20 17y.

EDUCATIONAL-METHODICAL COMPLEX OF DISCIPLINE  
FTEVE 7201 «Physics and technics of energy savings and renewable  
energetics»

Specialty "6D060400 – Physics"  
Educational program " on specialty 6D060400 – Physics "

Course – 1  
Semester – 1  
Number of credits – 3

Almaty 2017

Educational-methodical complex of the discipline is made by Takibayev Nurgali Zhabagaevich, d.s.p.-m., academic of NAS RK, professor (name, surname, scientific degree, academic rank)

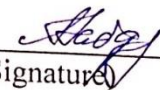
Based on the working curriculum on the specialty  
"6D060400 – Physics"

Considered and recommended at the meeting of the department of Theoretical and Nuclear Physics

from «\_05\_» 09 2017 year, protocol № 2

Head of department  Abishev M.Y.  
(Signature)

Recommended by methodical bureau of the faculty  
«\_06\_» 09 2017 year, protocol № 1

Chairman of the method bureau of the faculty  Gabdullina A.T.  
(Signature)

**Al-Farabi Kazakh National University**  
**Faculty of Physics and Technology**  
**Chair of Theoretical and Nuclear Physics**

**Syllabus**  
**Autumn semester, 2017-2018 academic year**

**Academic course information**

Discipline's code	Discipline's title	Type	No. of hours per week			Number of credits	ECTS
			Lect.	Pract.	Lab.		
FTEV 7201	Physics and technics of energy savings and renewable energetics	Basic	1	2	0	3	5
Lecturer	Takibayev N.Zh., d.s.p.-m., academic of NAS RK, professor			Office hours		Scheduled	
e-mail	E-mail: <a href="mailto:takibayev@gmail.com">takibayev@gmail.com</a>						
Telephone number	Telephone: 2925-133; 8-777-704-0396			Auditory		319	

Academic presentation of the course	<p><b>Type of university:</b> (theoretical, practical; basic, elective) and its purpose (role and place of the course in the educational program): Theoretical Nuclear Physics.</p> <p><b>The purpose of the discipline</b> - 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.</p> <p><b>As a result of learning the discipline, the doctoral student is able:</b></p> <ol style="list-style-type: none"> <li>1. describe the current scientific and environmental problems, the solution of which is now actual and widely discussed in the international scientific community;</li> <li>2. describe the problems of the development of the Earth's ecosphere;</li> <li>3. use modern technologies in solving problems on renewable energy;</li> <li>4. to analyze and discuss the results obtained on energy saving and renewable energy physics and technology;</li> <li>5. to interpret in practice a set of theoretical principles and practical techniques for the consideration of various tasks on non-traditional and renewable sources.</li> </ol>
Prerequisites	Organization and planning of research
Post requisites	It is necessary in a future professional practice
Information resources	<p><b>Literature:</b></p> <ol style="list-style-type: none"> <li>1. Aitken, Donald W. (2010). Transitioning to a Renewable Energy Future, International Solar Energy Society, January, 54 pages.</li> <li>2. Lovins, Amory (2011). Reinventing Fire: Bold Business Solutions for the New Energy Era, Chelsea Green Publishing, 334 pages.</li> <li>3. Makower, Joel, and Ron Pernick and Clint Wilder (2009). Clean Energy</li> </ol>


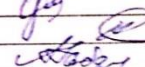
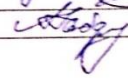
	<p>Trends 2009, Clean Edge.</p> <p>4. HM Treasury (2006). Stern Review on the Economics of Climate Change, 575 pages.</p> <p>5. International Energy Agency (2007). Renewables in global energy supply: An IEA facts sheet, OECD, 34 pages.</p> <p><b>Internet-resources:</b></p> <p>1. REN21 (2008). Renewables 2007 Global Status Report, Paris: REN21 Secretariat, 51 pages.</p> <p>2. REN21 (2009). Renewables Global Status Report: 2009 Update, Paris: REN21 Secretariat.</p> <p>3. REN21 (2010). Renewables 2010 Global Status Report, Paris: REN21 Secretariat, 78 pages.</p> <p>4. United Nations Environment Programme and New Energy Finance Ltd. (2007). 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.</p> <p>5. World watch Institute and Center for American Progress (2006). American energy: The renewable path to energy security, 40 pages.</p>
Academic policy of the course in the context of university moral and ethical values	<p><b>Academic Behavior Rules:</b> Compulsory attendance in the classroom, the impermissibility of late attendance. Without advance notice of absence and undue tardiness to the teacher is estimated at 0 points.</p> <p><b>Academic values:</b> Inadmissibility of plagiarism, forgery, cheating at all stages of the knowledge control, and disrespectful attitude towards teachers. (The code of KazNU Student's honor)</p>
Evaluation and attestation policy	<p><b>Criteria-based evaluation:</b> Assessment of learning outcomes in correlation with descriptors (verification of competence formation during midterm control and examinations).</p> <p><b>Summative evaluation:</b> evaluation of the presence and activity of the work in the classroom; assessment of the assignment, independent work of students, (project / case study / program / ...)</p>

Calendar (schedule) the implementation of the course content:

Wee ks	Topic title (lectures, practical classes, Independent work of students)	Numbe r of hours	Maximum score
<b>Module 1</b>			
1	Lecture-1 (L-1). Conventional and non-conventional sources of energy.	2	-
	Seminar -1 (S-1). Efficiency evaluation of conventional sources of energy.	1	5
2	L-2. The main relations of mechanics of liquid and gas. Application of thermodynamics laws.	2	-
	S-2. Estimated calculation of the system of heat transfer.	1	5
3	L-3. Physical bases of the transformation processes of solar energy.	2	-
	S-3. Calculation of thermal insulation systems by the method of thermal circuit.	1	5
	DSWT-1. Prepare the report: Processes of solar rays absorption in materials.	1	20

4	L-4. Physical principles of geothermal converter of energy.	2	-
	S-4. Problems on calculation of solar exposition.	1	5
<b>Module 2</b>			
5	L-5. Thermal storage of energy. Thermal solar systems for getting a cold, for heating of the room and air drying. Using of solar radiation for preparing food and fresh water.	2	-
	S-5. Calculation of thermal balance of heat sinks and opened, closed, isolated storage devices of thermal energy.	1	5
	DSWT-2. Prepare the report: Energetical constituents of solar radiation, evaluation of solar exposition.	1	20
6	L-6. Systems of solar heat supply. Transformation of thermal solar energy into mechanical and chemical energy. Stirling Engines. Solar power station of tower type and with dispersed collectors.	2	-
	S-6. Calculation of solar radiation collector.	1	5
7	L-7. Photoelectric properties of p-n junction. Electronic properties of semiconductor materials. Transformation of thermal solar energy into electric energy with semiconductor converters.	2	-
	S-7. Calculation of thermoelectronic generators efficiency.	1	5
	DSWT-3. Prepare the report: Physical properties and characteristics of semiconductors.	1	25
	<b>1st Intermediate Control (IC1)</b>		100
8	<b>Midterm (MT)</b>		100
8	L-8. Constructons and materials of solar elements.	2	-
	S-8. Calculation of electric circuits of solar radiation photovoltaic receiver.	1	5
<b>Module 3</b>			
9	L-9. Basic principles of cistern using and examples of energetical systems with their using.	2	-
	S-9. Calculation of thermal mode of solar module when the module is in horizontal and vertical position of module.	1	5
	DSWT-4. Prepare the report: Using of cistern and wind energy.	1	10
10	L-10. Wind energy and opportunities of its using. Problems of wind energetic in Kazakhstan. Production of wind energy, classification of wind turbine.	2	-
	S-10. Examples of energetic systems using cistern.	1	5
11	L-11. Theory of ideal wind turbine. Principles of work and parameters of vertical and orthogonal wind turbines, turbines of frontal resistance.	2	-
	S-11. Examples of energetic systems using cistern.	1	5
	DSWT-5. Prepare the report: Transformation of thermal solar energy into electrical energy.	1	10
12	L-12. Installations, using wind and rush energy. Examples of using installations of various type.	2	-
	S-12 Examples of energetic systems using wind and rush energy.	1	5
13	L-13. Principles of energetic devices based on photosynthesis and biofuels, exotic transformations of solar energy.	2	-
	S-13. Calculated examples of energetic systems using devices based on photosynthesis and biofuels.	1	5

	DSWT-6. Prepare the report: Direct conversion of thermal energy.	1	20
14	L-14. Thermal mode of Earth's crust. Sources of geothermal heat.	2	-
	S-14. Calculated examples of energetic systems using thermal energy of ocean.	1	5
15	L-15. Energy storage. Chemical and biological storage, storage of heat and electroenergy, fuel elements and mechanical storage.	2	-
	S-15. The calculation of the distribution chain and storage of renewable energy sources.	1	5
	DSWT-7. Prepare the report: Classification of heat accumulator.	1	25
<b>2nd Intermediate Control (IC2)</b>			100
<b>Exam</b>			100
<b>Total</b>			100
<b>Note: Independent work of students with teacher is 7 hours for semester. 3, 5, 7, 9, 11, 13 and 15 weeks are included into syllabus (assignment submission)</b>			

Lecturer \_\_\_\_\_  Takibayev N.Zh.  
Head of the Department \_\_\_\_\_  Abishev M.E.  
Chairman of the Faculty Methodical Bureau \_\_\_\_\_  Gabdullina A.T.