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.
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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: takibayev@gmail.com		
Telephone number	Telephone: *2925-133; 8-777-704-0396*	Auditory	319

Academic presentation of the course	**Type of university**: (theoretical, practical; basic, elective) and its purpose (role and place of the course in the educational program): Theoretical Nuclear Physics. **The purpose of the discipline** - 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. **As a result of learning the discipline, the doctoral student is able:** 1. describe the current scientific and environmental problems, the solution of which is now actual and widely discussed in the international scientific community; 2. describe the problems of the development of the Earth's ecosphere; 3. use modern technologies in solving problems on renewable energy; 4. to analyze and discuss the results obtained on energy saving and renewable energy physics and technology; 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.
Prerequisites	Organization and planning of research
Post requisites	It is necessary in a future professional practice
Information resources	**Literature**: 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 FinanceLtd. (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. 5. World watch Institute and Center for American Progress (2006).American energy: The renewable path to energy security, 40 pages.
Academic policy of the course in the context of university moral and ethical values	**Academic Behavior Rules:** 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. **Academic values:** Inadmissibility of plagiarism, forgery, cheating at all stages of the knowledge control, and disrespectful attitude towards teachers. (The code of KazNU Student's honor)
Evaluation and attestation policy	**Criteria-based evaluation:** Assessment of learning outcomes in correlation with descriptors (verification of competence formation during midterm control and examinations). **Summative evaluation:** evaluation of the presence and activity of the work in the classroom; assessment of the assignment, independent work of students, (project / case study / program / ...)

Calendar (schedule) the implementation of the course content:

Weeks	Topic title (lectures, practical classes, Independent work of students)	Number of hours	Maximum score
	Module 1		
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
	Module 2		
5	L-5. Thermal storage of energy. Thermal solar systems for gettig a cold, for heating of the room and air drying. Using of solar radiation for prepearing 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 collecters.	2	-
	S-6. Calculation of solar radiation collecter.	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 semicunductors.	1	25
	1st Intermediate Control (IC1)		**100**
8	**Midterm (MT)**		**100**
8	L-8. Constructons and materials of solar elements.	2	-
	S-8. Calculation of electric circuits of solar radiation photovoltaic receiver.	1	5
	Module 3		
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
	2nd Intermediate Control (IC2)		100
	Exam		100
	Total		100
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)			

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