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

APPROVED by
Dean of Faculty Davletov A.E.
"09" 09 2017

EDUCATIONAL-METHODICAL COMPLEX OF DISCIPLINE

FEP 7201 «Physics of energy processes»

Specialty "6D060500 – Nuclear Physics"
Educational program "on specialty 6D060500 – Nuclear Physics"

Course – 1
Semester – 1
Number of credits – 3

Almaty 2017

Educational-methodical complex of the discipline is made by Zhanseitov D., senior lecturer (name, surname, scientific degree, academic rank)

Based on the working curriculum on the specialty "6D060500 – Nuclear Physics"

Considered and recommended at the meeting of the department 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
Spring 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.		
FEP 7201	Physics of energy processes	Elective	2	1	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 course** (theoretical, practical; basic, elective) and its purpose (role and place of the course in the educational program): Physics of energy processes. **The aim of the course:** to give the students the deep understanding of the modern physics of nucleus of atoms and quantum mechanics of many-particle systems and self study, to form a system of competences in the context of qualification requirements: * A) be able to – demonstrate acquired knowledge (specifically) and it's understanding; - demonstrate an understanding of the overall structure of the study field and the relations between its elements (specifically); B) be able to – include new knowledge in the context of basic knowledge, interpret its contents; - analyze educational situation and offer direction to solve it; - use methods (research, calculation, analysis, etc.) inherent to the field of study (specifically) individually or in a group teaching and research activities: C) be able to - synthesize, interpret and evaluate the learning outcomes of discipline, modules, midterm exam content (specifically); D) be able to – constructive educational and social interaction and cooperation in the group; - propose to consider a problem, to reason its importance; - accept criticism and to criticize; - work in a team; E) be able to – recognize 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 (Look in Application 2) **Active and interactive methods is recommended to ensure deeper understanding and learning of educational material and to achieve learning out comes of the course (individual researches, group projects, case studies and there methods).
Prerequisites	Organization and planning of research, statistical physics, physics of elementary particles.
Post requisites	Nuclear astrophysics, chromodynamics, quantum gravity.
Information resources	Literature (with an indication of the authors and data output), the availability (number), software and consumables with information about where you can get them. (8-9) Recommended:

	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 ages. Additional: 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.
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 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 / case study / program / ...) The formula for calculating the final grade. $\text{Final grade for the discipline} = \frac{IC1 + IC2}{2} \cdot 0{,}6 + 0{,}1MT + 0{,}3FC$ Below are the minimum estimates in percentage terms: 5% - 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

Calendar (schedule) the implementation of the course content:

Week / date	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	8

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	8
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	8
	DSWT-1. Prepare the report: Processes of solar rays absorption in materials.	1	8
4	L-4. Physical principles of geothermal converter of energy.	2	-
	S-4. Problems on calculation of solar exposition.	1	8
	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	8
	DSWT-2. Prepare the report: Energetical constituents of solar radiation, evaluation of solar exposition.	1	8
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	8
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	8
	DSWT-3. Prepare the report: Physical properties and characteristics of semicunductors.	1	12
	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	8
	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	8
	DSWT-4. Prepare the report: Using of cistern and wind energy.	1	6
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	6
11	L-11. Theory of ideal wind turbine. Principles of work and parameters of vertical and orthogonal wind turbines, turbines of frontal resistence.	2	-
	S-11. Examples of energetic systems using cistern.	1	6
	DSWT-5. Prepare the report: Transformation of thermal solar energy into electrical energy.	1	6
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**	6
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**	6
	DSWT-6. Prepare the report: Direct conversion of thermal energy.	**1**	6
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**	6
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**	6
	DSWT-7. Prepare the report: Classification of heat accumulator.	**1**	6
	2nd Intermediate Control (IC2)		**100**
	Exam		**100**
	Total		**100**
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 _____ Zhanseitov D.

Head of the Department _____ Abishev M.E.

Chairman of the Faculty Methodical Bureau _____ A.T.Gabdullina A.T.