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

TPhAYaECh 7304 « Selected chapters of theoretical physics of atomic nucleus and elementary particles »

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

Course – 1
Semester – 2
Number of credits – 3

Almaty 2017

Educational-methodical complex of the discipline is made by Takibayev N.Zh., d.s.p.-m., academic of NAS RK, professor 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.		
TPhAYaECh 7304	Selected chapters of theoretical physics of atomic nucleus and elementary particles	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): Selected chapters of theoretical physics of atomic nucleus and elementary particles. **The aim of the course:** the formation of such a state, in which a doctoral student in further education and research in physics of atomic nucleus and elementary particles have had no problems and could easily continue research on this topic.* 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
Post requisites	It is necessary in a future professional practice
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. E. N. Kirillova. Physics of the nucleus and elementary particles. Lecture course. Tomsk: TSPU, 2006. 2. IM Kapitonov. Introduction to the physics of nuclei and particles. M .: Editorial URSS, 2002. 3. E. N. Kirillova. Elementary particles. Tasks: educational-methodical manual. Part I. Tomsk: TSPU, 2008. 4. DV Sivukhin. General course of physics. Atomic and nuclear physics. In 2 hours Part 2. Nuclear physics. M., 2002. 5. IV Saveliev. Course of General Physics. In the fifth book. Book. 5. Quantum optics. Atomic physics. Solid State Physics. Physics of the atomic nucleus and elementary particles. Moscow: Astrel, AST, 2002. Additional: 1. Yu. M. Shirokov, NP Yudin. Nuclear physics. M .: Nauka, 1980. 2. 4. Collection of problems on the general course of physics: Atomic physics. Physics of the nucleus and elementary particles, Ed. D.V. Sivukhin. M., 1981. 3. 5. L.B. Perch. Physics of elementary particles. M .: Editorial URSS, 2005. 4. 6. AI Naumov. Physics of the atomic nucleus and elementary particles. M., 1984. 5. 7. D. Orr. Physics. In two vol. T.2. Moscow: Mir, 1981. 6. 8. K. Gottfried, V. Weisskopf. Concepts of elementary particle physics. Moscow: Mir, 1988. 7. 9. IL Buchbinder, Fundamental Interactions, Encyclopedia "Contemporary Natural Science", Vol. 4, Physics of Elementary Particles. M: Astrophysics, Publishing House Magister Press, 2000, pp. 7- 12. 8. 10. Physics of the microcosm. A small encyclopedia. Ed. D. V. Shirkova. Moscow: Soviet Encyclopedia, 1980. 9. 11. Physical encyclopedic dictionary. Ed. A. M. Prokhorov. Moscow: Soviet Encyclopedia, 1983. 10. 12. Jonathan Allday. Quarks, Leptons and the Big Bang. UK, London: Institute of Physics Publishing, 2002.
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:

Weeks	Topic title (lectures, practical classes, Independent work of students)	Number of hours	Maximum score
	Module 1		
1	Lecture-1 (L-1). Introduction to Nuclear physics	**2**	-
	Seminar -1 (S-1). A Brief History of the Development of Nuclear Physics	**1**	5
2	L-2. Composition and properties of atomic nuclei	**2**	-
	S-2. Static characteristics of nuclei.	**1**	5
3	L-3. Nuclear bond energy	**2**	-
	S-3. Nucleon-nucleon interaction and properties of nuclear forces	**1**	5
	DSWT 1. Prepare the report: Nuclear bond energy	**1**	20
4	**L-4.** Models of atomic nuclei.	**2**	-
	S-4. Model of a liquid droplet Shell and generalized models	**1**	5
	Module 2		
5	L-5. General regularities of radioactive decay. Natural and artificial radioactivity. Types of decay	**2**	-
	S-5. Natural and artificial radioactivity. Types of decay	**1**	5
	DSWT 2. Prepare the report: General regularities of radioactive decay. Natural and artificial radioactivity. Types of decay	**1**	20
6	L.-6. Nuclear reactions. Classification.	**2**	-
	S.-6. Conservation laws. Energy of reactions and decays	**1**	5
7	L.-7. Nuclear fission. Thermonuclear reactions.	**2**	-
	S.-7. Use of nuclear energy	**1**	5
	DSWT 3. Prepare the report: Nuclear fission. Thermonuclear reactions.	**1**	25
	1stIntermediate Control (IC1)		**100**
8	**Midterm (MT)**		**100**
8	L-8. Experiments in high-energy physics.	**2**	-

	S-8. Methods of research in nuclear physics and particles.	1	5
	Module 3		
9	L-9. Observation, registration and production of elementary particles.	2	-
	S-9. Accelerators	1	5
	DSWT 4. Prepare the report: Types of measuring for particles	1	10
10	L-10. Classification of elementary particles.	2	-
	S-10. Fundamental interactions.	1	5
11	L-11. Trends in the development of high-energy physics	2	-
	S-11. Nuclei Under Extreme Conditions	1	5
	DSWT 5. Prepare the report: Phase Transition and Quark Gluon Plasma	1	10
12	L-12. Nuclear Astrophysics	2	-
	S-12 Supernova and Synthesis of Heavy Nuclei.	1	5
13	L-13. Nuclear Physics: Present and Future	2	-
	S-13. Developing of Nuclear physics	1	5
	DSWT 6. Prepare the report: Nuclear Astrophysics	1	20
14	L-14.The main Equations in Nuclear Physics	2	-
	S-14. Shrodinger equation	1	5
15	L-15. Sum of the Nuclear Physics	2	-
	S-15. Macroscopic quantum phenomena	1	5
	DSWT 7. Prepare the report: Elementary particles and classification	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 _____ TakibayevN.Zh.

Head of the Department _____ Abishev M.E.

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