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

APPROVED by
Dean of Faculty
_____ Davletov A.E.
"31" 08 2018

EDUCATIONAL-METHODICAL COMPLEX OF DISCIPLINE

VTYa 3301 « Introduction to the nucleus theory »

Specialty "5B060400 –Physics"
Educational program "5B060400 –Physics "

Course – 4
Semester – 7
Number of credits – 3

Almaty 2018

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 "5B060400 – Physics"

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

from «_26__» ___06___ 2018 year, protocol № 42

Head of department _____ Abishev M.E.
(Signature)

Recommended by methodical bureau of the faculty

«__27__» __06__ 2018 year, protocol № 10

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

Syllabus

on discipline (ITN4506) "Introduction to the nucleus theory"

for specialty **"5B060400-Physics"**

Autumn semester, 2018-2019 academic year,

Course 4

Academic course information

Discipline's code	Discipline's title	Type	No. of hours per week			Number of credits	ECTS
			Lect.	Pract.	Lab.		
ITN4506	Introduction to the nucleus theory	Elective	2	1	0	3	5

Lecturer	TakibayevN.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	The training course "Introduction to the nucleus theory" is **an elective** component in educational program of **baccalaureate on specialty "5B060400 – Physics"** **The aim of the course:** learning the modern physics of atom nucleus and quantum mechanics of many-particlesystems. As a result of the discipline, the student will be able to: 1. describe acquired knowledge (specifically) and it's understanding; 2. interpret an understanding of the overall structure of the study field and the relations between its elements (specifically); 3. generalize new knowledge in the context of basic knowledge, interpret its contents; 4. create educational and social interaction and cooperation in the group; 5. explain the solution of the problem, its importance; 6. classify criticism and to criticize; 7. decide to work in a team; 8. 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; 9. design active and interactive methods which are recommended to ensure deeper understanding and learning of educational material; 10. achieve learning outcomes of the course (individual researches, group projects, case studies and their methods).
Prerequisites	Mathematical analysis, the theory of functions of complex variables, differentialequations, mathematical physics, statistical physics, physics of elementaryparticles.
Post requisites	Taken knowledge will be used in research work.
Information resources	Literatures (with an indication of the authors and data output), the availability (number), software and consumables with information about where you can get

	them. 1. Kamal A. Nuclear Physics. Springer. 2014. — 612 p. — (Graduate Texts in Physics). 2. Iliadis Ch. Nuclear Physics of Stars. WILEY-VCH Verlag. Weinheim. 2007. 666 pages Martin B.R. Nuclear and Particle Physics: An Introduction. Wiley. 2006. — 415 p. 3. Takigawa N., Washiyama K., Fundamentals of Nuclear Physics. Springer. Japan. 2017. – 277 p. 4. Shultis J.K., Faw R.E. Fundamentals of Nuclear Science and Engineering. Kansas State University Manhattan. Marcel Dekker. New York. Basel. 2002. 506 pp. 5. A.Das. T.Ferbel. Introduction to Nuclear and Particle Physics. 416 pages. World Scientific Pub Co Inc; 2 edition. December 29. 2003
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/...) 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: 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

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). Gravitational interaction.	2	-
	Seminar -1 (S-1).Characteristics of fundamental interactions.	1	5
2	L-2.Weak interaction.	2	-

	S-2.Decay of atomic nuclei.	1	5
3	L-3. Electromagnetic interaction.	2	-
	S-3.The theory of the Weinberg-Salam- Glashow.	1	5
	SSWT 1.Assignment submission № 1: Electromagnetic interaction (prepare the report)	1	20
4	L-4. Strong interaction.	2	-
	S-4. Potential of Yukavo.	1	5
	Module 2		
5	L-5. Some problems of physics of elementary particles.	2	-
	S-5. Quantum chromodynamics.	1	5
	SSWT 2.Assignment submission № 2: Some problems of physics of elementary particles. (prepare the presentation)	1	20
6	L.-6.The concept of mass in modern physics.	2	-
	S.-6. The concept of mass in modern physics.	1	5
7	L.-7. Physical experiment: the current state and prospects of development.	2	-
	S.-7. Some achievements of experimental physics.	1	5
	SSWT 3.Assignment submission № 3: Physical experiment: current state and development prospects. (in oral form)	1	25
	1st Intermediate Control (IC1)		**35+65=100**
8	**Midterm (MT)**		**100**
	L-8.Quarks and nuclei.	2	-
	S-8. The quark structure of the proton and neutron.	1	5
	Module 3		
9	L-9. Particle accelerators.	2	-
	S-9. Largest projects in the world.	1	5
	SSWT 4. Assignment submission № 4: Particle accelerators. (prepare the presentation)	1	10
10	L-10. Energetic properties of nuclei.	2	-
	S-10. The binding energy of nuclei.	1	5
11	L-11. Nuclei. which far from the stability region.	2	-
	S-11.Stability region.	1	5
	SSWT 5. Assignment submission № 5: Nuclei, which far from the stability region. (prepare the report)	1	10
12	L-12.Radioactivity.	2	-
	S-12 General characteristics of radioactive processes.	1	5
13	L-13. Spontaneous fissionand spontaneously fissionable nuclear isomers.	2	-
	S-13. Synthesis of transuranic elements.	1	5
	SSWT 6. Assignment submission № 6: Spontaneous fission of nuclear isomers. (prepare the presentation)	1	20
14	L-14. Radioactivity of proton and double-proton. Cluster radioactivity.	2	-
	S-14. Theory of alpha- decay.	1	5

15	L-15. Super dense nuclear matter. Transition radiation.	**2**	-
	S-15. Classification of radiations mechanisms of fast particles in the medium.	**1**	5
	SSWT7. Assignment submission № 7: Feynman diagrams. (in oral form)	**1**	25
	2nd Intermediate Control (IC2)		**35+65=100**
	Exam		**100**
	Total		**100**

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