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	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 "Introduction to the nucleus theory" is elective component** and its purpose: Theoretical Nuclear 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: – 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); – include new knowledge in the context of basic knowledge, interpret its contents; – 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; – 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; – active and interactive methods is recommended to ensure deeper understanding and learning of educational material and to achieve learning outcomes of the course (individual researches, group projects, case studies and there 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	Literatures (with an indication of the authors and data output), the

<table>
<tr><td>resources</td><td>availability(number), software and consumables with information about where you can getthem.
Bethe H.A., Morrison P. Elementary Nuclear Theory, 1st ed. New York: Wiley, 1947. 147 p.
Heyde K. Basic Ideas and Concepts in Nuclear Physics: An Introductory Approach, 2nd Edition. Institute of Physics Publishing Bristol and Philadelphia, 1999. 547 p.
Kamal A. Nuclear Physics, Springer, 2014. — 612 p. — (Graduate Texts in Physics).
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.
Takigawa N., Washiyama K., Fundamentals of Nuclear Physics, Springer, Japan, 2017. – 277 p.
Shultis J.K., Faw R.E. Fundamentals of Nuclear Science and Engineering, Kansas State University Manhattan, Marcel Dekker, New York, Basel, 2002, 506 pp.
Frobrich P., Lipperheide R., Theory of nuclear reactions, Clarendon Press, Oxford. 1996 - 476 p.
J.M.Blatt and V.F.Weisskopf, Theoretical Nuclear Physics, Springer, 1979, VII.5
Nuclear Physics by Irving Kaplan 2nd edition1962 Addison-Wesley</td></tr>
<tr><td>Academic policy of the course in the context of university moral and ethical values</td><td>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)</td></tr>
<tr><td>Evaluation and attestation policy</td><td>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/casestudy/ program/...)
The formula for calculating the final grade.
$$\text{Final grade for the discipline} = \frac{\text{IC1} + \text{IC2}}{2} \cdot 0{,}6 + 0{,}1\text{MT} + 0{,}3\text{FC}$$
Below are the minimum estimates in percentage terms:
% - 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</td></tr>
</table>

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). Gravitationalinteraction.	**2**	-
	Seminar -1 (S-1).Characteristics of fundamental interactions.	**1**	*5*
2	L-2.Weakinteraction.	**2**	-
	S-2.Decay of atomic nuclei.	**1**	*5*
3	L-3. Electromagneticinteraction.	**2**	-
	S-3.The theory of the Weinberg-Salam- Glashow.	**1**	5
	SSWT 1.Assignment submission№ 1: Electromagnetic interaction	**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. Quantumchromodynamics.	**1**	5
	SSWT 2.Assignment submission № 2: Some problems of physics of elementary particles.	**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. Someachievements of experimental physics.	**1**	5
	SSWT 3.Assignment submission№ 3: Physical experiment: currentstate and development prospects.	**1**	25
	1st Intermediate Control (IC1)		**100**
8	**Midterm (MT)**		**100**
8	L-8.Quarksandnuclei.	**2**	-
	S-8. The quark structure of the proton and neutron.	**1**	5
	Module 3		
9	L-9. Particleaccelerators.	**2**	-
	S-9. Largest projects in the world.	**1**	5
	SSWT 4. Assignment submission№ 4:Particle accelerators.	**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.Stabilityregion.	**1**	5
	SSWT 5. Assignment submission № 5: Nuclei, which far from the stability region.	**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.	**1**	20
14	L-14. Radioactivity of proton and double-proton.Clusterradioactivity.	**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.	**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 weeksareincludedintosyllabus (assignmentsubmission)			

Lecturer_____TakibayevN.Zh.
Head of the Department_____Abishev M.E.
Chairman of the Faculty Methodical Bureau_____Gabdullina A.T.