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

Syllabus
Spring semester, 2017-2018academicyear

Academic course information

Discipline's code	Discipline's title	Type	No. of hours per week			Number of credits	ECTS
			Lect.	Pract.	Lab.		
YaA5208	Nuclear Astrophysics	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) anditspurpose (roleandplaceofthecourseintheeducationalprogram): TheoreticalNuclearPhysics. **The aim of the course:** to give the students the deep understanding of themodern 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 over all 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 out comes 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	Mathematical analysis, the theory of functions of complex variables, differentialequations, mathematical physics, statistical physics, physics of elementaryparticles.
Post requisites	The theory of gauge fields and electroweak interactions, 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. Cotnikova R. T, Klimushkin DY, Fundamentals of stellar evolution and cosmology. Irkutsk: RIO 1998. 2. Cotnikova R. T Astrophysics. Irkutsk .: RIO 2005. 3. Martynov D. Y, Course of General Astrophysics. M .: Nauka, 1984. 4. Sobolev V. Course of Theoretical Astrophysics. M .: Nauka, 1987 Additional: 1. N.G Bochkarev Magnetic fields in space. M .: Nauka, 1985. 2. Vorontsov -Velyaminov B. A. Extragalactic astronomy. M .: Nauka, 1978. 3. Gershberg R. E. Active solar-type main sequence stars. Odessa: Astroprint 2002. 4. Ginsburg V. L. About physics and astrophysics. M: The Bureau "Quantum", 1995. 5. Gurevich L. E, Chernin A. D. The origin of galaxies and stars. M .: Nauka, 1987.
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. $$\text{Final grade for the discipline} = \frac{\text{IC1} + \text{IC2}}{2} \cdot 0{,}6 + 0{,}1\text{MT} + 0{,}3\text{FC}$$ 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). Stars and interstellar medium.	**2**	-
	Seminar -1 (S-1).The birth of stars. Study interstellar medium.	**1**	*5*
2	L-2.Galaxies and quasars.	**2**	-
	S-2.Galaxies and quasars.	**1**	*5*
3	L-3. Basic physical laws.	**2**	-
	S-3.The use of physicallaws to the study of space objects (stars, cosmic plasma) and the universe as a whole.	**1**	5
	MSWT 1.Prepare the report: The use of physicallaws to the study of space objects (stars,cosmic plasma) and the universe as a whole.	**1**	20
4	L-4. Sources of stellar energy.	**2**	-
	S-4. Renewable energy sources.	**1**	*5*
	Module 2		
5	L-5. Interaction of radiation with matter.	**2**	**-**
	S-5.Elementary bases of the interaction of matter and radiation.	**1**	5
	MSWT 2. Prepare the report: Elementary basis of the interaction of matter and radiation.	**1**	20
6	L.-6.Radiative transfer equation and it's simple solutions.	**2**	-
	S.-6. Consideration of problems using the transfer equation.	**1**	5
7	L.-7.Physical processes in celestial sources of radiation.	**2**	-
	S.-7. Nuclear reactions in stars and other astronomical objects.	**1**	5
	MSWT 3. Prepare the report: Nuclear reactions in stars and other astronomical objects.	**1**	25
	1stIntermediate Control (IC1)		**100**
8	**Midterm (MT)**		**100**
8	L-8.The theory of interactions.	**2**	-
	S-8.The interactions and reactions of two-particle and three-particle types	**1**	5
	Module 3		
9	L-9. Energy and mechanisms of nuclear fission.	**2**	-
	S-9. Thermonuclear reactions, thermonuclear bomb.	**1**	5
	MSWT 4. Prepare the report: Thermonuclear reactions, thermonuclear bomb.	**1**	10
10	L-10. The luminosity of stars and their mass.	**2**	-
	S-10**.** The explosions of supernovae, quasars,pulsars, neutron stars.	**1**	5

11	L-11. Modern theoretical ideas about the nature of stars and their systems.	**2**	-
	S-11.Modern problems of astrophysics.	**1**	5
	MSWT 5. Prepare the report: Modern problems of astrophysics.	**1**	10
12	L-12.Physical methods of research of space objects.	**2**	-
	S-12The use of the achievements of nuclear physics to the study of cosmic phenomena.	**1**	5
13	L-13. Current problems in astrophysics.	**2**	-
	S-13**.** The latest discoveries and developments in the study of the universe in recent years.	**1**	5
	MSWT 6. Prepare the report: The latest discoveries and developments in the study of the universe in recent years.	**1**	20
14	L-14.Nuclear reactions in astrophysical objects.	**2**	-
	S-14.Nuclear reactions in astrophysical objects.	**1**	5
15	L-15**.**Databases on nuclear reactions.	**2**	-
	S-15**.**Databases on nuclear reactions.	**1**	5
	MSWT 7. Prepare the report: Astrophysical observations.	**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_____A.T.Gabdullina A.T.