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

APPROVED
Dean of the Faculty
_____ Davletov A.E.
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SYLLABUS
Autumn 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.		
5303 VTS	Introduction to the theory of supersymmetry	Basic	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	**Typeofcourse** (theoretical, practical; basic, elective) anditspurpose (roleandplaceofthecourseintheeducationalprogram): TheoreticalNuclearPhysics. **Theaimofthecourse:**togivethestudentsthedeepunderstandingofthemodernphysics ofnucleusofatomsandquantummechanicsofmany-particlesystemsandselfstudy, toform a systemofcompetencesinthecontextofqualificationrequirements: ∗ A) cognitive: beableto - demonstrateacquiredknowledge (specifically) andit'sunderstanding; - demonstrateanunderstandingoftheoverallstructureofthestudyfieldandtherelationsb etweenitselements (specifically); B) functional: beableto - includenewknowledgeinthecontextofbasicknowledge, interpretitscontents; - analyzeeducationalsituationandofferdirectiontosolveit; - usemethods (research, calculation, analysis, etc.) inherenttothefieldofstudy (specifically) individuallyorin a groupteachingandresearchactivities; ∗∗ C) systemic: beableto - synthesize, interpretandevaluatethelearningoutcomesofdiscipline, modules, midtermexamcontent (specifically); makeananalysisofD) Social: beableto - constructiveeducationalandsocialinteractionandcooperationinthegroup; - proposetoconsider a problem, toreasonitsimportance; - acceptcriticismandtocriticize; - workin a team; E) metacompetences: beableto - recognizetheroleoftakencourseintheimplementationofindividuallearningpaths. ∗Thesystemofdescriptorverbsmustbeusedduringtheformationofcompetences (LookinApplication 2)

	**Activeandinteractivemethodsisrecommendedtoensuredeeperunderstandingandlearningofeducationalmaterialandtoachievelearningoutcomesofthecourse (individualresearches, groupprojects, casestudiesandothermethods).
Prerequisites	Mathematical analysis, the theory of functions of complex variables, differential equations, mathematical physics, statistical physics, physics of elementary particles.
Post requisites	Actual problems of physics and ecology, trends in the development of technology and environmental problems, Problems of energy and nanotechnologies, Modern problems of space ecology and physics.
Information resources	**Literature** : 1. M. Kaku: Introduction to superstrings and M- Theory, Springer, 624 (1999). 2. *J. Wess, J. Bagger*:Supersymmetry and Supergravity, Princeton University Press (1992). 3. *E. Witten,* "Constraints on supersymmetry breaking", Nucl. Phys. **B202**, 253(1982). 4. *S.P. Martin,* "A supersymmetry primer",ArXiv:hep-ph/9709356. 5. *J.D. Lykken,* "Introduction to supersymmetry",ArXiv:hep-th/9612114. 6. *A. Bilal,* "Introduction to Supersymmetry",ArXiv:hep-th/0101055. 7. *D.I. Kazakov,* «Supersymmetric expansion of the Standard model of fundamental interactions», the works of the summer school of the «Dynasty» foundation «Physics of fundamental interactions», (2006). 8. *M. Shifman, A. Vainshtein,* "Instantons Versus Supersummetry: Fifteen years later,"ArXiv:hep-th/9902018. **Internet resources:** 1. Krasnikov N V, Matveev V A hep-ph/9703204 2. *Y.A. Golfand, E.P. Likhtman,* JETP Lett. **13** 452 (1971) 3. Volkov D V, Akulov V P *Phys. Lett. B* **46** 109 (1973) 4. Wess J, Zumino B *Nucl. Phys. B* **70** 39(1974)
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	**Crite ria-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 / ...)

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). Continuous integrals and point particles.	**2**	-
	Seminar -1 (S-1).Relativistic point particles.	**1**	*8*
2	L-2.Secondary quantization.Harmonic oscillators.	**2**	-
	S-2.Currents and secondary quantization.	**1**	*8*
3	L-3. The strings of Nambu-Goto.	**2**	-
	S-3.Boson strings.	**1**	8
	SSW-3.Quantization in the calibration of a light cone.	**1**	8
4	L-4. Two-dimensional supersymmetry.	**2**	-
	S-4. Closed strings.	**1**	*8*
	SSW-4. Destruction of spirits.	**1**	*8*
Module 2			
5	L-5. Supersymmetry	**2**	-
	S-5. Supersymmetric point particles.	**1**	8
	SSW-5. Quantization.	**1**	8
6	L.-6.Two-dimensional supersymmetry.Trees.	**2**	-
	S.-6. Local two-dimensional supersymmetry.	**1**	8
	SSW-6.Superstrings.	**1**	8
7	L.-7.Conformal field theory and the Kac-Moody algebra.	**2**	-
	S.-7. Conformal field theory.	**1**	8
	SSW-7.Superconformal field theory.	**1**	12
	1stInterme diate Control (IC1)		**100**
8	**Midterm (MT)**		**100**
	L-8.Fermion vertex operator. Spinors and trees.	**2**	-
	S-8.The Kac-Moody algebras.	**1**	8
	SSW-8. Supersymmetry.	**1**	6
Module 3			
9	L-9. Multi- loop amplitudes and Teichmüller spaces.	**2**	-
	S-9. Unitarity. One-loop amplitudes.	**1**	8
	SSW-9. Harmonic oscillators.	**1**	6
10	L-10. Field theory in the calibration of the light cone.	**2**	-
	S-10**.** Derivation of the field theory of point particles.	**1**	6
	SSW-10. Field theory of superstrings.	**1**	6
11	L-11. Field theory of BRST.	**2**	-
	S-11.Covariant field string theory.	**1**	6

	SSW-11. Closed strings and superstrings.	**1**	6
12	L-12.Geometric field string theory.	**2**	-
	S-12String group.	**1**	6
	SSW-12. Geometrical output of the action.	**1**	6
13	L-13. Anomalies and the Atiyah-Singer theorem.	**2**	-
	S-13**.** Anomalies and Feynman diagrams.	**1**	6
	SSW-13. Reduction of anomalies in string theory.	**1**	6
14	L-14.Heterotic strings and compactification.	**2**	-
	S-14.Spectrum of states. Covariant and fermion formulations.	**1**	6
	SSW-14. A ten-dimensional theory without supersymmetry	**1**	6
15	L-15**.**On the theory of supersymmetry.	**2**	-
	S-15**.**Four-dimensional superstrings.	**1**	6
	SSW-15. Review of the theory of supersymmetry.	**1**	6
	2ndInterme diate Control (IC2)		**100**
	Exam		**100**
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