

## Speciality NUCLEAR AND PARTICLE PHYSICS

Academic 2013/2014 year

Course	Compulsory – C Facultative – F Optional – O	Semester	ECTS credits	Hours				Weekly LSP	Exam or score during the term E/T
				Total	Lectures – L	Seminars – S	Practical Exercises – P		
3	4	5	6	7	8	9	10	11	12

### Compulsory courses

Linear Algebra and Analytical Geometry	C	1	8	240	60	60	0	4 4 0	E
Calculus of a function of a single real variable	C	1	8	240	60	60	0	4 4 0	E
Mechanics	C	1	6	180	45	30	0	3 2 0	E
Laboratory Exercises in Mechanics	C	1	4,5	135	0	0	45	0 0 3	T
Calculus of a function of several real variables	C	2	6	180	60	60	0	4 4 0	E
Probability and Statistics in Physics	C	2	4	120	30	0	30	2 0 2	E
Calculus of Complex Functions	C	2	4	120	30	30	0	2 2 0	E
Object-oriented Programming	C	2	5	150	45	30	0	3 2 0	T
Molecular Physics	C	2	4,5	135	30	30	0	2 2 0	E
Laboratory Exercises in Molecular Physics	C	2	4,5	135	0	0	45	0 0 3	T
Vectors and Tensors	C	3	5	150	30	30	0	2 2 0	E
Ordinary Differential Equations	C	3	5	150	30	30	0	2 2 0	E
Electricity and Magnetism	C	3	6,5	195	60	30	0	4 2 0	E
Laboratory Exercises in Electricity and Magnetism	C	3	4,5	135	0	0	45	0 0 3	T
Basics of Electronics	C	3	2	60	30	0	0	2 0 0	E

Laboratory Exercises in Basics of Electronics	<b>C</b>	3	4,5	135	0	0	45	0 0 3	<b>T</b>
Partial Differential Equations	<b>C</b>	4	4	120	30	30	0	2 2 0	<b>E</b>
Theoretical Mechanics	<b>C</b>	4	6,5	195	60	30	0	4 2 0	<b>E</b>
Optics	<b>C</b>	4	5	150	60	15	0	4 1 0	<b>E</b>
Laboratory Exercises in Optics	<b>C</b>	4	4,5	135	0	0	45	0 0 3	<b>T</b>
Programming and Computational Physics	<b>C</b>	4	4	120	30	0	30	2 0 2	<b>E</b>
Atomic Physics and Interaction of Ionizing Radiation with Matter	<b>C</b>	5	6	180	45	30	0	3 2 0	<b>E</b>
Laboratory Exercises in Atomic Physics and Interaction of Ionizing Radiation with Matter	<b>C</b>	5	4,5	135	0	0	45	0 0 3	<b>T</b>
Electrodynamics	<b>C</b>	5	6,5	195	60	30	0	4 2 0	<b>E</b>
Quantum Mechanics	<b>C</b>	5	6,5	195	60	30	0	4 2 0	<b>E</b>
Nuclear Electronics	<b>C</b>	6	6	180	45	0	45	3 0 3	<b>E</b>
Nuclear Physics	<b>C</b>	6	5	150	45	30	0	3 2 0	<b>E</b>
Laboratory Exercises in Nuclear Physics	<b>C</b>	6	4,5	135	0	0	45	0 0 3	<b>T</b>
Detectors of Ionizing Radiation	<b>C</b>	6	4,5	135	30	30	0	2 2 0	<b>E</b>
Nuclear Reactions	<b>C</b>	6	3	90	45	0	0	3 0 0	<b>E</b>
Thermodynamics and Statistical Physics	<b>C</b>	7	7	210	60	30	0	4 2 0	<b>E</b>
Dosimetry and Radiation Protection	<b>C</b>	7	7,5	225	45	0	60	3 0 4	<b>E</b>
Particle Physics	<b>C</b>	7	5	150	45	30	0	3 2 0	<b>E</b>
Astrophysics	<b>C</b>	7	4,5	135	45	15	0	3 1 0	<b>E</b>
Theory of Elementary Particles	<b>C</b>	8	5,5	165	60	30	0	4 2 0	<b>E</b>
Theoretical Nuclear Physics	<b>C</b>	8	4,5	135	45	30	0	3 2 0	<b>E</b>
Experimental Nuclear Physics	<b>C</b>	8	7,5	225	45	0	60	3 0 4	<b>E</b>

**Optional courses - the courses chosen have to add up at least 29 ECTS to the curriculum**

### RECOMMENDED OPTIONAL COURSES \*

**In the first semester the students have to sign up for courses of at least 3.5 ECTS.**

Key Experiments in Modern Physics	O	1	3,5	105	45	0	0	300	T
Programming in Unix environment	O	1	4,5	135	30	0	30	202	T

**In the second semester the students have to sign up for courses of at least 2 ECTS.**

Programming with JAVA	O	2	3,5	105	30	0	15	2 0 1	T
Smart materials and systems	O	2	3,5	105	30	0	15	2 0 1	T
Phylosophy of Science	O	1/2	6	180	60	0	0	220	T
Statistical Methods in Sociology	O	2	4,5	135	30	30	0	220	T
Quantitative Methods for Economic Analysis	O	2	4	120	30	30	0	220	T
Ecology and Environment Safety	O	2	2	60	30	0	0	200	T

**In the third semester the students have to sign up for courses of at least 2.5 ECTS.**

General Astronomy I	O	3	4,5	135	30	0	30	2 0 2	T
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**In the fourth semester the students have to sign up for courses of at least 3.0 ECTS.**

General Astronomy II	O	4	4,5	135	30	0	30	2 0 2	E
Data Bases in Economics	O	3/4	8	240	60	60	0	2 2 0	T
Data Bases	O	4	6	180	45	0	30	3 0 2	E
Statistical Data Bases and Indexes	O	4	3	90	30	0	0	2 0 0	T

**In the fifth semester the students have to sign up for courses of at least 6.5 ECTS.**

Galactic Astronomy	O	5	5	150	30	0	30	2 0 2	E
Solid state physics: essentials and high technological applications	O	5	5	150	45	15	0	3 1 0	E
Introduction to Medical Physics	O	5	3	90	45	0	0	3 0 0	E

Data analysis with ROOT and RooFit	O	5	4,5	135	30	0	30	2 0 2	T
Physical Applications of the Group Theory	O	5	6,5	195	45	30	0	3 2 0	E
<b>In the sixth semester the students have to sign up for courses of at least 3.0 ECTS.</b>									
Nuclear astrophysics	O	6	4,5	135	45	15	0	3 1 0	T
Extragalactic astronomy	O	6	2	60	30	0	0	2 0 0	E
Introduction to Monte Carlo Simulations of Radiation Transport	O	6	4,5	135	30	0	30	2 0 2	T
Functional Analysis	O	6	3	90	45	0	0	3 0 0	E
Radiochemistry	O	6	5,5	165	30	0	30	2 0 2	E
<b>In the seventh semester the students have to sign up for courses of at least 6.0 ECTS.</b>									
Modeling in Finite-size Systems	O	7	6	180	45	0	30	3 0 2	E
Computational Methods in Nuclear Engineering	O	7	6	180	45	0	30	3 0 2	E
Introduction to Quantum Field Theory	O	7	6	180	45	30	0	3 2 0	T
Gravitation	O	7	3	90	45	0	0	3 0 0	E
<b>In the eight semester the students have to sign up for courses of at least 2.5 ECTS.</b>									
Cosmology and Elementary Particles	O	8	2,5	75	45	0	0	3 0 0	T
Nuclear symmetries	O	8	5	150	45	0	30	3 0 2	E
Physics of Nuclear Fission	O	8	3	90	45	15	0	3 1 0	T
Nuclear Reactor Physics	O	8	3	90	45	0	0	3 0 0	T
Contemporary Trends in the Experimental Nuclear Physics Research	O	8	3	90	45	0	0	3 0 0	T

Besides recommended courses, the students can choose from the full list of optional courses offered in the Faculty of Physics

**Facultative courses (Their ECTS do not sum up to the compulsory 360 points to get the degree.)**

Sport	F	1/2/3	3,0	90			90	002	T
Foreign language (at choice, Bulgarian incl.)	F	1/2/3/4	12,0	360			180	030	T

### **Educational Practice and course works**

Practice	C, F, O	Semester	ECTS credits	Weeks	Hours	Exam or score during the term
Summer internship after the second year	C	4	3,0	3	90	T
Summer internship after the third year	C	6	4,0	3	120	T

### **Defence of diploma thesis**

		ECTS - credits	First state session	Second state session
Defense of diploma thesis	C	10	July	September

Sofia University "St Kliment Ohridski"

**Statement of curriculum**

Speciality " *Nuclear and Particle Physics*"

form of study – **full time**, Period of study: eight semesters

Workload, ECTS credits and ratings by semeters																											
Type of courses	I semester			II semester			III			IV			V			VI			VII			VIII semester			Total		
	Workload (hours)	ECTS – credits	number of exams	Workload (hours)	ECTS – credits	number of exams	Workload (hours)	ECTS – credits	number of exams	Workload (hours)	ECTS – credits	number of exams	Workload (hours)	ECTS – credits	number of exams	Workload (hours)	ECTS – credits	number of exams	Workload (hours)	ECTS – credits	number of exams	Workload (hours)	ECTS – credits	number of exams	Workload (hours)	ECTS – credits	number of exams
compulsory courses	795	26,5	4	840	28	6	825	27,5	6	720	24	5	705	23,5	4	690	23	5	720	24	4	525	17,5	3	5820,0	194,0	37
min optional courses	105	3,5	1	60	2	1	75	2,5	1	90	3	1	195	6,5	1	90	3	1	180	6	1	75	2,5	1	870	29,0	8
educational practice										90	3	1				120	4	1							210	7	2
Total	900	30,0	5	900	30,0	7	900	30,0	7	900	30,0	7	900	30,0	5	900	30,0	7	900	30,0	5	600	20,0	4	6900,0	230,0	47

Method of Graduation	ECTS – credits	number of hours for preparation	First state session	Second state session
Defense of diploma thesis	10	300	July	September

**Professional qualifications:**

Bachelor in Physics (specialisation in Nuclear and Particle Physics)