SOFIA UNIVERSITY "ST. KLIMENT OHRIDSKI"

FACULTY: Physics

CURRICULUM

Approve: .....

Approved by the Academic Council with protocol
№ 6 / 30 март 2016г.

Professional field: 4.1 Physical Sciences

Bachelor degree

Specialty:

P	H	H	1	2	0	1	1	6

Nuclear and Particle Physics

Form of training: Full-time
Duration of training: 8 semesters

Professional qualification: Bachelor in Nuclear and Particle Physics

Qualification characteristics

Specialty:
Nuclear and Particle Physics

1. Focus and educational purposes

The specialty of Nuclear and Particle Physics (NPP) comprises disciplines related to studies of matter at the subatomic level, and to application of physical methods developed in other areas of physics and engineering.

The program of study is especially geared toward providing the students with specific expertise allowing for immediate employment in the corporate research world or in government laboratories, or for further graduate study. Students obtain a solid physics background plus significant experience in computational science, physics of elementary particles, fundamental and applied nuclear physics, dosimetry of ionizing radiation, radioecology, accelerators and their applications. The teaching takes place entirely in English. The training methods are based on modern information technologies that rely on the well-developed Internet network of the Sofia University. Workload allows students to perform scientific research in one of the research groups at the Department of Atomic Physics from the beginning of their training.

2. Training (knowledge and skills required for successful professional activity; general theoretical and specialized training, etc.).

To perform their professional activities in accordance with the expectations the NPP bachelors must be well educated and must possess practical skills in the following fields:

1. Mathematics and Information Technology - linear algebra and analytic geometry; analysis of functions of one or more variables; probability theory and mathematical statistics; vector, tensor and complex analysis; differential equations; basic computer skills, programming and computational physics; fundamentals of information technology including object-oriented programming and database architectures.
2. Physics – mechanics, molecular physics, electricity and magnetism, optics, atomic, nuclear, and elementary particle physics, thermodynamics and statistical physics, theoretical mechanics, electrodynamics, quantum mechanics, astrophysics and cosmology.
3. Specialized training – nuclear and elementary particle physics, dosimetry and radiation protection, nuclear electronics, mathematical statistics for data, analysis, computer simulation of physical processes.

3. Professional competences

NPP Bachelors can perform advanced research in all areas where the quantum physics plays a central role. This includes both fundamental and applied research in nuclear and particle physics, computer science and computational physics, dosimetry and radiation protection, and technological developments in nuclear engineering.

Bachelors in this specialty can be involved in activities related to measurements and construction of detectors of ionizing and non-ionizing radiation, and the risk assessment upon radiation exposure, including in emergency situations. NPP Bachelors can identify various radiological factors of natural and technogenic origin, can establish procedures for monitoring and evaluation of radiation risks, and can determine the mitigation criteria for implementation and use of new technologies.

4. Professional realization

NPP Bachelors hold a university bachelor's degree in physics and can work in research institutes and laboratories, universities, high-tech companies and enterprises, as well as in many state institutions where the respective knowledge and skills are relevant.

Good language skills (in English) allow them to develop a career in international research institutes such as the European Organization for Nuclear Research (CERN) in Geneva, the Joint Institute for Nuclear Research (JINR) in Dubna, near Moscow, European Space Agency (ESA) and others. The solid training in computer science and statistical methods in various fields of human activity, as well as the additional training, which is offered via optional courses, enable the NPP bachelor diploma holders to be employed in banks, in the management of companies and enterprises and in statistical institutions.

The envisaged high and broad academic level of education in the program allows the NPP bachelors to continue their education in MSc or PhD programs not only in our university but also in other internationally well-recognized universities all over the world.

5. Admission requirements

The programme is open to citizens of countries from the European Union (EU, including Bulgarian citizens) as well as to citizens of countries outside the EU.

The EU and Bulgarian citizens are admitted according to the general rules of the St. Kliment Ohridski University of Sofia available at:
https://www.uni-sofia.bg/index.php/eng/admission/international_students/application_procedure/applicants_from_eu_member_countries
In addition to the general requirements they have to provide: (i) a grade from a State (matriculation) exam in physics or mathematics held in EU member country or to pass an admission exam in physics; (ii) a grade from a State (matriculation) exam in English language or internationally recognized certificate in English corresponding to the Level B1 or higher according to the Common European Framework of Reference for Languages.

The candidates from non-EU member countries have to comply with the general rules for admission in the St. Kliment Ohridski University of Sofia as foreign students: (http://www.uni-sofia.bg/index.php/eng/admission/international_students/applicants_from_non_eu_member_countries/).
In addition to the general requirements they have to provide a grade in physics from the high-school diploma and an internationally recognized certificate in English corresponding to the Level B1 or higher according to the Common European Framework of Reference for Languages.

Admitted foreign students are required to take a course of Bulgarian language during the first four semesters of their study.

PHH	1	2	0	1

specialty code

Speciality NUCLEAR AND PARTICLE PHYSICS

for the classes starting at the 2016/2017 academic year

№	Code ot the course	Name of the course	Type* – З, И, Ф	Semester	ECTS credits	Hours - total number				Weekly hours	Form of assesment** - и, то, ки, прод
						All	Lectures	Exercisez	Practical exercisez		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*

* *З = compulsory; И = optional; Ф = facultative*

** *И = final exam; ТО = ongoing assesment*

Compulsory courses

1	A	0	0	1	Linear Algebra and Analytical Geometry	**3**	1	8	240	60	60	0	4 4 0	И
2	A	0	0	2	Calculus of a function of a single real variable	**3**	1	8	240	60	60	0	4 4 0	И
3	A	0	0	3	Mechanics	**3**	1	6	180	45	30	0	3 2 0	И
4	A	0	0	4	Laboratory Exercises in Mechanics	**3**	1	4,5	135	0	0	45	0 0 3	ТО
5	A	0	0	5	Calculus of a function of several real variables	**3**	2	8	240	60	60	0	4 4 0	И
6	A	0	0	6	Probability and Statistics in Physics	**3**	2	4	120	30	0	30	2 0 2	И
7	A	0	0	7	Calculus of Complex Functions	**3**	2	4	120	30	30	0	2 2 0	И
8	A	0	0	8	Object-oriented Programming	**3**	2	5	150	45	30	0	3 2 0	ТО
9	A	0	0	9	Molecular Physics	**3**	2	4,5	135	30	30	0	2 2 0	И
10	A	0	1	0	Laboratory Exercises in Molecular Physics	**3**	2	4,5	135	0	0	45	0 0 3	ТО
11	A	0	1	1	Vectors and Tensors	**3**	3	5	150	30	30	0	2 2 0	И
12	A	0	1	2	Ordinary Differential Equations	**3**	3	5	150	30	30	0	2 2 0	И
13	A	0	1	3	Electricity and Magnetism	**3**	3	6,5	195	60	30	0	4 2 0	И
14	A	0	1	4	Laboratory Exercises in Electricity and Magnetism	**3**	3	4,5	135	0	0	45	0 0 3	ТО
15	A	0	1	5	Basics of Electronics	**3**	3	2	60	30	0	0	2 0 0	И

16	A	0	1	6	Laboratory Exercises in Basics of Electronics	**3**	3	4,5	135	0	0	45	0 0 3	ТО
17	A	0	1	7	Partial Differential Equations	**3**	4	4	120	30	30	0	2 2 0	И
18	A	0	1	8	Theoretical Mechanics	**3**	4	6,5	195	60	30	0	4 2 0	И
19	A	0	1	9	Optics	**3**	4	5	150	60	15	0	4 1 0	И
20	A	0	2	0	Laboratory Exercises in Optics	**3**	4	4,5	135	0	0	45	0 0 3	ТО
21	A	0	2	1	Programming and Computational Physics	**3**	4	4	120	30	0	30	2 0 2	И
22	A	0	2	2	Atomic Physics and Interaction of Ionizing Radiation with Matter	**3**	5	6	180	45	30	0	3 2 0	И
23	A	0	2	3	Laboratory Exercises in Atomic Physics and Interaction of Ionizing Radiation with Matter	**3**	5	4,5	135	0	0	45	0 0 3	ТО
24	A	0	2	4	Electrodynamics	**3**	5	6,5	195	60	30	0	4 2 0	И
25	A	0	2	5	Quantum Mechanics	**3**	5	6,5	195	60	30	0	4 2 0	И
26	E	0	0	1	Nuclear Electronics	**3**	6	6	180	45	0	45	3 0 3	И
27	E	0	0	2	Nuclear Physics	**3**	6	5	150	45	30	0	3 2 0	И
28	E	0	0	3	Laboratory Exercises in Nuclear Physics	**3**	6	4,5	135	0	0	45	0 0 3	ТО
29	E	0	0	4	Detectors of Ionizing Radiation	**3**	6	4,5	135	30	30	0	2 2 0	И
30	E	0	0	5	Nuclear Reactions	**3**	6	3	90	45	0	0	3 0 0	И
31	A	0	2	6	Thermodynamics and Statistical Physics	**3**	7	7	210	60	30	0	4 2 0	И
32	E	0	0	6	Dosimetry and Radiation Protection	**3**	7	7,5	225	45	0	60	3 0 4	И
33	E	0	0	7	Particle Physics	**3**	7	5	150	45	30	0	3 2 0	И
34	A	0	2	7	Astrophysics	**3**	7	4,5	135	45	15	0	3 1 0	И
35	E	0	0	8	Theory of Elementary Particles	**3**	8	5,5	165	60	30	0	4 2 0	И
36	E	0	0	9	Theoretical Nuclear Physics	**3**	8	4,5	135	45	30	0	3 2 0	И
37	E	0	1	0	Experimental Nuclear Physics	**3**	8	7,5	225	45	0	60	3 0 4	И

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.														
1	E	0	1	1	Key Experiments in Modern Physics	И	1	3,5	105	45	0	0	300	ТО
2	E	0	1	2	Programming in Unix environment	И	1	4,5	135	30	0	30	202	ТО
In the second semester the students have to sign up for courses of at least 2 ECTS.														
3	E	0	1	3	Programming with JAVA	И	2	3,5	105	30	0	15	201	ТО
4	E	0	1	4	Smart materials and systems	И	2	3,5	105	30	0	15	201	ТО
5	E	0	1	5	Phylosophy of Science	И	1/2	6	180	60	0	0	220	ТО
6	E	0	1	6	Statistical Methods in Sociology	И	2	4,5	135	30	30	0	220	ТО
7	E	0	1	7	Quantitative Methods for Economic Analysis	И	2	4	120	30	30	0	220	ТО
8	E	0	1	8	Ecology and Environment Safety	И	2	2	60	30	0	0	200	ТО
In the third semester the students have to sign up for courses of at least 2.5 ECTS.														
9	E	0	1	9	General Astronomy I	И	3	4,5	135	30	0	30	202	ТО
In the fourth semester the students have to sign up for courses of at least 3.0 ECTS.														
10	E	0	2	0	General Astronomy II	И	4	4,5	135	30	0	30	202	И
11	E	0	2	1	Data Bases in Economics	И	3/4	8	240	60	60	0	220	ТО
12	E	0	2	2	Data Bases	И	4	6	180	45	0	30	302	И
13	E	0	2	3	Statistical Data Bases and Indexes	И	4	3	90	30	0	0	200	ТО
In the fifth semester the students have to sign up for courses of at least 6.5 ECTS.														
14	E	0	2	4	Galactic Astronomy	И	5	5	150	30	0	30	202	И
15	E	0	2	5	Solid state physics: essentials and high technological applications	И	5	5	150	45	15	0	310	И
16	E	0	2	6	Introduction to Medical Physics	И	5	3	90	45	0	0	300	И

17	E	0	2	7	Data analysis with ROOT and RooFit	И	5	4,5	135	30	0	30	2 0 2	ТО
18	E	0	3	8	Physical Applications of the Group Theory	И	5	6,5	195	45	30	0	3 2 0	И
In the sixth semester the students have to sign up for courses of at least 3.0 ECTS.														
19	E	0	2	9	Nuclear astrophysics	И	6	4,5	135	45	15	0	3 1 0	ТО
20	E	0	3	0	Extragalactic astronomy	И	6	2	60	30	0	0	2 0 0	И
21	E	0	3	1	Introduction to Monte Carlo Simulations of Radiation Transport	И	6	4,5	135	30	0	30	2 0 2	ТО
22	E	0	3	2	Functional Analysis	И	6	3	90	45	0	0	3 0 0	И
23	E	0	3	3	Radiochemistry	И	6	5,5	165	30	0	30	2 0 2	И
In the seventh semester the students have to sign up for courses of at least 6.0 ECTS.														
24	E	0	3	4	Modelling in Finite-size Systems	И	7	6	180	45	0	30	3 0 2	И
25	E	0	3	5	Computational Methods in Nuclear Engineering	И	7	6	180	45	0	30	3 0 2	И
26	E	0	3	6	Introduction to Quantum Field Theory	И	7	6	180	45	30	0	3 2 0	ТО
27	E	0	3	7	Gravitation	И	7	3	90	45	0	0	3 0 0	И
In the eigth semester the students have to sign up for coursesof at least 2.5 ECTS.														
28	E	0	3	8	Cosmology and Elementary Particles	И	8	2,5	75	45	0	0	3 0 0	ТО
29	E	0	3	9	Nuclear symmetries	И	8	5	150	45	0	30	3 0 2	И
30	E	0	4	0	Physics of Nuclear Fission	И	8	3	90	45	15	0	3 1 0	ТО
31	E	0	4	1	Nuclear Reactor Physics	И	8	3	90	45	0	0	3 0 0	ТО
32	E	0	4	2	Contemporary Trends in the Experimental Nuclear Physics Research	И	8	3	90	45	0	0	3 0 0	ТО

*) Besides recommendedd 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 credits to get the degree.)

1	A	0	2	8	Sport	Ф	1/2/3	3,0	90			90	002	ТО
2	A	0	2	9	Bulgarian language**	Ф	1/2/3/4	12,0	360			180	030	ТО
3	A	0	3	0	Foreign language (other than Bulgarian)	Ф	1/2/3/4	12,0	360			180	30	ТО

**) Compulsory for foreign students

Interships and coursework

№	код				Name of the intership	Type – З, И, Ф	Semester	ECTS - credits	Weeks	Hours	Form of assesment - И, ТО
1	E	0	4	3	Summer internship after the second year	З	4	3,0	3	90	ТО
2	E	0	4	4	Summer internship after the third year	З	6	4,0	3	120	ТО

Graduation

Mode of graduation	ECTS - credits	First State Session	Second State Session
Defense of diploma thesis	10	July	September

The curriculum is approved by the Faculty Council with protocol № 1 от 15.01.2013 г.

DEAN:.....

SOFIA UNIVERSITY "ST. KLIMENT OHRIDSKI"

Reference - excerpt from the curriculum

Specialty ***" Nuclear and Particle Physics"***

form of training ***full time***, duration of training **8** semesters

Workload, ECTS-credits and number of marks

Type of workload	I semester			II semester			III semester			IV semester			V semester			VI semester			VII semester			VIII semester			Total		
	workload (hours)	ECTS – credits	number of marks	workload (hours)	ECTS – credits	number of marks	workload (hours)	ECTS – credits	number of marks	workload (hours)	ECTS – credits	number of marks	workload (hours)	ECTS – credits	number of marks	workload (hours)	ECTS – credits	number of marks	workload (hours)	ECTS – credits	number of marks	workload (hours)	ECTS – credits	number of marks	workload (hours)	ECTS – credits	number of marks
Comulsory 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
Minimum number of 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
Interships										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

Graduation	ECTS - credits	Hours of training	First State Session	Second State Session
Defense of diploma thesis	10	300	July	September

Professional qualification: Bachelor in Physics in Nuclear and Particle Physics

№ of protocol of the Faculty Council: 1/15.01.2013 г.

Dean: