SOFIA UNIVERSITY ST. KLIMENY OHRIDSKI

FACULTY: Physics

CURRICULUM

Approved by: .....

Approved by the Academic Council with Record of Proceedings
№ ....8..... / ...28.02.2024 год.

Professional Field: 4.1 Physics

Educational and Qualification Degree: „Master"

Area of Study: "Nuclear technology and nuclear power"

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/Master's Degree Program: " Nuclear power and technology"

Form of Study: part time
Length of Study (number of weeks*/-): 60 weeks (4 semesters)

Professional Qualification: **Master of Physics Engineer in Nuclear Power and Technologies**

Qualification Description

Master's Degree Program: *Nuclear technology and nuclear power*

1. Aims and Educational Objectives

The Master's program "Nuclear Energy and Technologies" is aimed at training students who already have a bachelor's degree in the following two areas of higher education: i) 4. Natural sciences, mathematics and informatics; and ii) 5. Technical Sciences. The aim of the program is to build interdisciplinary specialists in the fields of nuclear energy, radiation protection and radioecology, measurement, research and use of ionizing radiation and radionuclides in industry, science, technology and medicine.

The program is extremely suitable for continuing education of students who wish to retrain from another major to the major of Nuclear Engineering and Nuclear Energy. For this reason, a program is declared for a non-specialist training program.

2. Admission of students (knowledge and skills required for a successful professional realization; general and theoretical background, specific areas of study, etc.)

The program is designed for a wide range of specialists who have a bachelor's degree in the following fields of higher education: i) 4. Natural sciences, mathematics and informatics; and ii) 5.Technical Sciences. Candidates who have not completed the Bachelor's program "Nuclear Technology and Nuclear Energy" of the Faculty of Physics of the University of Sofia, in the process of their studies, will undergo training in the special courses taught in the Bachelor's degree of this specialty. According to the curriculum, these courses must be chosen in order to achieve the minimum number of credits from elective courses.

The minimum requirements for admission to the specialty are an average grade from the bachelor's degree "Good 4.00" and a successful interview. The interview date will be determined after the documents are submitted. The training in this curriculum is only paid and by correspondence. The program can also be used for bachelor's degrees in the Faculty of Physics of the Sofia University.

3. Description of the educational content (knowledge and skills required for a successful professional realization; general and theoretical background, specific areas of study, etc.)

The engineer-physicist who has completed the Master's program "Nuclear Power and Technologies" will acquire a broad fundamental training from the taught theoretical and applied disciplines, as well as solid professional knowledge in the field of specialization. An additional condition for successful completion is to be highly motivated for professional development and improvement.

The broad-based preparation is obtained from the engineering-physics orientation of the master's program, in which the following topics are covered balanced way:

- basic nuclear physics disciplines such as Neutron Physics, Physics of Nuclear Reactors, Experimental Nuclear Physics, Dosimetry and Radiation Protection, Nuclear Electronics, Introduction to Nuclear Technologies, Computational Methods in Nuclear Technologies;
- specialized theoretical and applied disciplines such as operational reactor physics and nuclear safety, reactor analysis, radiochemistry, metrology of ionizing radiation;
- engineering-applied courses such as Thermal Physics of NPP, Technical Hydromechanics, Reliability in Nuclear Power, Reactor Materials in NPP;

These compulsory disciplines, the set of elective courses, and the development and defense of a master's thesis or the successful appearance of a state exam, give a complete look to the educational program.

4. Professional and general competences, specific competences

Masters in "Nuclear Power and Technologies" must be able to:

- conduct research, improve or develop physics-related concepts, theories, practical methods, instrumentation or software;
- conduct experiments, tests and analyzes of the structure and properties of matter in fields such as mechanics, thermodynamics, electronics, communications, power generation and delivery, aerodynamics, optics and lasers, remote sensing, medicine, technological use of sound, magnetism and nuclear physics;
- evaluate results of conducted studies and experiments and draw conclusions using mathematical techniques and models;
- apply principles, techniques and processes to develop or improve industrial, medical, military and other practical applications and techniques of physics;
- advise and consult with medical practitioners and other health professionals to optimize the balance between the beneficial and harmful effects of radiation;
- develop, implement and maintain standards and protocols for the measurement of physical phenomena and for the use of nuclear technologies for industrial and medical purposes;
- prepare scientific reports and reports.

5. Professional realization (according to the National Classification of Occupations in the Republic of Bulgaria /based on the International Standard Classification of Occupations (ISCO)/ and in reference to the place of the future specialists in the National Qualifications Framework for higher education and the European Qualifications Framework for higher education)

According to the "National Classification of Professions and Positions in the Republic of Bulgaria", the main opportunity for realization is by classifier "Physicists and Astronomers". Also, professional realization can be found according to the "ORDINANCE on the conditions and procedure for acquiring professional qualifications and on the procedure for issuing licenses for specialized training and certificates of legal capacity to use nuclear energy", of the Nuclear Regulatory Agency, where a certain set of positions in the nuclear power industry that could be filled by graduates of the NPP master's program. These positions include:

- Head of a structural unit responsible for nuclear safety control of a nuclear power unit or nuclear power plant
- Head of a structural unit responsible for radiation protection or emergency preparedness of a nuclear power unit or nuclear plant
- A qualified expert in radiation protection at a nuclear power plant
- Operational personnel of research reactors
- Management staff of research reactors

According to the national classification for professional realization, these positions correspond to "Managerial positions".

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Area of Study "Nuclear technics and nuclear power (NTNP)" / Master's Degree Program "Nuclear power and technologies" (NPT), 4 semesters, part-time training

admission winter semester of 2024/2025 academic year

№	Course Code	Course Title	Type- C, E, O	Semester	ECTS credits	Classes - total number					Classes per week	Assessment* - e, ca, ce, cont.
						Total	Lectures	Seminars	Practical Classes/ Observation	Self study		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
Core Subjects												
1	M 1 1 7	Quantum physics	C	1	10.5	315	60	30	0	225		E
2	M 1 0 1	Technical hydromechanics	C	1	6	180	23	8	0	149		CA
3	H 0 9 2	Programming and Computational Physics	C	1	5	135	15	0	15	105		E
4	M 1 0 4	Operational Reactor Physics and Nuclear Safety-1	C	1	6	180	23	8	0	149		E
5	M 1 0 5	Reactor analysis	C	2	9	270	23	23	0	224		E
6	M 0 9 9	Operational Reactor Physics and Nuclear Safety-2	C	2	6	180	23	8	0	149		E
7	M 1 0 2	Reliability in nuclear power	C	3	6	180	23	8	0	149		E
8	M 1 0 7	Reactor materials in the NPP	C	3	6	180	23	2	8	147		CA
9	M 1 0 0	Thermal physics of nuclear power plants	C	3	4.5	135	15	8	0	112		E
10	M 1 0 6	Metrology of ionizing radiation	C	3	6	180	8	0	15	157		E
11	M 1 0 3	Radiochemistry	C	4	7.5	225	15	0	23	187		CA
Elective Courses – *the chosen electives have to contribute to minimum 27 credits. Allowed selestion of elective cources from other master's degree programme after approval by the head of NPT programme.*												
1	N 0 3 3	One-time course on current issues of nuclear technology and engineering*	E	1/2/3/4	3	90	8	0	0	82		E/CA
2	E 1 2 6	Physics of nuclear fission	E	1	3.0	90	23	0	0	67		E
3	H 1 4 2	Neutron physics**	E	2	5.5	165	23	15	0	127		E
4	N 0 4 9	Licensing of nuclear fuel	E	2	3	90	8	0	0	127		E
5	H 1 2 1	Introduction to Nuclear Technology**	E	2	8.5	255	15	15	30	195		E
6	H 1 3 0	Physics of nuclear reactors**	E	2	4	120	15	15	0	90		E
7	M 1 0 9	Methods of non-destructive testing of materials	E	2	6	180	23	0	8	149		E

8	H	0	2	0	Computational methods in nuclear technology	E	2	5.5	165	23	0	15	127		E
9	H	0	1	3	Dosimetry and radiation protection**	E	3	9	270	30	0	30	210		E
10	H	0	1	5	Experimental nuclear physics**	E	3	7	210	23	0	23	164		E
11	H	1	5	1	Nuclear electronics**	E	1/3	7.5	225	23	0	23	179		E
12	M	1	1	1	Nuclear Electronics 2	E	3	9	270	23	0	23	224		E
13	M	1	0	8	Environmental radioactivity and radioecology	E	3	10.5	315	30	0	23	262		E
14	E	1	2	7	Nuclear fuel cycle**	E	4	3	90	23	0	0	112		E
15	M	1	1	4	Fundamentals of Engineering	E	4	6	180	15	0	15	150		E
16	E	1	7	3	Monte Carlo modeling of the interaction of ionizing radiation with matter	E	4	4.5	135	15	8	0	112		E

Optional courses															
1	H	0	0	2	Nuclear Power Plants	O	1	4.0	120	30	15	0	75		E
2	H	1	2	0	Introduction in nuclear heat-transfer equipment	O	1	6.0	180	15	15	0	75		E
3	И	0	9	5	Absolute dating methods	O	3	4.0	120	30	0	30	60		E

*The course program is announced at the beginning of the current semester

**Courses must be select by students non specialists. Students with bachelor degree in NTNP major do not select these cources. the undergraduate stage of study. Bachelors who have auditioned for the relevant disciplines do NOT choose these courses.

Internships

№	code	Internship	Type- C, E, O	Semester	ECTS credits	weeks	hours	Assessment* e, ca, ce, cont.
1	M 1 1 6	Scientific-research intership (mandatory for students non-specialists)	3	3	6.0	5	180	E

Degree Completion

Form of degree completion	ECTS credits	First State Exam Session	Second State Exam Session
State Exam in Nuclear Power and Technology or Defence of a Master thesis (with average semestrial grade higher than 4,00)	**15**	**July**	**September**

The curriculum has been approved by the Faculty Council, Record of Proceedings № 17/12.12.2023

DEAN:.....

Sofia University "St. Kliment Ohridski"

Curriculum Reference Statement

Area of Study "Nuclear technics and nuclear power (NTNP)" / Master's Degree Program "Nuclear power and technologies" (NPT)
form of study part-time length of study: 4 Semesters

Course hours, ECTS credits and number of grades per semester																																		
Type of courses	I семестър			II семестър			III семестър			IV семестър			V			VI			VII			VIII			IX			X			Общо		
	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades	course hours	ECTS credits	number of grades
compulsory courses	182.0	27.0	4.0	77.0	15.0	2.0	110.0	22.5	4.0	38.0	7.5	1.0																			407	72	11
min elective courses	45.0	3.0	1.0	135.0	9.0	2.0	112.5	7.5	1.0	112.5	7.5	2.0																			405	27	6
optional courses	23.0	4.0	1.0	0.0	0.0	0.0	23.0	4.0	1.0	0.0	0.0	0.0																			46	8	2
internships				180.0	6.0	1.0																									180	6	1
Total:	227.0	30.0	5.0	392.0	30.0	5.0	222.5	30.0	5.0	150.5	15.0	3.0																			992	105	18

Form of degree completion	ECTS credits	Study Hours	First State Exam session	Second State Exam Session
State Exam in Nuclear Power and Technology or Defence of a Master thesis (with average semestrial grade higher than 4,00)	15	450	July	September

Acquired Professional Qualification: Master of Physics Engineer in Nuclear Power and Technologies

Record of Proceedings of the Faculty Council № 17/12.12.2023

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