PHYSICS (STUDIES IN ENGLISH)

2-year second cycle programme, full-time

1. GENERAL CHARACTERISTICS OF THE PROGRAMME

Program supported by the European Social Fund through the University's Integrated Development Programme (ZIP), whih is is a comprehensive project focused on improving the quality and effectiveness of education in Bachelor, Master and Doctoral programmes, as well as supporting adaptation of the University's offer to the needs of the economy, labour market and the society. The main aim of the programme is to contribute to the implementation of permanent changes in the functioning of the University of Warsaw, adapted to the needs of the academic community and taking into account the current socio-economic challenges. Beneficiaries of the programme will be the students of the class starting in the academic year 2019/20.

The main goal of the programme of studies consists in providing students with extended knowledge of contemporary physics and specialization in a chosen subfield of physics by developing its conceptual understanding, as well as the command of theoretical and experimental methods.

Description of specializations:

Physics of Condensed Matter and Semiconductor Nanostructures: The goal of the program consists is training professionals in experimental studies and interpretation of physical phenomena in semiconductors, semiconductor structures and other systems based of condensed matter; graduates also understand physical foundations of devices based on these materials. They are trained in experimental research, chracterization of

materials, data analysis and interpretation based on knowledge about quantum structure of matter; they are also trained in technology and applications of semiconductors and semiconductor nanostructures.

Profile of the graduate

Graduates are prepared to research and design in research institutions, R&D centers and high-tech industry.

Theoretical Physics: The goal of the program consists in training theoretical physicists well prepared to conduct their own research or to collaborate with experimental physicists, both in academic and R&D settings.

Profile of the graduate

Graduates have general knowledge about physics and selected topics in mathematics, as well as thorough knowledge in one selected topic in theoretical physics. Graduates are trained to formulate, assess critically and solve problems in advanced physics. These qualifications are appropriate for employment in research institutions, R&D laboratories, consulting complanies, insurance companies, banks and other financial institutions.

Geophysics : Modeling and monitoring of weather and climate, transport of pollution, studies of Earth, other planets and outer space are important for the economy, the society and the understanding of nature. Students are trained in atmospheric physics, Earth and planetary physics or environmental physics. Atmospheric physis includes: physical foundations of weather and climate, basics of dynamical meteorology, atmospheric thermodynamics, radiation transfer in the atmosphere, atmospheric turbulences, measurement techniques and basics of numerical modeling. Environmental physics includes: combustion theory, transport theory, aerodynamics and hydrodynamics of renewable energy, magnetohydrodynamics of the outer space, numerical simulations and statistical approach to complex systems. Earth and planetary physics focuses on physical processes regarding planets and the outer space, geophysical measurements and computer simulations.

Profile of the graduate

Graduates are well trained to work in meteorological services and other units monitoring and modeling the atmosphere, Earth or environment, including research institutions.

Computer Modeling of Physical Phenomena : Studies focus on modeling of physical processes in all branches of physics present at the Faculty of Physics, University of Warsaw. Students gain experience in modern approach to studying nature by performing state-of-the art numerical simulations of physical phenomena. MSc theses can be advised by any academic teacher employing numerical simulations in her/his research.

Profile of the graduate

Graduates have general knowledge about physics and selected topics in mathematics, as well as thorough knowledge in one selected topic in theoretical physics. Graduates are trained to formulate, assess critically and solve problems in advanced physics. These qualifications are appropriate for employment in research institutions, R&D laboratories, consulting complanies, insurance companies, banks and other financial institutions.

Optics: The goal of the program consists in training in modern optics, understood as photonics together with atomic and molecular physics. Subjects include physics of atoms and molecules, laser spectroscopy, laser physics, non-linear optics and quantum information. The training is aimed at applications of optics in various aspects of science and technology. In particular, photonics belongs to fastest-growing branches of technology, hence appropriately trained specialists are in high demand on the job market.

Profile of the graduate

Graduates can use advanced optical and electronic equipment, and they understand physical foundations of the hardware, so they can design and prepare their own optical systems. They can employ a wide variety of experimental techniques and analyze data, as well as describe observed

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phenomena, thanks to theoretical background. With this training, the graduates are higly employable in research institutions, schools and technological companies active in designing and producing photonic equipment.

2. FEATURES OF THE PROGRAM

- leading discipline: **physical sciences**
- teaching in English
- choice of specializations:
  - Theoretical Physics,
  - Computer Modeling of Physical Phenomena,
  - Physics of Condensed Matter and Semiconductor Nanostructures,
  - Geophysics,
  - Optics
- selection of specialization at the end of the first semester
- selected specialization training starts from the second semester
- physics training based on world-class research carried out at the Faculty of Physics, University of Warsaw
- training based on an individual plan of studies prepared by the student according to their interests and advised by the specialization coordinator
- many laboratory classes available
- access to computer laboratories and libraries
- access to Makerspace@UW for carrying out students' own project and prototypes
- opportunity to join research groups at the Faculty of Physics
- work placement included in the curriculum

- classes at the Faculty of Physics (ul. Pasteura 5)

Selected requirements:

a) number of ECTS points obtained from general courses unrelated to physical sciences **6**,

b) number of ECTS points obtained from courses in humanities and social sciences **5**, not necessarily diferent from general courses mentioned above,

Program for specialization: Theoretical Physics

Year of the program: first
Semester: first and second

Course name/group of courses	Type of course - number of hours								Total number of hours	Total number of ECTS points	Verification of effects related to the course
	lecture	colloquium	seminar	Recitation/exercises	Laboratory class	Workshop	Project	other			
Physics Laboratory, 2nd Level A1					45				45	5	grade

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or **Physics Laboratory, 2nd Level A2**											
Courses selected from the list Statistical physics	30			30					60	6	Exam: written or oral
Intellectual property and entrepreneurship	30								30	2	written exam
Courses selected from the list Numerical analysis									60	6	written exam or grade
Courses selected from the list Advanced quantum mechanics	30			30					60	6	written exam
Courses selected from the list Topics in contemporary physics									270	25	written exam or grade

Selected seminar			60						60	4	grade
General courses*									60	6	written exam or grade

***5 ECTS points required within the duration of the program

Total number of ECTS points (year): 60
Total number of hours (year): 645
Total number of hours for the entire program:1315

Year of the program: second
Semester: third and fourth

Course name/group of courses	Type of course - number of hours								Total number of hours	Total number of ECTS points	Verification of effects related to the course
	lecture	colloquium	seminar	Recitation/exercises	Laboratory class	Workshop	Project	other			

Work placement									70	3	pass/fail (no grade)
Team project**									75	5	grade
Proseminar Challenges of the modern times			30						30	3	grade
Courses selected from the list Topics in contemporary physics									120	12	written exam or grade
Selected seminar			60						60	4	grade
Proseminar Theoretical physics			30						30	3	grade

Workshop in theoretical physics I						120			120	10	grade
Workshop in theoretical physics II						240			240	25	pass/fail (no grade)

** Team project can be realized as a separate course or within a course if the course coordinator requires teamwork.

Total number of ECTS points (year): 60
Total number of hours (year): 670
Total number of hours for the entire program:1315

Program for specialization: Computer Modeling of Physical Phenomena

Year of the program: first
Semester: first and second

Course name/group of courses	Type of course - number of hours								Total number of hours	Total number of ECTS points	Verification of effects related to the course
	lecture	colloquium	seminar	Recitation/exercises	Laboratory class	Workshop	Project	other			
Physics Laboratory, 2nd Level A1 **or Physics Laboratory, 2nd Level A2**					45				45	5	grade
Courses selected from the list Statistical physics	30			30					60	6	Exam: written or oral
Intellectual property and entrepreneurship	30								30	2	written exam
Courses selected from the list Numerical analysis									60	6	written exam or grade
Courses selected from the list	30			30					60	6	written exam

Advanced quantum mechanics											
Courses selected from the list Topics in contemporary physics									180	18	written exam or grade
Workshop on computer modeling									105	10	written exam or grade
Selected seminar			60						60	4	grade
General courses*									30	3	written exam or grade

***5 ECTS points required within the duration of the program

Total number of ECTS points (year): 60
Total number of hours (year): 630
Total number of hours for the entire program:1300

Year of the program: second
Semester: third and fourth

Course name/group of courses	Type of course - number of hours								Total number of hours	Total number of ECTS points	Verification of effects related to the course
	lecture	colloquium	seminar	Recitation/exercises	Laboratory class	Workshop	Project	other			
Work placement									70	3	pass/fail (no grade)
Team project**									75	5	grade
Proseminar Challenges of the modern times			30						30	3	grade
Courses selected from the list Topics in contemporary physics									90	9	written exam or grade

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Selected seminar			60						60	4	grade
Proseminar Theoretical physics			30						30	3	grade
Workshop in advanced computer modeling I						135			135	13	grade
General courses*									30	3	written exam or grade
Workshop on advanced computer modeling II						225			225	22	pass/fail (no grade)

*****5 ECTS points required within the duration of the program
** Team project can be realized as a separate course or within a course if the course coordinator requires teamwork.

Total number of ECTS points (year): 60
Total number of hours (year): 670
Total number of hours for the entire program:1300

Program for specialization: Physics of Condensed Matter and Semiconductor Nanostructures

Year of the program: first
Semester: first and second

Course name/group of courses	Type of course - number of hours								Total number of hours	Total number of ECTS points	Verification of effects related to the course
	lecture	colloquium	seminar	Recitation/exercises	Laboratory class	Workshop	Project	other			
Physics Laboratory, 2nd Level A1 **or Physics Laboratory, 2nd Level A2**					45				45	5	grade
Courses selected from the list Statistical physics	30			30					60	6	Exam: written or oral
Intellectual property and entrepreneurship	30								30	2	written exam

Courses selected from the list Numerical analysis									60	6	written exam or grade
Introduction to solid state physics	30			30					60	6	written exam
Low-dimensional systems	30			30					60	6	Exam: written or oral
Magnetism and superconductivity	30								30	3	Exam: written or oral
Experimental methods in semiconductor phyiscs	30								30	3	Exam: written or oral
Physics Laboratory, 3rd Level					120				120	12	grade
Selected specialization courses									30	3	written exam or grade

Selected seminar			60						60	4	grade
General courses*									45	4	written exam or grade

***5 ECTS points required within the duration of the program

Total number of ECTS points (year): 60
Total number of hours (year): 630
Total number of hours for the entire program:1345

Year of the program: second
Semester: third and fourth

Course name/group of courses	Type of course - number of hours								Total number of hours	Total number of ECTS points	Verification of effects related to the course
	lecture	colloquium	seminar	Recitation/exercises	Laboratory class	Workshop	Project	other			
Work placement									70	3	pass/fail (no grade)
Team project**									75	5	grade
Proseminar Challenges of the modern times			30						30	3	grade
Optical properties of semiconductors	30			30					60	6	Exam: written or oral

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Diluted magnetic semiconductors	30								30	3	Exam: written or oral
Bose-Einstein condensation and superfluidity	30								30	3	Exam: written or oral
Selected specialization courses									45	4	written exam or grade
Selected seminar			60						60	4	grade
Proseminar Physics of Condensed Matter and Semiconductor Nanostructures			30						30	3	grade
Laboratory in condensed matter physics I						120			120	10	grade
Laboratory in condensed matter physics II						210			210	19	pass/fail (no grade)

General courses*									30	2	written exam or grade

** Team project can be realized as a separate course or within a course if the course coordinator requires teamwork.

Total number of ECTS points (year): 60
Total number of hours (year): 715
Total number of hours for the entire program:1345

Program for specialization: Geophysics

Year of the program: first
Semester: first and second

Course name/group of courses	Type of course - number of hours								Total number of hours	Total number of ECTS points	Verification of effects related to the course
	lecture	colloquium	seminar	Recitation/exercises	Laboratory class	Workshop	Project	other			
Physics Laboratory, 2nd Level A1					45				45	5	grade

or Physics Laboratory, 2nd Level A2											
Courses selected from the list Statistical physics	30			30					60	6	Exam: written or oral
Intellectual property and entrepreneurship	30								30	2	written exam
Courses selected from the list Numerical analysis									60	6	written exam or grade
Courses selected from the list Topics in contemporary physics									90	9	written exam or grade
Proseminar Geophysics			30						30	3	grade
Geophysical laboratory					100				100	10	grade

Courses selected from the list Topics in contemporary physics									30	3	Exam: written or oral
Selected specialization courses									120	12	written exam
General courses*									45	4	written exam or grade

***5 ECTS points required within the duration of the program

Total number of ECTS points (year): 60
Total number of hours (year): 610
Total number of hours for the entire program:1300

Year of the program: second
Semester: third and fourth

Course name/group of courses	Type of course - number of hours								Total number of hours	Total number of ECTS points	Verification of effects related to the course
	lecture	colloquium	seminar	Recitation/exercises	Laboratory class	Workshop	Project	other			
Work placement									70	3	pass/fail (no grade)
Team project**									75	5	grade
Proseminar Challenges of the modern times			30						30	3	grade
Selected specialization courses									180	18	written exam or grade

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Proseminar: Geophysics			30						30	3	grade
Geophysical Laboratory II					100				100	10	grade
Selected seminar			30						30	2	grade
General courses*									30	2	written exam or grade
Geophysics Laboratory III						210			210	19	pass/fail (no grade)

** Team project can be realized as a separate course or within a course if the course coordinator requires teamwork.

Total number of ECTS points (year): 60
Total number of hours (year): 680
Total number of hours for the entire program:1290

Program for specialization: Optics

Year of the program: first
Semester: first and second

Course name/group of courses	Type of course - number of hours								Total number of hours	Total number of ECTS points	Verification of effects related to the course
	lecture	colloquium	seminar	Recitation/exercises	Laboratory class	Workshop	Project	other			
Physics Laboratory, 2nd Level A1 **or, 2nd Level A2**					45				45	5	grade
Courses selected from the list Statistical physics	30			30					60	6	Exam: written or oral
Intellectual property and entrepreneurship	30								30	2	written exam

Courses selected from the list Numerical analysis									60	6	written exam or grade
Courses selected from the list Topics in contemporary physics									90	9	written exam or grade
Proseminar: Optics			30						30	3	grade
Optics Laboratory I					180				180	17	grade
Selected specialization courses									120	12	written exam

Total number of ECTS points (year): 60
Total number of hours (year): 615
Total number of hours for the entire program:1285

Year of the program: second
Semester: third and fourth

Course name/group of courses	Type of course - number of hours								Total number of hours	Total number of ECTS points	Verification of effects related to the course
	lecture	colloquium	seminar	Recitation/exercises	Laboratory class	Workshop	Project	other			
Work placement									70	3	pass/fail (no grade)
Team project**									75	5	grade
Proseminar Challenges of the modern times			30						30	3	grade
Selected specialization courses									60	6	written exam or grade

Optics Laboratory II					210				210	19	grade
Optics Seminar			60						60	4	grade
General courses*									30	6	written exam or grade
Optics Laboratory III						210			210	19	pass/fail (no grade)

***5 ECTS points required within the duration of the program
** Team project can be realized as a separate course or within a course if the course coordinator requires teamwork.

Total number of ECTS points (year): 60
Total number of hours (year): 670
Total number of hours for the entire program:1285