

University of Maribor
Faculty of Natural Sciences and Mathematics

Information on the degree programme
Physics

A) General description

QUALIFICATION AWARDED

- **Undergraduate programme of university studies Physics**

Qualification awarded: University degree in Physics

Duration of studies: 3 years

ADMISSION REQUIREMENTS

Undergraduate university programme:

- a) a successfully completed Matura examination or
- b) professional Matura with the fifth subject (which should differ from the professional Matura subjects) or
- c) successfully finished secondary school before June 1, 1995.

In case of enrolment limitations, applicants under a) and c) are admitted according to their GPA on the Matura examination or final exam (60% of the points) and their overall GPA in the third and the fourth year of secondary school (40% of the points).

The applicants under b) are admitted according to their GPA at the professional Matura (20% of the points), their overall GPA in the third and the fourth year of secondary school (20% of the points), their GPA in Mathematics in the third and the fourth year of the secondary school (40% of points) and the GPA at the fifth subject (20% of points).

EDUCATIONAL AND PROFESSIONAL GOALS

The main educational and professional goal is to educate the students in the following fields: analysis of dynamics of complex systems, econophysics, computational physics in combination with measurements in science and technology, biophysics (also related to medicine) and environmental physics. All the fields are in accordance with the current employment needs and the envisioned future needs of experts.

The graduates of the undergraduate and the postgraduate study are able to perform their work with the support of up-to-date communicational, informational and computer systems in different fields like economy, informatics, biophysics and technology. So the new possible areas, that can be covered by the graduates of the program Physics of complex system, lie in industry, telecommunications, biotechnology and economy.

The main general competences achieved by the graduates at both levels are:

- ability of system thinking, which enables the graduates to integrate themselves into the interdisciplinary groups, which study complex systems in different fields in science, insurance business, solution of environmental problems,
- the ability to analyze complex systems, which is a precondition to understand how the systems function in nature, environment and society,
- understanding the structure and functioning of physics systems and application of this knowledge to other fields,
- solutions of professional work problems, based on the use of scientific methods.

The main specific competences achieved by the graduates at both levels are:

- knowledge and understanding of physical systems,
- knowledge and understanding of basic physical concepts and their use to describe the processes in nature,
- understanding the interaction of physical systems with other systems in nature and society,
- understanding and solving basic physical problems at the qualitative and quantitative level,
- ability to use scientific approach for quantitative descriptions of problems related to nature, environment and society,
- the ability for safe experimental lab work and fieldwork, the ability to estimate the risk involved and knowledge of safety precautions and how to obey them,
- the presentation and interpretation of experimental data and their connection to theory, estimation of accuracy of the measured data,
- developed computational skills for problem solving,
- the ability to integrate into project, group and lab work,
- planning of project, group and lab work,
- the ability to relate the microscopic and macroscopic explanations of phenomena,
- knowledge of and understanding of impact of physics on the development of technology,
- the basic understanding of environmental problems and the role of physics in reducing and preventing the pollution.

The graduates at the postgraduate level additionally achieve the following competences:

- the ability of advanced system thinking, which enables the graduate to organize and lead the interdisciplinary groups that study complex systems in different fields in science, insurance business, solution of environmental problems,
- the ability to analyze complex systems qualitatively and quantitatively, in order to predict the future development of the system and foresee the impact of different effects on the system, thus being able to solve the real problems in nature, environment and society,
- thorough knowledge of the structure and functioning of the physical systems and the transfer of knowledge to other fields,
- professional criticism, responsibility, initiative and self sufficient work at making decisions and the leading of complicated tasks,
- the ability to work in international groups,
- knowledge of experimental and theoretical methods for testing scientific theories,
- detailed knowledge and understanding of physical systems,
- understanding of advanced physical problems and the ability to study and solve them on the quantitative level,
- the organizing and leading of project, group and lab work.

ACCESS TO FURTHER STUDIES

Graduates of the undergraduate university programme Physics of Complex Systems and graduates of any other undergraduate university programme of Physics can continue their studies at the postgraduate level leading to the M. Sc. degree. Graduates of the postgraduate level will be able to continue the studies at a higher level leading to the Doctor degree (the doctoral programme is in preparation).

COURSE STRUCTURE DIGRAM WITH CREDITS

Complete curricula of the undergraduate university programme and the post graduate programme of the Physics of Complex Systems is given in the following pages. All the courses (obligatory and elective) are given together with the semester of study, the amount

and type of the contact hours and the assigned number of the ECTS credits. The abbreviations in the curriculum have the following meaning:

L – lectures

EL – experimental lectures

S – seminar

T – tutorial

LW – lab work

FW – field work

Undergraduate university programme Physics of Complex Systems

1st year, 1st semester

Course number	Course title	L /EL	S	T	LW	FW	Total contact hours	Individual work	Total hours/ ECTS
1	Mechanics	60		30			90	120	210/7
2	Basic Measurements				30		30	60	90/3
3	Calculus	60		45			105	135	240/8
4	Computer in Physics	45			45		90	90	180/6
5	System Thinking	45			30		75	105	180/6
		210		75	105		390	510	900/30

1st year, 2nd semester

Course number	Course title	L /EL	S	T	LW	FW	Total contact hours	Individual work	Total hours/ ECTS
6	Electromagnetism	60		30			90	120	210/7
7	Physics Experiments 1				55		55	65	120/4
8	Basic Linear Algebra and Vector Analysis	60		45			105	105	210/7
9	Thermodynamics	30		30			60	90	150/5
10	Modelling of System Dynamics	45			30		75	105	210/7
		195		105	85		385	515	900/30

2nd year, 3rd semester

Course number	Course title	L /EL	S	T	LW	FW	Total contact hours	Individual work	Total hours/ ECTS
11	Oscillations and Waves	60		30			90	120	210/7
12	Physics Experiments 2				55		55	65	120/4
13	Mathematical Physics 1	45		30			75	135	210/7
14	Physics Measurements	30			30		60	30	90/3
15	Multimedia in Physics	30			15		45	105	150/5
16	Chemistry	45			15		60	60	120/4
		210		60	115		385	515	900/30

2nd year, 4th semester

Course number	Course title	L /EL	S	T	LW	FW	Total contact hours	Individual work	Total hours/ ECTS
17	Modern Physics	60		30			90	150	210/7
18	Physics Experiments 3				55		55	125	150/5
19	Mathematical Physics 2	45		30			75	165	210/7
20	Physics Today	30		15	30		75	165	120/4
21	Numerical Methods in Physics	135		75	85		295	605	210/7
		60		30			90	150	900/30

3rd year, 5th semester

Course number	Course title	L /EL	S	T	LW	FW	Total contact hours	Individual work	Total hours/ ECTS
22	Physics Experiments 4	/15			45		60	60	120/4
23	Applied Physics	15				45	60	60	120/4
24	Complex Systems	30		15			45	75	120/4
ELECTIVE COURSES – 3 have to be chosen									
25	Information Systems	45			30		75	105	180/6
26	Econophysics	60		15			75	105	180/6
27	Dynamical Systems	45			30		75	105	180/6
28	Environmental Physics	45				30	75	105	180/6
29	Physics of Biological Systems	30	15	30			75	105	180/6
							390	510	900/30

3rd year, 6th semester

Course number	Course title	L /EL	S	T	LW	FW	Total contact hours	Individual work	Total hours/ ECTS
30	Diploma Seminar	5	30				35	265	300/10
ELECTIVE COURSES: MINIMUM 15 ECTS; the student can chose also from the elective courses of the 5th semester									
32	Practical Qualifying		30				30	270	300/10
33	Introduction to Quantum Mechanics	30		30			60	90	150/5
34	Solid State	30		30			60	90	150/5
35	Communication Human - Machine	30			30		60	90	150/5
36	Photonics	45		15			60	90	150/5
37	Computer Communications and Networks	30			30		60	90	150/5
38	Embedded Systems	30			30		60	90	150/5
39	Physics of Fluids	45		15			60	90	150/5
40	Acoustics	30		15	15		60	90	150/5
41	Analytical Mechanics	45		15			60	90	150/5
42	Mechanics of Continuous Media						60	90	150/5
43	Physics in Medicine	30	15		15		60	90	150/5
44	Dynamics of Games	30		30			60	90	150/5
45	Introduction to Economics and Microeconomics	45		15			60	90	150/5
46	Macroeconomic Theory and Policy	30	15	15			60	90	150/5
47	Financial Markets and Instruments	45		15			60	90	150/5
							275 ali 185	715 ali 625	900/30

FINAL EXAMINATION

There is no final examination other than the defence of the bachelor or master thesis.

EXAMINATION AND ASSESMENT REGULATIONS

The examinations are usually written and oral. Some of the courses involve the preparation of a seminar work which is usually defended by an oral presentation. The oral examination is usually preconditioned by laboratory attendance, the successful completion of the written exam and the seminar work where required.

Timetables of examinations are issued yearly by the Faculty senate at the beginning of the academic year and are published on the faculty web page and on the notice boards. There are at least 6 examinations for each course per academic year and students are free to choose the date of examination. The students need to register for examination 7 days before the examination date. The examination can be cancelled no later than 3 days before the examination date. The use of calculators, literature and other items during the examination is determined by the lecturer and may vary from course to course.

The diploma work is presented publicly before an examination board composed of the Head of the Chair, the diploma work mentor and co-mentor.

The M. Sc. thesis is publicly presented and defended before an examination board, chaired by an internationally recognized academician, who is an expert in the field. The members of the board are also the Dean of the Faculty, the mentor, co-mentor and one or two internationally recognized academicians, who are experts in the field.

ECTS DEPARTMENTAL CO-ORDINATOR

ECTS departmental co-ordinator is the actual head of the department.

Information on the degree programme Physics

B) List of Courses

Undergraduate university programme Physics of Complex Systems

Code	Course title	Type	ECTS
	Acoustics	E	5
	Analytical Mechanics	E	5
	Applied Physics	O	4
	Basic Linear Algebra and Vector Analysis	O	7
	Basic Measurements	O	3
	Calculus	O	8
	Chemistry	O	4
	Communication Human - Machine	E	5
	Complex Systems	O	4
	Computer Communications and Networks	E	5
	Computer in Physics	O	6
	Diploma Seminar	O	10
	Dynamic of Games	E	5
	Dynamical Systems	E	6
	Econophysics	E	6
	Electromagnetism	O	7
	Embedded Systems	E	5
	Environmental Physics	E	6
	Financial Markets and Instruments	E	5
	Information Systems	E	6
	Introduction to Economics and Microeconomics	E	5
	Introduction to Quantum Mechanics	E	5
	Macroeconomic Theory and Policy	E	5
	Mathematical Physics 2	O	7
	Mathematical Physics 1	O	7
	Mechanics	O	7
	Mechanics of Continuous Media	E	5
	Modelling of System Dynamics	O	7
	Modern Physics	O	7
	Multimedia in Physics	O	5
	Numerical Methods in Physics	O	7
	Oscillations and Waves	O	7
	Photonics	E	5
	Physics Experiments 1	O	4
	Physics Experiments 2	O	5
	Physics Experiments 3	O	4
	Physics Experiments 4	O	4
	Physics in Medicine	E	5
	Physics Measurements	O	3
	Physics of Biological Systems	E	6
	Physics of Fluids	E	5
	Physics Today	O	4
	Practical Qualifying	E	10
	Selected Topics from Physics	O	5
	Solid State	E	5
	System Thinking	O	6
	Thermodynamics	O	5

O ... obligatory course E ... elective course