



# STUDY GUIDE 2020

UNDERGRADUATE PROGRAMME IN PHYSICS  
FACULTY OF MATHEMATICS AND NATURAL SCIENCES  
INSTITUT TEKNOLOGI BANDUNG

## ***Physics Building ITB***

*Jl. Ganesha 10 Bandung, West Java, Indonesia  
+62-22-2500834 (Tel); +62-22-2506452 (Fax)  
Website: [www.fi.itb.ac.id](http://www.fi.itb.ac.id)  
Email: [fisika@fi.itb.ac.id](mailto:fisika@fi.itb.ac.id)*

## The Programme



The Undergraduate Programme in Physics (UPP) at the Faculty of Mathematics and Natural Sciences - ITB, focuses its objectives to produce graduates that are capable to become professionals, such as researchers, lecturers, teachers, industrial experts as well as entrepreneurs. The objectives include:

1. Mastering knowledge and methodology of physics, and having a problem solving capability in their work.
2. Having a capability to continuously develop knowledge for further study, either formally or informally.
3. Mastering scientific methods for observing, analyzing, and understanding of physical phenomena, in addition to mastering induction as well as deduction methods and their applications to support their career.
4. Keeping with development on their physics fields of interest and their interactions with science and technology, industry and life in general.
5. Having a capability to communicate ideas orally and in writing, either scientifically or popularly, to take appropriate initiatives, and to lead a working group in relevant fields.



The Undergraduate Programme in Physics sets the programme learning outcomes (PLO) for the graduates as follows:

1. To be able to demonstrate their knowledge of classical and modern physics by identifying physical properties of a physical system.
2. To be able to formulate a standard physical system into a physical model by using mathematics.
3. To be able to solve problems of a standard physical system comprehensively by the use of mathematics and computational tools.
4. To be able to analyse a physical system by applying mathematics and computational tools/ICT.
5. To be able to design and conduct experiments in physics or related physics areas, and to acquire, analyse and interpret the resulting data.
6. To have a basic capability in oral communication and in writing scientific report in an appropriate scientific style.
7. To be able to work effectively, both individually and in group.
8. To be able to apply knowledge of physics to broader areas/interdisciplinary problems.
9. To have basic characters of a good scientist.
10. To have an ability to improve their knowledge and be able to continue their study in a higher degree program.

## Professional Job and Career Opportunities

The Undergraduate Program in Physics is not designed to produce graduates to be ready-worked for a specific job, but to be adaptive and trainable. In order to give flexibility to the graduates to adapt the current job market that are strongly driven by new science based technologies, the program equips the graduates by solid core physics along with enrichment of the intended subject and also with important skills which will enable them to match up the expectation set in the objectives. The skills are communication skill, personal skill, group skill, cognitive skill, problem solving skill, as well as IT related skill.

The alumnae of UPP work in various sectors, both government and private agencies as well as develop their own business. According to the most recent Tracer Study of ITB, waiting time for graduates of the Undergraduate Programme in Physics to get their first job is 4.5 months. The tracer study shows that 65% of graduates work in related physics job fields, such as information & communication sector (25%), education (25%) as well as professional scientific and technical services (15%). Due to their adaptability the rest of graduates spread out in non-related physics job fields such as finance, retail, and other services activities.

## Program Structure

The programme structure of the Undergraduate Programme in Physics (UPP) is designed to equip graduates with the basic knowledge, skill, competence, and attitude required as physicists as well as a professional whose career as a researcher and industrial practitioners. The programme focuses on the development of the ability to solve complex problems, to use creative and comprehensive thinking, and to develop the best alternative solutions to the problems. The programme also trains students to be able to work in multidisciplinary teams, morally responsible, and do the job ethically. Students are also equipped with the most recent information, knowledge, and skill to develop their life-long learning ability, and adaptable to a new development of science and technology. The program structure offers students the flexibility to take the course of their interest expertise. Student can even choose areas of study by combining subjects from different departments and/or faculties to tailor student goals. These goals are achieved through courses, both compulsory and elective courses, which can be grouped into 11 clusters.

No	Course Cluster	CU	Workload	ECTS credit eq. *)
1	Knowledge of core physics	43	29.9%	59.72
2	Subject in physics specialized competences	22	15.3%	30.56
3	Mathematical tools	16	11.1%	22.22
4	Physics experiments and methods	14	9.7%	19.44
5	Tools for analyzing, modelling, simulation and problem-solving	11	7.6%	15.28
6	General education	8	5.6%	11.11
7	Interdisciplinary subjects	7	4.9%	9.72
8	Communication skill	7	4.9%	9.72
9	Subject in other natural sciences	6	4.2%	8.33
10	Bachelor thesis	6	4.2%	8.33
11	Internship and independent study	4	2.8%	5.56
<b>TOTAL</b>		<b>144</b>	<b>100</b>	<b>200</b>

\*) 1 CU equivalent to ~1.39 ECTS



# Curriculum

The courses are developed by taken into account the contribution of courses to the attainment of programme learning outcomes. To meet with the international standard, courses are benchmarked with other undergraduate programmes in physics at leading universities around the world. The workload of each course is designed by considering the learning outcome to be attained, teaching, and learning strategy and availability of the learning support. The courses to support the graduate specialized competence are developed through elective courses in seven streams specialization, i.e: Theoretical Physics, Electronic Material Physics, Magnetic and Photonic Materials, Nuclear Physics, Earth physics, Instrumentation and Computational Physics, Biophysics.

The curriculum for the Undergraduate Programme in Physics consists of two stage: the first year stage (Common Preparatory Level) and the Bachelor stage with a total load of 144 credits completed in 8 semesters.

## List of elective courses

Subject	Course	CU	Semester	ECTS credit eq.
Biophysics	Biophysics	2	4	2.78
	Physics of Radiology	2	5	2.78
	Dosimetry and Radiation Protection	2	6	2.78
	Electrophysiology and Bioenergetics	2	6	2.78
	Selected Topics on Biophysics and Medical Physics	3	7	4.17
Earth Physics	Capita Selecta Earth Physics and Complex System	3	3	4.17
	Physics of Volcanoes and Geothermal Systems	2	4	2.78
	Econophysics	2	6	2.78
	Electromagnetic Methods	2	7	2.78
	Physics of Rocks and Porous Media	2	8	2.78
Electronic Materials Physics	Material Science and Engineering	2	5	2.78
	Synthesis and Characterizations of Electronic Materials	3	6	4.17
	Electronic and Optoelectronic Devices	3	7	4.17
	Selected Topics on Electronic Materials	3	8	4.17
Instrumentation and Computational Physics	Instrumentation System	3	4	4.17
	Microcontroller and Digital Instrumentation	2	5	2.78
	Network-based Instrumentation	2	6	2.78
	Computation and Smart Instrumentation System	2	7	2.78
	Special Topics in Instrumentation Physics	2	8	2.78
Magnetic and Photonic Materials	Science and Technology of Optics and Magnetics	2	4	2.78
	Photonics Theory and Applications	2	5	2.78
	Material Characterizations	2	6	2.78
	Synthesis and Physical Properties of Materials as well as their Functionalizations	3	7	4.17
Nuclear Physics	Selective Topics in Physics of Magnetism and Photonics	2	8	2.78
	Nuclear Applications and Instrumentation	2	5	2.78
	Reactor Physics	3	6	4.17
	Nuclear Fuel Management	2	6	2.78
	Special Topics on Nuclear Physics	2	8	2.78
Theoretical Physics	Thermal Hydraulics and Nuclear Safety	2	7	2.78
	Special Theory of Relativity	2	4	2.78
	General Theory of Relativity	2	5	2.78
	Advanced Quantum Physics	2	6	2.78
	Group Theory and Symmetry in Physics	2	6	2.78
	Selected Topics in Theoretical Physics	3	7	4.17
	Internships	2	5/6/7/8	2.78
	Independent Study	2	5/6/7/8	2.78

Stage	Course	CU	Semester	ECTS credits eq.
Common Preparatory Level (1st year)	Elementary Physics I	4	1	5.56
	Elementary Physics II	4	2	5.56
	Mathematics I	4	1	5.56
	Mathematics II	4	2	5.56
	General Chemistry I	3	1	4.17
	General Chemistry II	3	2	4.17
	Indonesian Language: Scientific Writing	2	1	2.78
	English	2	2	2.78
	Introduction to Mathematics and Natural Sciences	2	1	2.78
	Introduction to Engineering and Design	3	2	4.17
	Introduction to Computation	3	1	4.17
	Sports	2	2	2.78
	Bachelor Stage	Mathematical Physics I	4	3
Mathematical Physics II		4	4	5.56
Mechanics		4	3	5.56
Electromagnetic Fields		4	4	5.56
Modern Physics		4	4	5.56
Electronics		4	3	5.56
Data Processing and Analysis		2	3	2.78
Measurement Methods		2	4	2.78
Experimental Physics I		2	4	2.78
Experimental Physics II		2	5	2.78
Experimental Physics III		2	6	2.78
Waves		4	5	5.56
Quantum Physics		4	5	5.56
Thermodynamics		3	5	4.17
Fluid Mechanics		3	6	4.17
Statistical Physics		3	6	4.17
ITB Compulsory Courses: Religion and Ethics		2	3/4	2.78
ITB Compulsory Courses: Pancasila and Civic Education		2	3/4	2.78
ITB Compulsory Courses: Management		2	5/6	2.78
ITB Compulsory Courses: Environmental		2	5/6	2.78
Computational Physics		3	6	4.17
Simulation and Modelling of Physical Systems		3	7/8	4.17
Problem-solving in Physics		2	7/8	2.78
Solid State Physics		3	7/8	4.17
Nuclear and Particle Physics		3	7/8	4.17
Scientific Communication		3	7/8	4.17
Final Project I		3	7/8	4.17
Final Project II	3	7/8	4.17	
Elective Courses	26	3-8	36.11	

- Core Physics
- Mathematical Tools
- Other Natural Sciences
- Communication Skill
- Interdisciplinary
- Analyzing, modelling, problem solving
- General Education
- Experiments
- Thesis (Final Project)
- Physics Specific, Internships, Independent Study, etc

## Student Activities

In addition to the student activity units at the ITB level, student activities in UPP are specifically accommodated by HIMAFI - ITB: the Physics Student Association. HIMAFI - ITB regularly organizes workshops/ seminars, industrial visits, physics competitions for high school students or university students on a national scale.

