

## For entrants in AY 2019

subjects in which they can study state of the art knowledge in areas such as space, elementary science, and optics.

The process is a bottom-up process. In the Physics Program, subjects are arranged as a hierarchy as liberal arts, specialized basic subjects, and specialized subjects, in order to enable students to acquire knowledge and skills related to physics. In the courses before students take specialized subjects, they are intended to acquire the basic academic skills required for science studies in general, not limited to fields of physics.

In the fundamental subjects and specialized fundamental subjects, lectures are provided based on a

model syllabus in which important items students are required to learn in this program are systematically organized into a step-by-step process. In the specialized courses, students are permitted to observe the research activities of faculty members, in order to gain an understanding of the details of state-of-the-art research in the area they have chosen, and to acquire knowledge, abilities, and skills related to physics. The study in specialized courses is designed to have a certain continuity with courses in the graduate school. The liberal arts subjects which are not directly related to the basis for physics are intended to achieve the aim of liberal arts education in Hiroshima University, namely to

to educate students to acquire the basic and specialized knowledge, abilities, and skills related

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The ability to think logically while fully applying knowledge, abilities, and skills related to physics to objective facts derived from experiments, observations, and the results of model calculations;

The qualities necessary for working in various areas such as scientific research, education, and business, with a broad perspective that is not limited to the fields of physics and ethics; and

An international consciousness, and the ability to report, discuss, and present scientific contents in English.

4. Curriculum policy (policy for organizing and implementing the curriculum)

To allow students to obtain the knowledge, abilities, and skills related to physics that represent the culmination of the learning process, this program is composed of subject groups that are organized hierarchically into those of liberal arts subjects, specialized basic subjects, and specialized subjects. Courses taken before students take specialized subjects are designed to educate students to acquire the basic academic skills required for scientific studies in general, not limited to the fields of physics. For specialized basic subjects, practical lessons are provided, corresponding to each lecture, to educate students to develop their understanding and ability in the application of physics. Their academic achievement is evaluated based on their grade scores for the subjects and their achievement level against the target set for this program. The educational courses are organized and implemented according to the following policies:

Students are able to acquire the basics of physics through the study of subjects such as mathematics in physics, mechanics, electromagnetism, quantum mechanics, and thermodynamics and statistical mechanics. Furthermore, students enhance their knowledge and understanding in their specialized area through specialized subjects provided for advanced expertise. In addition to this, students learn experiment techniques in the subject "experiments in general physics";

Students receive education in the subject "experiments in general physics" and their graduation research to obtain the ability to think logically while fully applying their knowledge, abilities, and skills related to physics to objective facts derived from experiments, observations, and the results of model calculations;

Students are able, through liberal arts subjects, seminars, and graduation research to acquire the necessary qualities for working in various areas such as scientific research, education, and business, with a broad perspective that is not limited to the fields of physics and ethics; and

## 6. Obtainable qualifications

Educational personnel certification

1: Type 1 License for Junior High School Teacher (Science)

2: Type 1 License for High School Teacher (Science)

Curator license

Assistant registered surveyor

## 7. Class subjects and their contents

\* For the class subjects, refer to the subject table in Attachment 1.

\* For the details of the class subjects, refer to the syllabus that is published for each academic year.

## 8. Academic achievement

The evaluation criteria are specified for each evaluation item for academic achievement, and the level of achievement against these criteria is designated at the end of the semester.

The evaluation score for each evaluation item is converted to a numerical value (S = 4, A = 3, B = 2, and C = 1) and the evaluation standard for academic achievement, from when the student entered the university to the current semester, is determined using these values while applying weightings. The evaluation standards consist of three levels, i.e. Excellent, Very Good, and Good.

Evaluation of academic achievement	Converted value
S (90 or more points)	4
A (80 – 89 points)	3
B (70 – 79 points)	2
C (60 – 69 points)	1

Academic achievement	Evaluation criteria
Excellent	3.00 – 4.00
Very Good	2.00 – 2.99
Good	1.00 – 1.99

\* Refer to the relationship between evaluation items and evaluation criteria described in Attachment 2.

\* Refer to the relationship between evaluation items and class subjects described in Attachment 3.

\* Refer to the curriculum map in Attachment 4.

## 9 Graduation thesis (graduation research) (meaning, student allocation, timing, etc.)

### 1. Purpose

Students are able to observe the research activities of faculty members in order to broaden their understanding of state-of-the-art research in their area of choice. In addition to organizing the knowledge of physics that they have acquired up to the third year, they are able to acquire further specialized understanding that can be used in graduate school courses, as well as the abilities and skills required by independent researchers.

### 2. Overview

The contents of the graduation research vary widely depending on the laboratory to which the student is allocated. Students are able to get to know the specialty of each mentor while taking the subject "advanced

physics." The topic for graduation research in the laboratory made known during a focused guidance session.

### 3. Student allocation timing and method

1 Students are allocated to a laboratory at the beginning of the fourth academic year. To be allocated to a laboratory, students must satisfy the "Conditions for Starting Graduation Research."

2 For the "Conditions for Starting Graduation Research," refer to "Criteria for Attendance 2" in "Study Guidance for the Physics Program" in the "Students Handbook" (received when the student enters the university).

## 10 Responsibility

### (1) Responsibility for PDCA (plan, do, check, and act) cycle

The faculty committee of the Physics Program (chief: chair of the Department of Physics) is engaged in the "plan" and "do" processes.

For the processes "check" and "act", the chair of the Department of Physics consults with the committee responsible (the education affairs committee) and carries out the required actions while taking the results of the consultation into consideration.

The faculty members who constitute the faculty committee for each major program are listed in Attachment 5.

### (2) Evaluation of the program

#### 1 Perspectives for evaluation of the program

The program is reviewed and evaluated in general for its contents and composition, based on the level of understanding and achievement of students, taking into account the standard levels of knowledge in physics.

#### 2 Evaluation method (also describing the relationship to class evaluation)

The program is reviewed and evaluated by the faculty committee based on evaluation from the perspective both of the students and of the faculty members.

From the perspective of the students, the program is reviewed based on the results of the analysis of the "class questionnaire", as well as on the opinions and requests expressed during the "roundtable meeting with students". From the perspective of members of faculty, the program is reviewed based on the analysis of the "faculty members' evaluation of achievement in the subject" using such measures as score distribution and results of follow-up checks. The education affairs committee prepares a draft of the report on the review and evaluation, and the faculty committee discusses it.

#### 3 Policy and method for feedback to students

Based on the evaluation of the level of understanding and achievement of students, feedback is provided regarding the methodology and contents of classes, the teachers in charge of the classes, and the composition of the program.

##### (1) Methodology and contents of class

Based on the results of the analysis of the "class questionnaire" and the analysis of the "faculty members' evaluation of achievement in the subject", advice is provided to the faculty members who are in charge of the classes for the purpose of reviewing or improving of the methodology and contents of the classes.

##### (2) Teachers in charge of the classes

Although an appropriate faculty member is assigned to each subject, consideration may be given to possibly changing the faculty member based on evaluation of the analysis of the "class questionnaire".

(3) Review of the composition of the program

Revision of the program that requires revision of the curriculum is conducted from both mid- and long-term perspectives. Even in the case of minor revisions, while taking into account the current stage that has been reached in the academic year, these revisions are made in order to help students improve their understanding and achievement.

credit for those subjects that the faculty committee of the Physics Program certifies is accepted as the required credit for graduation.

Type	Subject type			Required No. of credits	Class subjects, etc.	No. of credits	Type of course registration	Year in which the subject is taken (*The lower figure means semester) Note 1										
								1st grade		2nd grade		3rd grade		4th grade				
								Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall			
								1	2	3	4	5	6	7	8			
Liberal Arts Education Subjects	Basic Courses in University Education	Peace Science Courses			2	From "Peace Science Courses"	Each 2	Elective/required										
		Introduction to University Education			2	Introduction to University Education	2	Required										
		Introductory Seminar for First-Year Students			2	Introductory Seminar for First-Year Students	2	Required										
	Common Subjects	Area Courses					1 or 2	Elective/required										
		Foreign Languages	Basic English Usage	2	Basic English Usage I	1	Required											
					Basic English Usage II	1												
				2		1	Required											
						1												
				2		1	Required											
						1												
			(0)		1	Free elective												
					1													
					1													
					1													
		Information Courses			2	Exercise in Information Literacy	2	Required										
		Health and Sports Courses			2	From "Health and Sports Courses"	1 or 2	Elective/required										
		Social Cooperation Courses			(0)	From "Social Cooperation Courses"	1 or 2	Free elective										
	Foundation Courses			12	10	Calculus I	2	Required										
						Calculus II	2											
							2											
							2											
							1											
							1											
				2	From "Foundation Courses"	1 or 2	Elective/required											

Any credit earned that exceeds 4 credits is accepted as credit for the category of "Any subject".

because some subjects might be provided in an intensive course.



# Academic achievements of Physics Program

## Relationships between the evaluation items and evaluation criteria

Academic achievements			Evaluation criteria		
Evaluation items			Excellent	Very Good	Good
Knowledge and Understanding	(1)	Knowledge and understanding of physical mathematics, mechanics, electromagnetism, thermodynamics, statistical mechanics and quantum mechanics.	To be able to sufficiently understand and consider physical mathematics, mechanics, electromagnetism, thermodynamics, statistical mechanics and quantum mechanics. Also, to be able to further consider.	To be able to sufficiently understand and consider physical mathematics, mechanics, electromagnetism, thermodynamics, statistical mechanics and quantum mechanics.	To be able to understand the basics of physical mathematics, mechanics, electromagnetism, thermodynamics, statistical mechanics and quantum mechanics.
	(2)	Knowledge and understanding of specialized field of elementary particle physics, cosmophysics, astrophysics, solid-state physics, condensed matter physics and radiation physics.	To be able to precisely understand technical knowledge of elementary particle physics, cosmophysics, astrophysics, solid-state physics, condensed matter physics and radiation physics. Also, to be able to evolve opinions logically.	To be able to precisely understand and examine basic technical knowledge about elementary particle physics, cosmophysics, astrophysics, solid-state physics, condensed matter physics and radiation physics.	To be able to understand and examine basic technical knowledge about elementary particle physics, cosmophysics, astrophysics, solid-state physics, condensed matter physics and radiation physics.
	(3)	that you can practice reading comprehension, journal publication, conference presentation.	1. Being able to correctly understand the contents of papers written in English or other languages. 2. Being able to appropriately write scientific contents in English or other languages. 3. Being able to make well-grounded discussion and effective presentations in English or other languages.	1. Being able to understand the contents of papers written in English or other languages. 2. Being able to write scientific contents in English or other languages. 3. Being able to make discussion and presentations in English or other languages.	1. Being able to understand the contents of papers written in English or other languages. 2. Being able to write scientific contents in English or other languages.
	(4)	The knowledge and understanding on construction and development process and relations with culture and society of each academic discipline.	Being able to understand, deeply consider and explain construction and development process and relations with culture and society of each academic discipline.	Being able to understand and explain construction and development process and relations with culture and society of each academic discipline.	Being able to understand construction and development process and relations with culture and society of each academic discipline.
Abilities and Skills	(1)	Ability to formulate and solve physical problems.	1. Being able to assume appropriate physical principles. 2. Being able to set up models and assume quantities to solve issues. 3. Being able to release results based on clear hypotheses and similarities.	1. Being able to assume appropriate physical principles. 2. Being able to set up models to solve issues. 3. Being able to release results based on hypotheses and similarities.	To be able to formulate and solve physical problems.
	(2)	Mathematical ability to describe physical items.	1. Being able to correctly understand the role of approximation and meaning of mathematical modeling. 2. Being able to critically compare experiments, observation and other objective facts to model calculating results.	1. Being able to understand the role of approximation and meaning of mathematical modeling. 2. Being able to compare experiments, observation and other objective facts to model calculating results.	To be able to understand the basic mathematics required for describing physics.
	(3)	experiment results and solution to given issues into report.	1. Being able to find solution of issues by understanding the concepts making use of some appropriate documents facilities and to integrate them into reports. 2. Being able to select appropriate ways for data analysis. 3. Being able to appropriately assess errors and accuracy in analysis. 4. Being able to relate their own results acquired as a result of the assessment to physical theory.	1. Being able to find solution of issues making use of some appropriate documents facilities and to integrate them into reports. 2. Being able to conduct appropriate ways for data analysis. 3. Being able to appropriately assess errors and accuracy of analysis. 4. Being able to lead conclusion from their own study.	1. Being able to carry out research and experiments and to integrate them into reports. 2. Being able to find out a solution toward given challenges.



Academic achievements	Evaluation criteria		
Evaluation items	Excellent	Very Good	Good
(4) Acquisition of understanding of the principles, research methods and skills of physics.	1. Being able to understand principles of physical experiments and detailed ways and procedures to get correct data. 2. Having acquired experimental technique to develop the experiments. 3. Being able to analyze experimental data appropriately.	2.4.(g)(6)2.4.(f)(7)2.4.(e)(8)2.4.(d)(9)	T.3(t2-1.11 T(a)2.9)eT(b)d)

## Relationships between the evaluation items and class subjects

[illegible]

Subject Classification	Subject Name	Credits	Type of course registration	Grade	Evaluation items																												Total weighted values of evaluation items in the subject
					Knowledge and Understanding								Abilities and Skills								Comprehensive Abilities												
					(1)		(2)		(3)		(4)		(1)		(2)		(3)		(4)		(1)		(2)		(3)		(4)						
					Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject				
Specialized Education	Introduction to Earth and Planetary Sciences A	2	Elective/required	1							100	1																	100				
Specialized Education	Introduction to Earth and Planetary Sciences B	2	Elective/required	2							100	1																	100				
Specialized Education	English on Physics	2	Elective/required	3			50	1	50	1																			100				
Specialized Education	Mechanics A	2	Required	1	100	1																							100				
Specialized Education	Mechanics B	2	Required	2	100	1																							100				
Specialized Education	Exercises in Mechanics	2	Required	2									100	1															100				
Specialized Education	Mathematics for Physics B	2	Required	2											100	1													100				
Specialized Education	Analytical Mechanics	2	Required	3	100	1																							100				
Specialized Education	Thermodynamics Mechanics	2	Required	3	100	1																							100				
Specialized Education	Electromagnetism I	2	Required	3	100	1																							100				
Specialized Education	Exercises in Electromagnetism	2	Required	3									100	1															100				
Specialized Education	Mathematics for Physics C	2	Required	3											100	1													100				
Specialized Education	Electromagnetism II	2	Required	4	100	1																							100				
Specialized Education	Quantum Mechanics I	3	Required	4	100	1																							100				
Specialized Education	Mathematics for Physics D	2	Required	4											100	1													100				
Specialized Education	Quantum Mechanics II	2	Required	5	100	1																							100				
Specialized Education	Exercises in Quantum Mechanics	2	Required	5									100	1															100				
Specialized Education	Statistical Mechanics I	2	Required	5	100	1																							100				
Specialized Education	Statistical Mechanics II	2	Required	6	100	1																							100				
Specialized Education	Exercises in Statistical Mechanics	2	Required	6									100	1															100				
Specialized Education	Exercises of Physics	2	Free elective	1									100	1															100				
Specialized Education	Mathematics for Physics A	2	Free elective	1											100	1													100				
Specialized Education	Introduction of Physics	2	Free elective	2	100	1																							100				
Specialized Education	Exercise in Electromagnetism and Quantum Mechanics	2	Free elective	4									100	1															100				
Specialized Education	Computational Physics	2	Free elective	4																					100	1			100				
Specialized Education	Physics Internship	1	Free elective	3																			100	1					100				
Specialized Education	Experimental Methods in Physics	2	Required	4														50	1	50	1								100				
Specialized Education	Laboratory in Physics I	3	Required	5														35	1	35	1	30	1						100				
Specialized Education	Laboratory in Physics II	3	Required	6														35	1	35	1	30	1						100				



	statistical mechanics and quantum	Mechanics A	Mechanics B	Analytical Mechanics	Electromagnetism II	Quantum Mechanics II	Statistical Mechanics II			
			Introduction of Physics	Thermodynamics Mechanics	Quantum Mechanics I	Statistical Mechanics I				
				Electromagnetism I						
				English on Physics				Relativistic Quantum Mechanics( )		
						Applied Electromagnetic Mechanics( )				
	Acquiring science english foreign	Communication IA	Communication IIA							
		Communication IB	Communication IIB							
		Basic English Usage I	Basic English Usage II							
			Foreign Languages: Basic Studies	English on Physics						
		Foreign Languages: Basic Studies	Foreign Languages: Basic Studies							
		Students								
		Area Courses	Area Courses	Area Courses	Area Courses					
		Introduction to Chemistry	Introduction to Chemistry B							
		Sciences	Sciences B							
		Introduction to Mathematics	Mathematics							
		Peace Science Courses								
			Exercises of Physics( )	Exercises in Mechanics	Exercises in Electromagnetism( )	Quantum Mechanics( )	Mechanics( )	Mechanics( )		
		Mathematics for Physics A	Mathematics for Physics B	Mathematics for Physics C	Mathematics for Physics D					
		Calculus	Calculus							
		Linear Algebra	Linear Algebra							
The ability skills to compile research and		Students		Work in Physics ( )	Physics( )	Laboratory in Physics I( )	Laboratory in Physics II( )	Special Study for Graduation A( )	Special Study for Graduation B( )	
				Work in Physics ( )						
Acquisition of understanding of the				Work in Physics ( )	Physics( )	Laboratory in Physics I( )	Laboratory in Physics II( )			
				Work in Physics ( )						
	Problem-solving ability ability of	Social Cooperation Courses	Social Cooperation Courses			Laboratory in Physics I( )	Laboratory in Physics II( )	Special Study for Graduation ( )	Special Study for Graduation B( )	
		Students		Physics Internship				Special Study for Graduation ( )	Special Study for Graduation B( )	
		Exercise in Information Literacy			Computational Physics			Special Study for Graduation ( )	Special Study for Graduation B( )	
		Health and Sports Courses	Health and Sports Courses							
						Required	Elective/required	Free elective		