

Tokyo Metropolitan University Graduate School Education Curriculum Diploma Policy and Curriculum Organization and Implementation Policies

Program: Graduate School of Science — Physics

1. Diploma Policy (DP)

(1) Degrees to be conferred

[Master's Program]

Master's degree (Master of Science): Awarded upon successful completion

[Doctoral Program]

Doctorate (Doctor of Science): Awarded upon successful completion

(2) Certifications to be granted

- i. Certifications to be granted upon completion of specified courses

Junior High School Advanced Teacher's License in Science, High School Advanced Teacher's License in Science

Students can obtain the above teacher's license by satisfying the condition that they have completed the master's or doctoral program and completed and earned credits for specified teacher training and subject courses (lectures, exercises, practices).

(3) Educational goals

The Department of Physics aims to develop individuals with advanced knowledge and research skills in physics covering the wide range of the natural world, including elementary particles, substances with various structures, and the universe. It also aims to develop competent individuals who can lead the next generation of advanced science and solve various social and environmental issues based on science.

[Master's Program]

The master's program aims to develop researchers, professional engineers, and educators specializing in physics as a basis for science and technology who have basic knowledge in physics and a global perspective and interact with other natural science fields. In order to achieve these objectives, students will acquire:

1. The basic knowledge necessary for conducting research in physics as well as logical thinking and practical research methods.
2. The ability to initiate research projects in each field of physics, solve problems, conduct research individually or under the graduate advisor's guidance, as well as the ability to write logically organized papers and present the research findings.
3. The ability to discuss with other researchers and present research findings from a broad perspective.

[Doctoral Program]

The doctoral program aims to develop individuals to be independent researchers and research supervisors who can conduct leading research activities in the global arena. The students will develop broad insights into fundamental and applied physics while having the social responsibilities associated with research in mind. The students will acquire:

1. The extensive knowledge, logical thinking, and practical research methods necessary to identify advanced and important research projects in physics.
2. The ability to initiate unique research projects in each field of physics, plan and conduct research, and develop the ability to deliver adequate research findings, write original papers, and publish them in international journals.

3. The ability to conduct research projects as an independent researcher, engage in international research discussions, widely present the findings and significance of the research, and associate the research projects with the society.

(4) Program features

Master's and doctoral students are assigned to a laboratory to pursue research projects in their respective specialized fields. Students will acquire the knowledge and skills necessary for cutting-edge research with a group of research staff (professors, associate professors, and assistant professors) and other graduate students in the laboratory. The students also pursue their own research projects and present their findings in a thesis/dissertation. The Department of Physics has 16 laboratories consisting of four groups of theoretical and experimental physics in each field of elementary particles, nuclei, the universe, and materials, covering the major fields of physics. In addition to earning the required credits, students must submit a thesis and a dissertation in the master's and doctoral programs, respectively, to complete the program.

The interdisciplinary and multi-layered curriculum aims to systematically develop the knowledge and skills necessary to pursue their research projects. The curriculum offers core courses in the fundamentals of physics, specialized applied physics courses, intensive lectures given by external experts, physics-chemistry combined courses provided by both the Physics and Chemistry departments, and courses in English for science.

After completing the master's program, students will acquire knowledge and independent research skills in specialized fields, as well as solid basic knowledge and problem-solving skills so that students can be successful in a wide range of fields, including information and communications industries, electrical and mechanical industries, and physical and chemical manufacturing industries. Students are also encouraged to continue their research in the doctoral program at Tokyo Metropolitan University or other universities. While the curriculum also encourages students to engage in research and education as university faculty members after completing the doctoral program, it aims to develop the ability to work continuously as researchers or engineers at public research institutions and companies in Japan and abroad.

(5) Specialized knowledge, R&D skills, and other skills

The curriculum aims to develop individuals with advanced knowledge and research skills in physics covering the wide range of the natural world, including elementary particles, substances with various structures, and the universe. It also aims to develop individuals who can lead the next generation of advanced science and solve various social and environmental issues based on science. See Section (3) for the details of specialized knowledge, R&D skills, and other skills that can be acquired in the master's and doctoral programs.

(6) Completion requirements

Completion requirements of the master's and doctoral program are prescribed in the Graduate School Rules of Tokyo Metropolitan University and the Department Rules of the Department of Physics. The students currently enrolled are advised to refer to the Course Guide issued in the first year of enrollment to check the completion requirements of the enrolled program. The outline of completion requirements is as follows:

[Master's Program]

In order to complete the master's program, students must complete the two-year enrollment period by attending regular classes, acquiring 30 or more credits of required courses in the master's program, submitting a thesis, and taking the final examination. In this case, if the graduate advisor considers it academically beneficial, up to 10 credits out of the 30 credits may be earned by taking non-major courses provided by the same graduate school or major courses provided by other graduate schools as prescribed by the Graduate School of Science. The standard enrollment period in the master's program is two years, and the enrollment period must not exceed four years.

1. The following courses are required for the master's degree.
 - [For theoretical physics]
 - Advanced Seminar in Physics I–IV and
 - Advanced Practice in Physics I–IV
 - [For experimental physics]
 - Advanced Seminar in Physics I–IV and
 - Advanced Experiment in Physics I–IV
2. For students admitted for early completion due to their outstanding research achievements, some of the requirements in Section 1 may be waived.

The thesis evaluation process and criteria are as follows:

An applicant shall decide a thesis title with the prior approval of their graduate advisor and submit the completed thesis to them. The applicant shall submit a degree application to the Graduate Faculty Committee with a document certifying that the thesis has been accepted by their graduate advisor.

Acceptance/rejection of the degree application shall be decided by the Graduate Faculty Committee. If the application is accepted, the Graduate Faculty Committee shall establish a Review Committee consisting of three or more faculty members, including the chief examiner, with extra examiners from other graduate schools or universities/institutions if necessary. The Review Committee shall rigorously review the content of the submitted thesis. The applicant shall write and submit the master's thesis in Japanese or English. The applicant shall give a public presentation on the research findings in Japanese or English and answer questions. The Review Committee shall determine pass or fail on the thesis and presentation based on the criteria below and report the result to the Graduate Faculty Committee through the Department Meeting. The Graduate Faculty Committee shall make the final decision on whether to confer a degree.

- (1) Did the applicant engage in a research project of scientific importance?
- (2) Were the research plan and methods appropriate?
- (3) Did the applicant conduct research activities sufficiently during the period of the standard two-year program?
- (4) Did the applicant perform an appropriate analysis of the research findings?
- (5) Was the thesis written in logical and clear language?
- (6) Were the presentation and response to questions in the thesis presentation logical and clear?

[Doctoral Program]

In order to complete the doctoral program, students must complete the three-year enrollment period by attending regular classes, acquiring 20 or more credits in the required courses of the doctoral program, submitting a dissertation, and taking the final examination. The standard enrollment period in the doctoral program is three years, and the enrollment period must not exceed six years.

- (1) The following courses are required for the doctorate.
 - [For theoretical physics]
 - Advanced Practice in Physics V–VIII
 - [For experimental physics]
 - Advanced Experiment in Physics V–VIII
- (2) For students admitted for early completion due to their outstanding research achievements, some of the requirements in Section 1 may be waived.

The dissertation evaluation process and criteria are as follows:

An applicant shall decide the dissertation title with the prior approval of their graduate advisor and submit the completed dissertation written in English to the graduate advisor and a degree application to the Graduate Faculty Committee. If the Graduate Faculty Committee accepts the application, it shall establish a Review Committee consisting of three or more faculty members, including the chief examiner, with extra examiners from other graduate schools or universities/institutions if necessary. The Review Committee shall review the content of the submitted dissertation. After the Review Committee approves, the applicant shall submit the dissertation to the Graduate Faculty Committee. The applicant shall give a public presentation on the research findings in Japanese or English and answer questions. The Review Committee shall determine pass or fail on the dissertation and presentation based on the criteria below and report the result to the Graduate Faculty Committee through the Department Meeting. The Graduate Faculty

Committee shall make the final decision on whether to confer a degree.

- (1) Did the applicant engage in a research project on an unsolved issue with scientific significance?
- (2) Were the research plan and methods appropriate and sufficient?
- (3) Did the applicant achieve significant results on the research project?
- (4) Was the dissertation written in logical and clear language?
- (5) Were the presentation and response to questions in the dissertation presentation logical and clear?
- (6) Have the major research findings been published or will they be published in a peer-reviewed academic journal?
- (7) Are appropriate ethical considerations given to planning and conducting research, presenting the research findings, and storing the data?

(Appended table)

List of Graduate School Courses (for students first enrolled in 2018)

[Master's Program]

- General Relativity
- Statistical
- Physics Field Theory
- Fluid Mechanics
- Nuclear Physics
- Particle Physics
- Astrophysics
- Atomic Physics
- Solid State Physics I, II
- Solid State Physics with Particle Beam
- Advanced Particle Physics
- Advanced High Energy Theoretical Physics
- Advanced Subatomic Physics
- Advanced High Energy Astrophysics I, II
- Advanced Nonlinear Physics
- Advanced Statistical Mechanics
- Advanced Quantum Many Body System
- Advanced Physics of Superconductivity
- Advanced Physics of Magnetism
- Advanced High Energy Physics I, II
- Advanced Atomic Physics I, II
- Advanced Astrophysics I, II
- Advanced Correlated Electron Physics I, II
- Advanced Nanophysical and Surface Optical Properties I, II
- Advanced Soft Matter Physics I, II
- Advanced Neutron Scattering and Magnetism I
- Advanced Minimum Material Science
- Advanced Experimental Technique in Physics A, B, C, D
- Advanced English for Science
- Advanced Seminar in Physics I–IV
- Advanced Experiment in Physics I–IV
- Advanced Practice in Physics I–IV

[Doctoral Program]

- Advanced Particle Physics
- Advanced High Energy Theoretical Physics
- Advanced Subatomic Physics
- Advanced High Energy Astrophysics I, II
- Advanced Nonlinear Physics
- Advanced Statistical Mechanics

- Advanced Quantum Many Body System
- Advanced Physics of Superconductivity
- Advanced High Energy Physics I, II
- Advanced Atomic Physics I, II
- Advanced Astrophysics I, II
- Advanced Correlated Electron Physics I, II
- Advanced Nanophysical and Surface Optical Properties I, II
- Advanced Soft Matter Physics I, II
- Advanced Neutron Scattering and Magnetism I
- Advanced Minimum Material Science
- Advanced Experimental Technique in Physics A, B, C, D
- Advanced English for Science
- Advanced Experiment in Physics V–VIII
- Advanced Practice in Physics V–VIII

2. Curriculum Policy (CP): Policy on curriculum organization and implementation

(1) Basic policy on curriculum organization

The curriculum shall be appropriately organized to provide students with a high level of expert knowledge and competence in their field of study and to develop basic knowledge in related fields as follows.

[Master's Program]

The master's program aims to develop researchers, professional engineers, and educators specializing in physics as a basis for science and technology, who have basic knowledge in physics and a global perspective and interact with other natural science fields. Each course in the master's program is in line with this goal, and the curriculum is designed to promote a systematic study.

The curriculum has a range of core courses extended from undergraduate courses to help students acquire the knowledge necessary to conduct research in physics. The subject matter of core courses is specially designed to allow students to share the fundamentals of physics more broadly beyond their own research projects. In addition, the Department offers highly specialized and applied physics courses that can lead to practical research. Therefore, the curriculum organized by interdisciplinary courses and specialized courses focused on specific fields offers the road map from the review of undergraduate studies to cutting-edge research. Many of the specialized courses include intensive courses taught by external experts to help students acquire basic to advanced knowledge systematically in a short period of time. In addition, the interdisciplinary courses established physics and chemistry departments allow students to acquire knowledge from a broader perspective. Furthermore, various courses, such as lectures offered in English and English for science, aim to improve students' English skills essential for physics research.

In the first year, students will focus on these courses to acquire comprehensive knowledge of physics while acquiring in-depth knowledge in specific fields. In addition to lecture courses, students will take part in advanced research activities in their assigned laboratories to acquire knowledge and the ability to collect and analyze information and solve problems.

In the second year, students will work on writing their master's thesis based on the knowledge and experience they have acquired. At the end of the year, students will give a public presentation on research findings in the thesis presentation event.

[Doctoral Program]

The doctoral program aims to develop individuals to be independent researchers and research supervisors who can conduct leading research activities in the global arena. The students will develop broad insights into fundamental and applied physics while having the social responsibilities associated with research in mind. In the doctoral program, students will further progress the research projects conducted in the master's program.

In particular, the program aims to help students to acquire the extensive knowledge, logical thinking, and practical research methods necessary to identify advanced and important research projects in physics. Students will also acquire the ability to initiate unique research projects, plan and conduct research, and develop the ability to deliver adequate research findings, write original papers, and publish them in international journals. The program also develops the ability to conduct research projects as an independent researcher, engage in international research discussions, widely present the findings and significance of the research, and associate the research projects with the society.

Students will conduct research in the assigned laboratory during the three years. Students are also encouraged to take common courses that are also offered in the master's program. Students must complete a doctoral dissertation by the end of their third year and give a public presentation in the dissertation examination event (dissertation defense).

(2) Policy on teaching and learning methods in the curriculum

The courses shall be taught with various methods and forms, such as lectures, exercises, and practical training, in accordance with the objectives and learning goals of each course so that students can learn independently and actively and acquire the qualities and abilities appropriate to the objectives of human resources development and the degree awarding policy.

Research guidance shall be provided to improve students' research skills and methods under the research guidance plans defined separately.

(3) Policy on the assessment of learning outcomes

All courses shall be assessed according to the level of achievement of the course objectives, based on the assessment methods and criteria specified in the syllabus. Theses/dissertations shall be assessed according to the following process and criteria.

[Master's Program]

○ Thesis evaluation process and criteria:

An applicant shall decide a thesis title with the prior approval of their graduate advisor and submit the completed thesis to them. The applicant shall submit a degree application to the Graduate Faculty Committee with a document certifying that the thesis has been accepted by their graduate advisor. Acceptance/rejection of the degree application shall be decided by the Graduate Faculty Committee. If the application is accepted, the Graduate Faculty Committee shall establish a Review Committee consisting of three or more faculty members, including the chief examiner, with extra examiners from other graduate schools or universities/institutions if necessary. The Review Committee shall rigorously review the content of the submitted thesis. The applicant shall write and submit the master's thesis in Japanese or English. The applicant shall give a public presentation on the research findings in Japanese or English and answer questions. The Review Committee shall determine pass or fail on the thesis and presentation based on the criteria below and report the result to the Graduate Faculty Committee through the Department Meeting. The Graduate Faculty Committee shall make the final decision on whether to confer a degree.

- (1) Did the applicant engage in a research project of scientific importance?
- (2) Were the research plan and methods appropriate?
- (3) Did the applicant conduct research activities sufficiently during the period of the standard two-year program?
- (4) Did the applicant perform an appropriate analysis of the research findings?
- (5) Was the thesis written in logical and clear language?
- (6) Were the presentation and response to questions in the thesis presentation logical and clear?

[Doctoral Program]

○ Dissertation evaluation process and criteria:

An applicant shall decide the dissertation title with the prior approval of their graduate advisor and submit the completed dissertation written in English to the graduate advisor and a degree application to

the Graduate Faculty Committee. If the Graduate Faculty Committee accepts the application, it shall establish a Review Committee consisting of three or more faculty members, including the chief examiner, with extra examiners from other graduate schools or universities/institutions if necessary. The Review Committee shall review the content of the submitted dissertation. After the Review Committee approves, the applicant shall submit the dissertation to the Graduate Faculty Committee. The applicant shall give a public presentation on the research findings in Japanese or English and answer questions. The Review Committee shall determine pass or fail on the dissertation and presentation based on the criteria below and report the result to the Graduate Faculty Committee through the Department Meeting. The Graduate Faculty Committee shall make the final decision on whether to confer a degree.

- (1) Did the applicant engage in a research project on an unsolved issue with scientific significance?
- (2) Were the research plan and methods appropriate and sufficient?
- (3) Did the applicant achieve significant results on the research project?
- (4) Was the dissertation written in logical and clear language?
- (5) Were the presentation and response to questions in the dissertation presentation logical and clear?
- (6) Have the major research findings been published or will they be published in a peer-reviewed academic journal?
- (7) Are appropriate ethical considerations given to planning and conducting research, presenting the research findings, and storing the data?

