

# Graduate School of Science

## Diploma Policy: Degree Awarding Policy

### **Mathematical Sciences**

The Department of Mathematical Sciences aims to educate competent individuals who have advanced knowledge in mathematics and applied mathematics as well as flexible and original scientific thinking skills and who can solve various problems in the natural sciences and the modern information society while being aware of the significance of mathematical sciences as a foundation of science.

It also aims to enhance students' ability to transfer specialized knowledge as educators and the communication and information utilization skills required in companies and research institutions to a level suitable for postgraduate study.

#### [Master's Program]

Students who complete the prescribed requirements and acquire the following abilities shall be awarded a Master of Science degree.

- Advanced technical knowledge in mathematical sciences and flexible mathematical thinking skills
- Ability to initiate a research project and conduct research systematically under the guidance of the graduate advisor
- Ability to clearly express the research findings and discuss them with other researchers

#### [Doctoral Program]

Students who complete the prescribed requirements and acquire the following abilities shall be awarded a Doctor of Science degree.

- Advanced technical knowledge in mathematical sciences and flexible and original mathematical thinking skills
- Ability to conduct original research activities as independent researchers with an international perspective
- Ability to assess the significance of their own research and its position in society objectively

### **Physics**

The Department of Physics aims to educate competent individuals who can lead the next generation of scientific advancement with highly specialized knowledge and research skills in physics that encompasses various aspects of the natural world, ranging from elementary particles and diverse structural materials to the vast universe, and who can solve social and environmental issues through a scientific approach.

#### [Master's Program]

Students who complete the prescribed requirements and acquire the following abilities shall be awarded a Master of Science degree.

- Basic knowledge necessary for conducting research in physics, logical thinking, and practical research methods
- Ability to initiate a research project in each field of physics individually or under the graduate advisor's guidance, solve problems, and conduct research, as well as the ability to write logically organized papers and present the research findings

- Ability to discuss with other researchers and widely disseminate the research findings

#### [Doctoral Program]

Students who complete the prescribed requirements and acquire the following abilities shall be awarded a Doctor of Science degree.

- Extensive knowledge, logical thinking, and practical research methods necessary to identify progressive and significant research topics in physics
- Ability to initiate a unique research project in each field of physics, plan and conduct research, achieve sufficient research findings, write original papers, and publish them in international journals
- Ability to conduct a research project as an independent researcher, engage in international research discussions, and widely disseminate the research findings and their significance while aligning research activities with societal needs

## Chemistry

The Department of Chemistry aims to educate researchers, engineers, and educators who understand natural phenomena at the atomic and molecular levels and who have an extensive knowledge of chemistry that encompasses a wide range of fields (not only substance creation and material development but also space, life, and environmental issues), a spirit of inquiry, and the ability to make comprehensive decisions based on high expertise and a broad perspective.

#### [Master's Program]

Students who complete the prescribed requirements and acquire the following abilities shall be awarded a Master of Science degree.

- Basic knowledge necessary for conducting research in chemistry, logical thinking, and practical research methods
- Ability to initiate a research project in each field of chemistry individually or under the graduate advisor's guidance, solve problems with own ideas, and conduct research, as well as the ability to write logically organized papers and present the research findings
- Ability to present research findings at academic conferences and widely disseminate the significance, as well as the ability to objectively grasp problems and engage in discussion with other researchers

#### [Doctoral Program]

Students who complete the prescribed requirements and acquire the following abilities shall be awarded a Doctor of Science degree.

- Extensive knowledge, logical thinking, and practical research methods necessary to identify progressive and significant research topics in chemistry
- Ability to initiate a unique research project in each field of chemistry and make an appropriate plan to research while considering safety, as well as the ability to achieve sufficient research findings, write original papers, and publish them in international journals
- Ability to conduct a research project as an independent researcher, present the findings at international conferences, engage in discussions in English, and widely disseminate the research findings and their significance while aligning research activities with international societal needs
- Ability to take the initiative in addressing various issues based on research experiences, demonstrate leadership with a broad perspective, and provide research, technical, and educational guidance in the future

## Biological Sciences

The Department of Biological Sciences aims to educate individuals who have the ability to define the objectives, methods, and problems to elucidate the mechanisms of living organisms (molecules, structures, behaviors, ecologies, and evolution) and the skills to carry them out. The department fosters creative research capabilities to address new challenges in biological sciences, along with a combination of an international perspective and communication skills.

### [Master's Program]

Students who complete the prescribed requirements and acquire the following abilities shall be awarded a Master of Science degree.

- Extensive knowledge, logical thinking, and practical methods necessary to conduct research in basic biological sciences and biology
- Advanced and specialized knowledge, logical thinking, and practical research methods related to their chosen research topics
- Basic research skills in each biological science and biology field through initiating a new research project or an applied or educational research project independently or under the graduate advisor's guidance, as well as writing papers and presenting the research findings
- Writing and communication skills in English necessary to conduct research and work on the international stage, and the ability to widely disseminate the research findings

### [Doctoral Program]

Students who complete the prescribed requirements and acquire the following abilities shall be awarded a Doctor of Science degree.

- Extensive knowledge, logical thinking, and practical research methods necessary to develop the skills to explore and discover a progressive and significant research topic in basic biological sciences and biology
- Independent research skills in each field of basic biological science and biology through initiating a new research project or an applied or educational research project independently, as well as delivering satisfactory research findings and publishing them as original papers in English
- Advanced English communication skills essential for leading international research, as well as the ability to convey the research findings and their significance to a broad audience

## Requirements for the Program Completion

- **Master's program:**

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. If the graduate advisor considers it academically beneficial, up to 10 out of the 30 credits can be certified as credits required for completion by taking the following courses.

- Non-major courses in the graduate program,
- Major courses in other graduate programs, or
- Undergraduate courses

Regarding the enrollment period for those recognized as delivering excellent research results, enrollment in the master's program for one year or more shall be considered to have satisfied the completion requirement. (Each graduate school has its additional requirements.)

- **Doctoral program:**

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 in the doctoral program, submitting a dissertation, and taking the final examination.

Regarding the enrollment period for those recognized as delivering exceptional research results, enrollment in the doctoral program for one year or more shall be considered to have satisfied the completion requirement. However, those who have completed the master's program with one year of enrollment must be enrolled for at least two years. (Each graduate school has its additional requirements.)

## Evaluation Criteria for Thesis and Dissertation

### Mathematical Sciences

#### [Master's Program]

- (1) The research topic is sufficiently understood.
- (2) The research activity has been conducted sufficiently well during the standard two-year program.
- (3) The research findings are appropriately analyzed.
- (4) The thesis is written logically and clearly.
- (5) The presentation and response to questions in the Master's thesis presentation are given logically and clearly.

#### [Doctoral Program]

- (1) The dissertation is original with new findings and insights.
- (2) The presentation and response to questions in the Dissertation presentation are logical and clear.
- (3) The dissertation is at an appropriate level of completion.
- (4) Part of the dissertation has been published or will be published in a peer-reviewed academic journal (written in the primary language).
- (5) Ethical considerations are given appropriately to planning and conducting research, presenting the research findings, and storing the data.

### Physics

#### [Master's Program]

- (1) The research project is focused on a scientifically important issue.
- (2) The research plan and methods are appropriate.
- (3) The research activity has been conducted sufficiently well during the standard two-year program.
- (4) The research findings are appropriately analyzed.
- (5) The thesis is written logically and clearly.
- (6) The presentation and response to questions in the Master's thesis presentation are given logically and clearly.

#### [Doctoral Program]

- (1) The research project is focused on an unsolved and significant issue.
- (2) The research plan and methods are appropriate and sufficient.
- (3) The research project has achieved significant results.
- (4) The dissertation is written logically and clearly.
- (5) The presentation and response to questions in the Dissertation presentation are logical and clear.
- (6) The primary research findings have been published or will be published in a peer-reviewed academic

journal.

- (7) Ethical considerations are given appropriately to planning and conducting research, presenting the research findings, and storing the data.

## Chemistry

[Master's Program]

- (1) The research plan and methods are appropriate.
- (2) The research activity has been conducted sufficiently well during the standard two-year program.
- (3) The research findings are appropriately analyzed.
- (4) The thesis is written logically and clearly.
- (5) The presentation and response to questions in the Master's thesis presentation are logical and clear.

[Doctoral Program]

- (1) The research project is focused on an unsolved and significant issue.
- (2) The research plan and methods are appropriate and sufficient.
- (3) The research project has achieved significant results.
- (4) The dissertation is written logically and clearly.
- (5) The presentation and response to questions in the Dissertation presentation are logical and clear.
- (6) The primary research findings have been published or will be published in a peer-reviewed academic journal.
- (7) Ethical considerations are given appropriately to planning and conducting research, presenting the research findings, and storing the data.

## Biological Sciences

The Thesis Review and Examination Committee shall evaluate the thesis/dissertation and presentation on a five-point scale based on the criteria below. The final grade of two points or higher shall be a passing grade.

[Master's Program]

- (1) The research project is focused on an unsolved issue. (Required)
- (2) The research plan and methods are appropriate. (Required)
- (3) The research activity has been conducted sufficiently well during the standard two-year program. (Required)
- (4) The research findings are appropriately analyzed. (Required)
- (5) The research findings have already been presented as an oral (poster) presentation at a conference or in an academic journal. (Optional)
- (6) The thesis is written logically and clearly. (Required)
- (7) The presentation and response to questions in the Master's thesis presentation are logical and clear. (Required)

[Doctoral Program]

- (1) The research project is focused on an unsolved and significant issue. (Required)
- (2) The research plan and methods are appropriate and sufficient. (Required)
- (3) Part of the research project or study of research methods has been conducted in a laboratory abroad. (Optional)
- (4) The research project has achieved significant results. The research activity has been conducted sufficiently well during the standard three-year program. (Required)
- (5) All or part of the research findings have already been published in an academic journal as an original paper (in English and peer-reviewed). (Required)
- (6) Part of the research findings have already been presented at an international conference. (Optional)

- (7) The dissertation is written logically and clearly. (Required)
- (8) The presentation and response to questions in the Dissertation presentation (public) are logical and clear and fully satisfy the evaluators and audience. (Required)
- (9) Ethical considerations are given appropriately to planning and conducting research, presenting the research findings, and storing the data.

## Policy on Curriculum Organization and Implementation: Curriculum Policy

The Graduate School of the Tokyo Metropolitan University structures its educational curriculum to equip students with advanced specialized knowledge and skills in their chosen field of study while fostering a basic understanding of related areas.

The Graduate School of Science provides a curriculum in Mathematical Sciences, Physics, Chemistry, and Biological Sciences for both Master's and Doctoral programs.

### Mathematical Sciences

[Master's Program]

The Department of Mathematical Sciences offers an educational curriculum based on the following policies to help students develop the skills outlined in the Diploma Policy.

#### (1) Basic policy on curriculum organization

- Courses are structured with a combination of introductory and special lectures, exercises, and seminars. These courses enable graduate students to learn actively and independently while developing the qualities and skills appropriate for a master's degree.
- The introductory and special lectures cover systematic theories in algebra, geometry, and analysis. By connecting these theories to various areas of applied mathematics, students are invited to explore the latest research in mathematical sciences, including interdisciplinary aspects.
- As a group of highly specialized subjects, special lectures are delivered by full-time faculty members and renowned external lecturers to offer students innovative research themes.
- Compulsory exercise courses are designed to help students develop practical skills, including searching and collecting information in mathematical sciences, writing comprehensive reports and research papers, and giving presentations.
- Seminar courses are designed to help students develop the ability to discover their research topics, conduct research, and present their findings as a master's thesis under the guidance of the graduate advisor.

#### (2) Policy on teaching and learning methods

- Courses are taught with various methods and forms, including lectures, exercises, and practical training, in accordance with the objectives and learning goals of each course, and are devised to encourage students to learn independently and actively while also acquiring the qualities and skills appropriate to the objectives of human resources development and the degree awarding policy.
- Research guidance aims to improve students' research skills and methods in accordance with the guidance plan defined separately.

#### (3) Policy on the assessment of learning outcomes

- Courses are assessed based on the extent to which the learning objectives have been met and follow the assessment methods and criteria outlined in the syllabus.

- Master theses are evaluated in accordance with the specified thesis assessment criteria.

[Doctoral Program]

The Department of Mathematical Sciences configures an educational curriculum based on the following policies to achieve the goals outlined in the Diploma Policy.

(1) Basic policy on curriculum organization

- Courses are structured with a combination of introductory and special lectures, exercises, and seminars. These courses enable graduate students to learn actively and independently while developing the qualities and skills appropriate for a doctoral degree.
- The special lectures cover systematic theories in algebra, geometry, and analysis. By connecting these theories to various areas of applied mathematics, students are invited to explore the latest research in mathematical sciences, including interdisciplinary aspects.
- Special lectures on advanced topics are delivered by full-time faculty members and renowned external lecturers to offer students innovative research themes.
- Exercise courses are designed to help students develop practical skills, including searching and collecting information in mathematical sciences, writing comprehensive reports and research papers, and giving presentations.
- Seminar courses are designed to help students develop the ability to discover their research topics on their own, conduct research, and present their findings as a doctoral dissertation, with advice from the doctoral advisor.

(2) Policy on teaching and learning methods

- Courses are taught with various methods and forms, including lectures, exercises, and practical training, in accordance with the objectives and learning goals of each course, and are devised to encourage students to learn independently and actively while also acquiring the qualities and skills appropriate to the objectives of human resources development and the degree awarding policy.
- Research guidance aims to improve students' research skills and methods in accordance with the guidance plan defined separately.

(3) Policy on the assessment of learning outcomes

- Courses are assessed based on the extent to which the learning objectives have been met and follow the assessment methods and criteria outlined in the syllabus.
- Doctoral dissertations are evaluated in accordance with the specified dissertation assessment criteria.

## Physics

[Master's Program]

The Department of Physics offers an educational curriculum based on the following policies to help students develop the skills outlined in the Diploma Policy.

(1) Basic policy on curriculum organization

- Courses are taught with a combination of lectures, exercises, and practical training in accordance with the objectives and learning goals of each course. These courses enable graduate students to learn actively and independently while also acquiring the qualities and skills appropriate to the objectives of human resources development and the degree awarding policy.
- The curriculum is designed to enhance core subjects from undergraduate programs, aiming to develop the knowledge necessary for advancing research in physics.
- Highly specialized applied subjects that lead to practical research are offered in an intensive course format.

- Courses on topics at the interface of physics and chemistry are co-offered by the Departments of Physics and Chemistry, enabling students to gain a broader knowledge base.
- Courses are designed to enhance English skills essential for physics research, including lectures conducted in English and lectures focusing on scientific English.

(2) Policy on teaching and learning methods

- Courses are taught with various methods and forms, including lecturers, exercises, and practical training, in accordance with the objectives and learning goals of each course, and are devised to encourage students to learn independently and actively while also acquiring the qualities and skills appropriate to the objectives of human resources development and the degree awarding policy.
- Research guidance aims to develop students' ability to address unknown issues in accordance with the guidance plan defined separately.

(3) Policy on the assessment of learning outcomes

- Courses are assessed based on the extent to which the learning objectives have been met and follow the assessment methods and criteria outlined in the syllabus.
- Master theses are evaluated in accordance with the specified thesis assessment criteria.

[Doctoral Program]

The Department of Physics configures an educational curriculum based on the following policies to achieve the goals outlined in the Diploma Policy.

(1) Basic policy on curriculum organization

- Courses are taught with a combination of lectures, exercises, and practical training in accordance with the objectives and learning goals of each course. These courses enable graduate students to learn actively and independently while also acquiring the qualities and skills appropriate to the objectives of human resources development and the degree awarding policy.
- The Department helps students acquire the extensive knowledge, logical thinking, and practical research methods necessary to identify progressive and significant research topics in physics.
- The Department helps students acquire the ability to initiate a unique research project, plan and conduct research, as well as achieve sufficient research findings, write original papers, and publish them in international journals.
- The Department helps students acquire the ability to conduct a research project as an independent researcher, engage in international research discussions, and widely disseminate the research findings and their significance while aligning research activities with societal needs.

(2) Policy on teaching and learning methods

- Courses are taught with various methods and forms, including lecturers, exercises, and practical training, in accordance with the objectives and learning goals of each course, and are devised to encourage students to learn independently and actively while also acquiring the qualities and skills appropriate to the objectives of human resources development and the degree awarding policy.
- Research guidance aims to develop students' ability to address unknown issues in accordance with the guidance plan defined separately.

(3) Policy on the assessment of learning outcomes

- Courses are assessed based on the extent to which the learning objectives have been met and follow the assessment methods and criteria outlined in the syllabus.
- Doctoral dissertations are evaluated in accordance with the specified dissertation assessment criteria.



# Chemistry

## [Master's Program]

The Department of Chemistry offers an educational curriculum based on the following policies to help students develop the skills outlined in the Diploma Policy.

### (1) Basic policy on curriculum organization

- Courses are structured with a combination of introductory and special lectures, exercises, and practical training. These courses enable graduate students to learn actively and independently while developing the qualities and skills appropriate for a master's degree.
- The Department provides advanced courses in the three main areas (inorganic and analytical chemistry, organic and biological chemistry, and physical chemistry) to help students acquire a broad range of basic knowledge in chemistry. One of the requirements for program completion is to take several interdisciplinary courses in each specified field.
- A seminar introducing English-language documents within each research group is organized as an exercise course, aiming to help students improve their skills in reading and understanding these documents, as well as to enhance their ability to deliver oral presentations and participate in question-and-answer sessions.
- Courses on topics at the interface of physics and chemistry are co-offered by the Departments of Physics and Chemistry, enabling students to gain a broader knowledge base and practical skills leading to research.
- Intensive courses taught by external experts are offered to help students acquire fundamental to advanced knowledge in a short timeframe.
- Guidance from graduate advisors helps students develop their research knowledge and skills along with universally useful abilities, such as gathering and analyzing information and problem-solving.
- The sub-advisor system enhances and supports the research activities of graduate students from various perspectives. In this system, faculty members from different research laboratories act as sub-advisors for students, reviewing their research objectives, plans, and progress. Students must submit an interim report during the second semester of their first and second years. Feedback and guidance are provided in response to these submissions, helping establish a research guidance framework that incorporates diverse viewpoints from both the main advisor and the sub-advisor from a different discipline.

### (2) Policy on teaching and learning methods

- Courses are taught with various methods and forms, including lectures, exercises, and practical training, in accordance with the objectives and learning goals of each course, and are devised to encourage students to learn independently and actively while also acquiring the qualities and skills appropriate to the objectives of human resources development and the degree awarding policy.
- Research guidance aims to improve students' research skills and methods in accordance with the guidance plan defined separately.

### (3) Policy on the assessment of learning outcomes

- Courses are assessed based on the extent to which the learning objectives have been met and follow the assessment methods and criteria outlined in the syllabus.
- Master theses are evaluated in accordance with the specified thesis assessment criteria.

## [Doctoral Program]

The Department of Chemistry configures an educational curriculum based on the following policies to achieve the goals outlined in the Diploma Policy.

(1) Basic policy on curriculum organization

- Courses are structured with a combination of introductory and special lectures, exercises, and practical training. These courses enable graduate students to learn actively and independently while developing the qualities and skills appropriate for a doctoral degree.
- Guidance from graduate advisors assists students in developing the skills to set their research topic, make plans, and solve problems with their own unique ideas.
- Students present their research findings at international conferences and publish them as original papers in international journals, enabling students to acquire the necessary skills to engage in international research discussions.
- Students participate in an interim report session at the beginning of their third year, following a format similar to the Dissertation presentation, to see what abilities will be necessary to present their research objectives, plans, progress, and results. Questioning and advice from faculty members from different laboratories enhance the quality of their research and dissertations.

(2) Policy on teaching and learning methods

- Courses are taught with various methods and forms, including lecturers, exercises, and practical training, in accordance with the objectives and learning goals of each course, and are devised to encourage students to learn independently and actively while also acquiring the qualities and skills appropriate to the objectives of human resources development and the degree awarding policy.
- Research guidance aims to improve students' research skills and methods in accordance with the guidance plan defined separately.

(3) Policy on the assessment of learning outcomes

- Courses are assessed based on the extent to which the learning objectives have been met and follow the assessment methods and criteria outlined in the syllabus.
- Doctoral dissertations are evaluated in accordance with the specified dissertation assessment criteria.

## **Biological Sciences**

[Master's Program]

The Department of Biological Sciences offers an educational curriculum based on the following policies to help students develop the skills outlined in the Diploma Policy.

(1) Basic policy on curriculum organization

- Courses are structured with a combination of introductory and special lectures, exercises, and practical training. These courses enable graduate students to learn actively and independently while developing the qualities and skills appropriate for a master's degree.
- Various English language and research communication courses are offered to develop students' English language skills.
- Exercise courses are designed to help students acquire the ability to independently discover, set, and work toward research objectives, methods, and problems
- A range of seminars and exercise courses are offered to encourage students' interaction and joint research across different laboratories. Through group work with students from various laboratories, graduate students develop practical skills in cooperation and coordination.
- Students receive close research guidance on specific themes through small-group sessions with their graduate advisors.
- The sub-advisor system enhances and supports the research activities of graduate students from various perspectives. In this system, several faculty members from different research laboratories act as sub-advisors for a single student, reviewing their research objectives, plans, and progress and engaging in active discussions with them. Students must make a research plan sheet in their first

year and an interim report in their second year. Feedback and guidance are provided in response to these submissions, helping establish a research guidance framework that incorporates diverse viewpoints from both the main advisor and the sub-advisor from a different discipline.

(2) Policy on teaching and learning methods

- Research guidance aims to improve students' research skills and methods in accordance with the guidance plan defined separately.
- Students are highly encouraged to present their research findings at domestic and international academic conferences.
- Courses are taught with various methods and forms, including lecturers, exercises, and practical training in accordance with the objectives and learning goals of each course, and are devised to encourage students to learn independently and actively while also developing the qualities and skills appropriate for a master's degree.

(3) Policy on the assessment of learning outcomes

- Courses are assessed based on assessment items such as tests, assignments, reports, quizzes, and participation. Instructors clearly outline the grading method in the syllabus.
- Master theses are assessed in accordance with the specified thesis assessment criteria.

[Doctoral Program]

The Department of Biological Sciences configures an educational curriculum based on the following policies to achieve the goals outlined in the Diploma Policy.

(1) Basic policy on curriculum organization

- Courses are structured with a combination of introductory and special lectures, exercises, and practical training. These courses enable graduate students to learn actively and independently while developing the qualities and skills appropriate for a doctoral degree.
- Students receive close research guidance on specific themes through small-group sessions with their doctoral advisors.
- Students are provided detailed guidance on compiling research findings as original papers and publishing them in international academic journals.

(2) Policy on teaching and learning methods

- Research guidance aims to improve students' research skills and methods in accordance with the guidance plan specified separately.
- Students are highly encouraged to present their research findings at domestic and international academic conferences.

(3) Policy on the assessment of learning outcomes

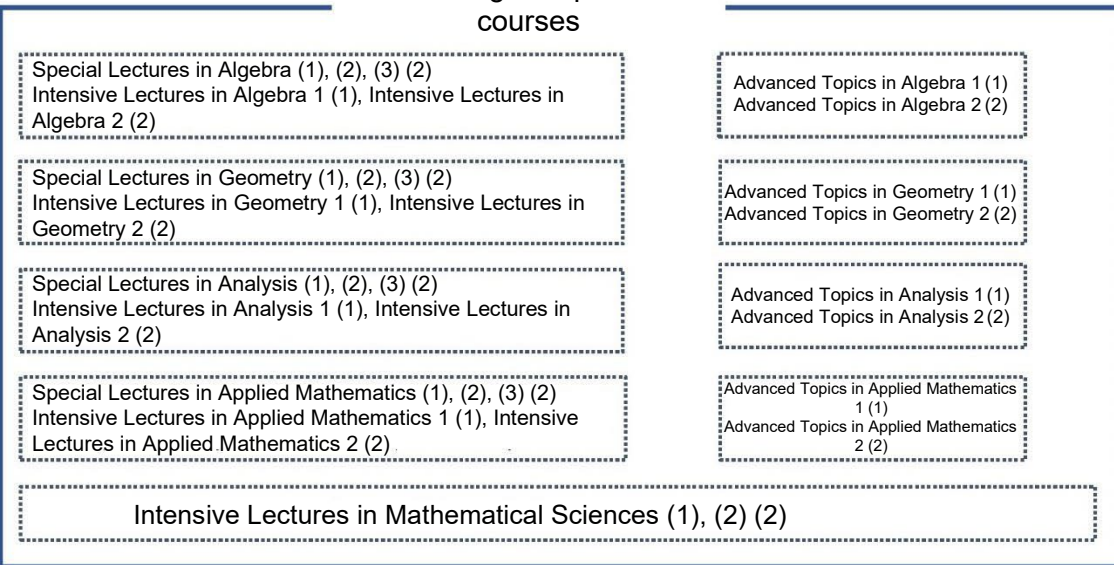
- Courses are assessed based on assessment items such as tests, assignments, reports, quizzes, and participation. Instructors clearly outline the grading method in the syllabus.
- Doctoral dissertations are assessed in accordance with the specified dissertation assessment criteria.

## Curriculum Tree

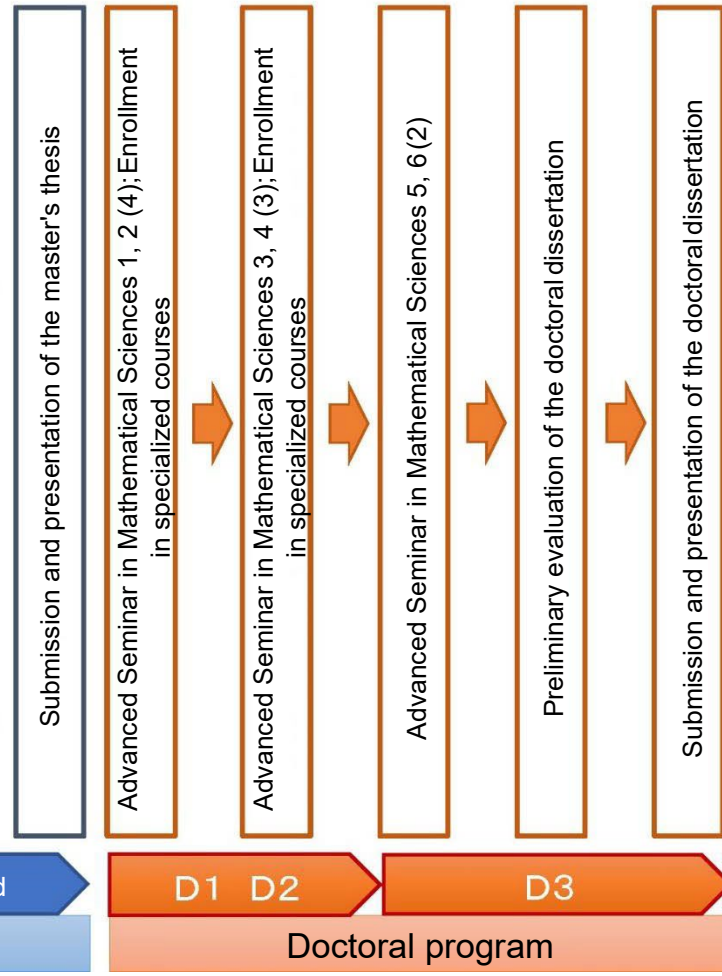
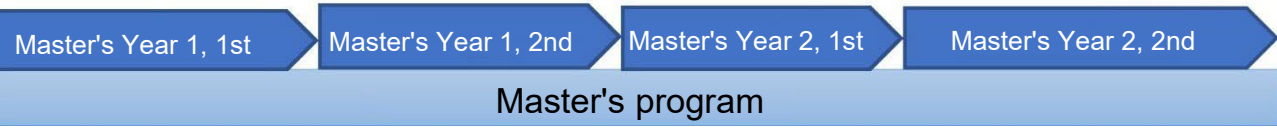
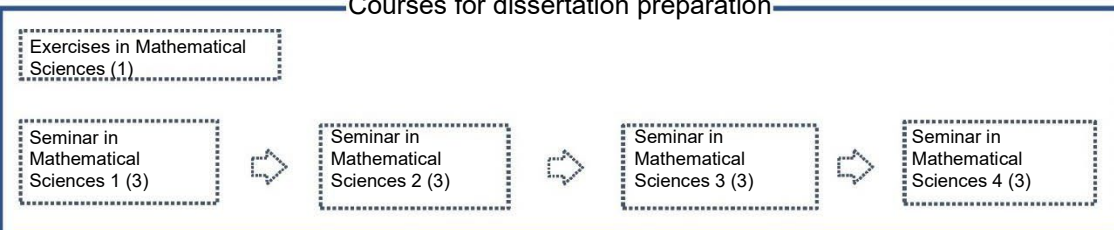
As shown in the Appendix.

# Curriculum Structure of the Department of Mathematical Sciences

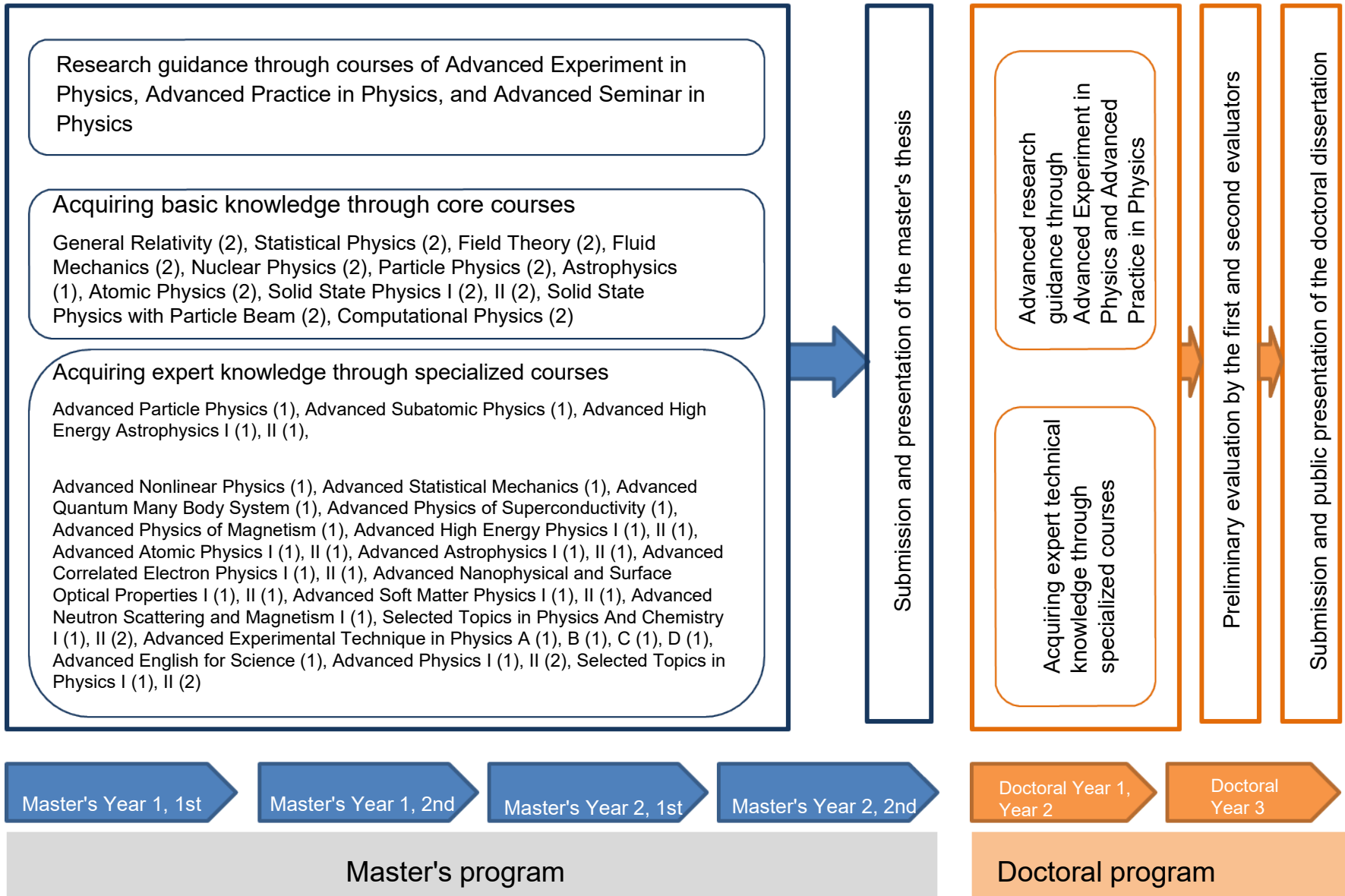
A wide range of specialized courses



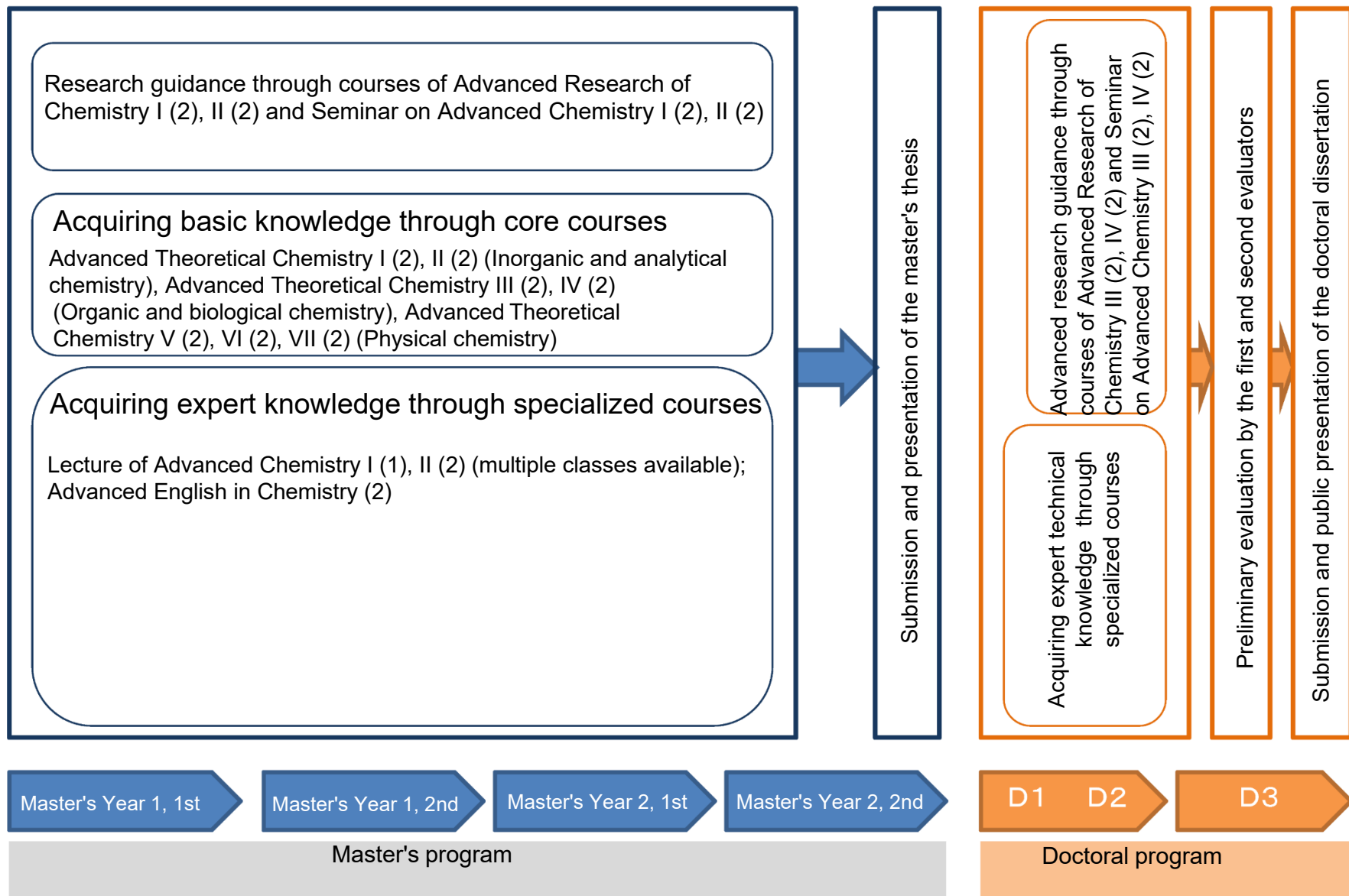
Courses for dissertation preparation



# Curriculum Structure of the Department of Physics



# Curriculum Structure of the Department of Chemistry



# Curriculum Structure of the Department of Biological Sciences

