# Graduate Major in Earth and Planetary Sciences

## 【Doctoral Degree Program】

### 1. Outline

Phenomena covered by earth and planetary sciences are complex combinations of various factors ranging from nano- to tera-scale in space and time. This program provides a variety of learning opportunities to foster human resources challenging and solving such global and planetary-scale problems with scientific thinking and skills.

### 2. Competencies Developed

Students in this program are expected to acquire following abilities:

- Ability to get insight into the nature of complex phenomena in the earth and planets
- Ability to set a subject of research and to form a research plan
- Ability to build own expertise necessary for research accomplishment
- Ability to present research achievements and take an international leadership in an area of expertise

### 3. Learning Goals

Students in this program are expected to study by utilizing the following opportunities to obtain the abilities mentioned above:

A) Intensive courses that learn a wide range of advanced research topics on earth and planetary sciences
B) Laboratory seminars, lectures, and exercise lessons that learn basic and applied research skills
C) Classes that improve English skills and teaching skills and that learn carrier development

### 4. IGP Completion Requirements

The following requirements must be met to complete the Doctoral Degree Program of this major.

1. Attain a total of 24 credits or more from 600-level courses.
2. Fulfill requirements in Table D1 below.
3. Pass the doctoral dissertation review and defense.

Table D1 shows course categories and the number of credits required to complete the Doctoral Degree Program of this major. It also shows the required minimum credits in each course category and points to be noted when selecting the required courses and electives.

The learning goals to be obtained by students through courses are listed as “associated learning goals”. Prior to registering courses, students need to fully understand the course goals.

**Table D1. Graduate Major in Earth and Planetary Sciences Completion Requirements**

| Course category | | <Required courses><br>Required credits | <Electives><br>Minimum credits required | Minimum credits required | Associated learning goals | Comments |
|---|---|---|---|---|---|---|
| Liberal arts and basic science courses | Humanities and social science courses | | 2 credits | 6 credits | C | |
| | Career development courses | | 4 credits | | C | All Graduate Attributes (GA) should be acquired. (Refer to Section 7 for the definition of GA.) |
| | Other courses | | | | | |
| Core courses | Research seminars | Seminar in Earth and Planetary Sciences S3<br>Seminar in Earth and Planetary Sciences F3<br>Seminar in Earth and Planetary Sciences S4<br>Seminar in Earth and Planetary Sciences F4<br>Seminar in Earth and Planetary Sciences S5<br>Seminar in Earth and Planetary Sciences F5<br>A total of 12 credits, 2 credits each from the above courses. | | 12credits | B | |
| | Research-related courses | | | | B | |
| | Major courses | | | | A, C | |
| | Major courses and Research-related courses <u>outside</u> the Graduate Major in Earth and | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Planetary Sciences standard curriculum** | | | | | |
| **Total required credits** | | **A minimum of 24 credits including those attained according to the above conditions** | | | | |
| **Note** | | **・Japanese Language and Culture Courses offered to international students can be recognized as equivalent to the Humanities and Social Science Courses of the corresponding course level.**<br>**・For details of the Liberal Arts and Basic Science Courses, please refer to the relevant sections.** | | | | |

## 5. IGP Courses

Table D2 shows the Core Courses of the Doctoral Degree Program of this major. Graduate Majors listed in the Comments column offer core courses that are recognized as equivalent to the corresponding Major Courses or Research-related Courses in the standard curriculum of this major.

**Table D2. Core Courses of the Graduate Major in Earth and Planetary Sciences**

| **Course category** | | **Course number** | **Course title** | | | **Credits** | **Competencies** | **Learning goals** | **Comments** |
|---|---|---|---|---|---|---|---|---|---|
| **Research seminars** | **600 level** | EPS.Z691.R | ◎ | | Seminar in Earth and Planetary Sciences S3 | 0-2-0 | 2,3 | B | |
| | | EPS.Z692.R | ◎ | | Seminar in Earth and Planetary Sciences F3 | 0-2-0 | 2,3 | B | |
| | | EPS.Z693.R | ◎ | | Seminar in Earth and Planetary Sciences S4 | 0-2-0 | 2,3 | B | |
| | | EPS.Z694.R | ◎ | | Seminar in Earth and Planetary Sciences F4 | 0-2-0 | 2,3 | B | |
| | | EPS.Z695.R | ◎ | | Seminar in Earth and Planetary Sciences S5 | 0-2-0 | 2,3 | B | |
| | | EPS.Z696.R | ◎ | | Seminar in Earth and Planetary Sciences F5 | 0-2-0 | 2,3 | B | |
| **Research-related courses** | **600 level** | EPS.E671.L | | | Exercise in Earth and Planetary Sciences I | 0-1-0 | 3,4,5 | A, B | |
| | | EPS.E672.L | | | Exercise in Earth and Planetary Sciences J | 0-1-0 | 3,4,5 | A, B | |
| | | EPS.E673.L | | | Exercise in Earth and Planetary Sciences K | 0-1-0 | 3,4,5 | A, B | |
| | | EPS.E674.L | | | Exercise in Earth and Planetary Sciences L | 0-1-0 | 3,4,5 | A, B | |
| | | EPS.E675.L | | | Exercise in Earth and Planetary Sciences M | 0-1-0 | 3,4,5 | A, B | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | EPS.E676.L | | | Exercise in Earth and Planetary Sciences N | 0-1-0 | 3,4,5 | A, B | |
| | | EPS.E677.L | | | Exercise in Earth and Planetary Sciences O | 0-1-0 | 3,4,5 | A, B | |
| | | EPS.E678.L | | | Exercise in Earth and Planetary Sciences P | 0-1-0 | 3,4,5 | A, B | |
| **Major courses** | **600 level** | EPS.A651.L | | | Special Lecture in Earth and Planetary Sciences I | 1-0-0 | 3 | A | |
| | | EPS.A652.L | | | Special Lecture in Earth and Planetary Sciences J | 1-0-0 | 3 | A | |
| | | EPS.A653.L | | | Special Lecture in Earth and Planetary Sciences K | 1-0-0 | 3 | A | |
| | | EPS.A654.L | | | Special Lecture in Earth and Planetary Sciences L | 1-0-0 | 3 | A | |
| | | EPS.A655.L | | | Special Lecture in Earth and Planetary Sciences M | 1-0-0 | 3 | A | |
| | | EPS.A656.L | | | Special Lecture in Earth and Planetary Sciences N | 1-0-0 | 3 | A | |
| | | EPS.A657.L | | | Special Lecture in Earth and Planetary Sciences O | 1-0-0 | 3 | A | |
| | | EPS.A658.L | | | Special Lecture in Earth and Planetary Sciences P | 1-0-0 | 3 | A | |
| | | EPS.C628.L | | | Cutting Edge Topics in Earth and Planetary Sciences I | 0-1-0 | 1,2,4 | C | |
| | | EPS.C629.L | | | Cutting Edge Topics in Earth and Planetary Sciences J | 0-1-0 | 1,2,4 | C | |
| | | EPS.C630.L | | | Cutting Edge Topics in Earth and Planetary Sciences K | 0-1-0 | 1,2,4 | C | |
| | | EPS.C631.L | | | Cutting Edge Topics in Earth and Planetary Sciences L | 0-1-0 | 1,2,4 | C | |
| | | EPS.C632.L | | | Cutting Edge Topics in Earth and Planetary Sciences M | 0-1-0 | 1,2,4 | C | |
| | | EPS.C633.L | | | Cutting Edge Topics in Earth and Planetary Sciences N | 0-1-0 | 1,2,4 | C | |
| | | EPS.C634.L | | | Cutting Edge Topics in Earth and Planetary Sciences O | 0-1-0 | 1,2,4 | C | |
| | | EPS.C635.L | | | Cutting Edge Topics in Earth and Planetary Sciences P | 0-1-0 | 1,2,4 | C | |
| | | EPS.C638.L | | | EPS Career Development I | 0-1-0 | 2,4,5 | C | |
| | | EPS.C639.L | | | EPS Career Development J | 0-1-0 | 2,4,5 | C | |
| | | EPS.C640.L | | | EPS Career Development K | 0-1-0 | 2,4,5 | C | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | EPS.C641.L | | | EPS Career Development L | 0-1-0 | 2,4,5 | C | |
| | | EPS.C642.L | | | EPS Career Development M | 0-1-0 | 2,4,5 | C | |
| | | EPS.C643.L | | | EPS Career Development N | 0-1-0 | 2,4,5 | C | |
| | | EPS.C644.L | | | EPS Career Development O | 0-1-0 | 2,4,5 | C | |
| | | EPS.C645.L | | | EPS Career Development P | 0-1-0 | 2,4,5 | C | |
| | | EPS.C658.L | | | EPS Tutorial I | 0-1-0 | 2,4,5 | C | |
| | | EPS.C659.L | | | EPS Tutorial J | 0-1-0 | 2,4,5 | C | |
| | | EPS.C660.L | | | EPS Tutorial K | 0-1-0 | 2,4,5 | C | |
| | | EPS.C661.L | | | EPS Tutorial L | 0-1-0 | 2,4,5 | C | |
| | | EPS.C662.L | | | EPS Tutorial M | 0-1-0 | 2,4,5 | C | |
| | | EPS.C663.L | | | EPS Tutorial N | 0-1-0 | 2,4,5 | C | |
| | | EPS.C664.L | | | EPS Tutorial O | 0-1-0 | 2,4,5 | C | |
| | | EPS.C665.L | | | EPS Tutorial P | 0-1-0 | 2,4,5 | C | |

Note：

• ◎：Required course, ○：Restricted elective, O：odd academic years, E ：even academic years

• □：Course recognized as equivalent to that of the Academy for Co-creative Education of Environment and Energy Science, Leading Graduate School (ACEEES).

• Competencies: 1 = Intercultural skills; 2 = Communication skills; 3 = Specialist skills; 4 = Critical thinking skills; 5 = Practical and/or problem-solving skills

• The character preceding the three digits in the course number denotes the course's subdiscipline (i.e., "D" represents the subdiscipline code in the course number ABC.D400.R): A (advanced), C (career)

## 6. IGP Courses That Can Be Counted as Humanities and Social Science Courses

None

## 7. IGP Courses That Can Be Counted as Career Development Courses

In order to fulfill the completion requirements for the doctoral degree program, students must attain at least 4 credits in Career Development Courses, and should satisfy all of the Graduate Attributes (GA) specified in Table A-1 or A-2 of the "Career Development Courses" (Liberal Arts and Basic Science Courses) in the Guide to Graduate Education and International Graduate Program. Students will be evaluated in regards to GA achievements at the time of their degree completion. As to the courses with more than one GA, the number of GA stipulated for the courses is considered to be acquired regardless of the credits received for the courses.

Major Courses that enable students to acquire GA and that are recognized as equivalent to Career Development Courses are listed in Tables D3-1 and D3-2 below.

However, it must be noted that credits attained from these courses cannot be counted more than once as Major Courses or Career Development Courses towards the completion requirements for the doctoral degree program.

For Graduate Attributes, refer to the Guide to the Career Development Courses.

The Graduate Attributes of the Academic Leader Program (ALP) are listed in Table A-1 as follows:

- A0D: You will be able to precisely draw your own career plan and self-train yourself to acquire the skills required for attaining your goals in the academic field
- A1D: You will be able to ascertain the true nature of phenomena, master the secret of learning, and lead the pioneering of a new academic discipline or research area
- A2D: You will be able to understand the position of academia in society, and adequately explain the academic progress to members of society, which is the stakeholder
- A3D: You will be able to nurture junior students in educational institutions, inculcating in them an interest in academics and enabling them to later join in the pioneering of new academic disciplines or research areas

The Graduate Attributes of the Productive Leader Program (PLP) are listed in Table A-2 as follows:

- P0D: You will be able to precisely draw your own career plan and self-train yourself to acquire the skills required for attaining your goals in the industry, etc.
- P1D: You will be able to precisely grasp the needs of society and detect its problems, and lead the future developments in science and technology
- P2D: While leading teams consisting of members with varied specialties and value systems, you will be able to create products and enterprises that bring forth new values in the society
- P3D: Through the project, you will be able to nurture junior students, enabling them to later join in the development of next generation society and industry

**Table D3-1. Courses of the Graduate Major in Earth and Planetary Sciences recognized as equivalent to Career Development Courses in the Academic Leader Program (ALP)**

| Course category | Course number | Course title | Credits | GA* | Learning goals | Comments |
|---|---|---|---|---|---|---|
| Courses that can be counted as Career Development Courses | XIP.A601 | Advanced International Practice in Science | 0-2-0 | A1D | | Common Course of School of Science<br>Outside the Graduate Major in Earth and Planetary Sciences standard curriculum |
| | EPS.C628.L ～ EPS.C635.L | Cutting Edge Topics in Earth and Planetary Sciences I～P | 0-1-0 | A1D, A2D, A3D | C | |
| | EPS.C638.L ～ EPS.C645.L | EPS Career Development I～P | 0-1-0 | A0D, A2D | C | |
| | EPS.C658.L ～ EPS.C665.L | EPS Tutorial I～P | 0-1-0 | A2D, A3D | C | |
| **Credits in Career Development Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.**<br>**＊GA: Graduate Attributes** | | | | | | |

**Table D3-2. Courses of the Graduate Major in Earth and Planetary Sciences recognized as equivalent to Career Development Courses in the Productive Leader Program (PLP)**

| Course category | Course number | Course title | Credits | GA* | Learning goals | Comments |
|---|---|---|---|---|---|---|
| Courses that can be counted as Career Development Courses | XIP.A601 | Advanced International Practice in Science | 0-2-0 | P1D | | Common Course of School of Science<br>Outside the Graduate Major in Earth and Planetary Sciences standard curriculum |
| | EPS.C628.L ～ EPS.C635.L | Cutting Edge Topics in Earth and Planetary Sciences I～P | 0-1-0 | P1D, P2D, P3D | C | |

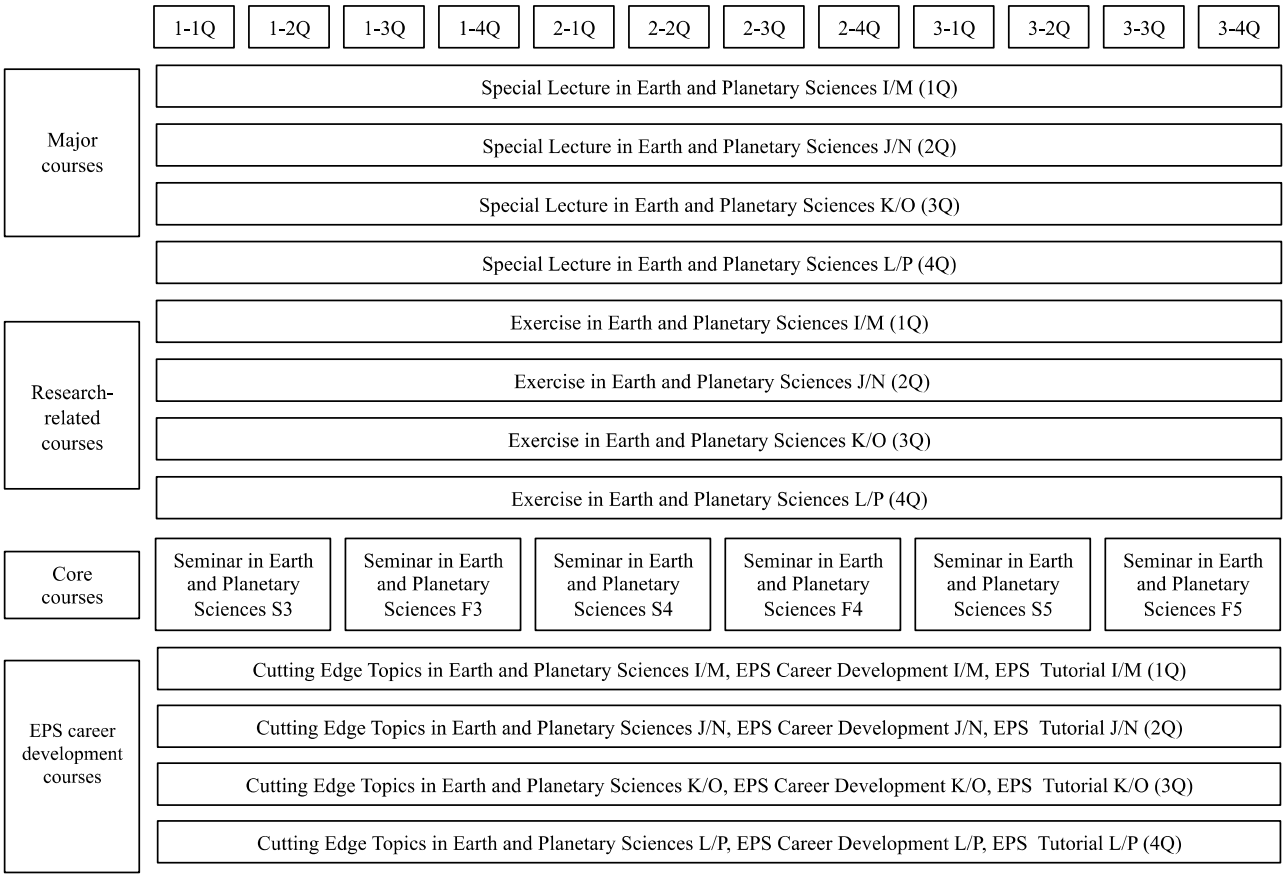
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | EPS.C638.L<br>～<br>EPS.C645.L | | | EPS Career Development I～P | 0-1-0 | P0D,<br>P2D | C | |

**Credits in Career Development Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.**

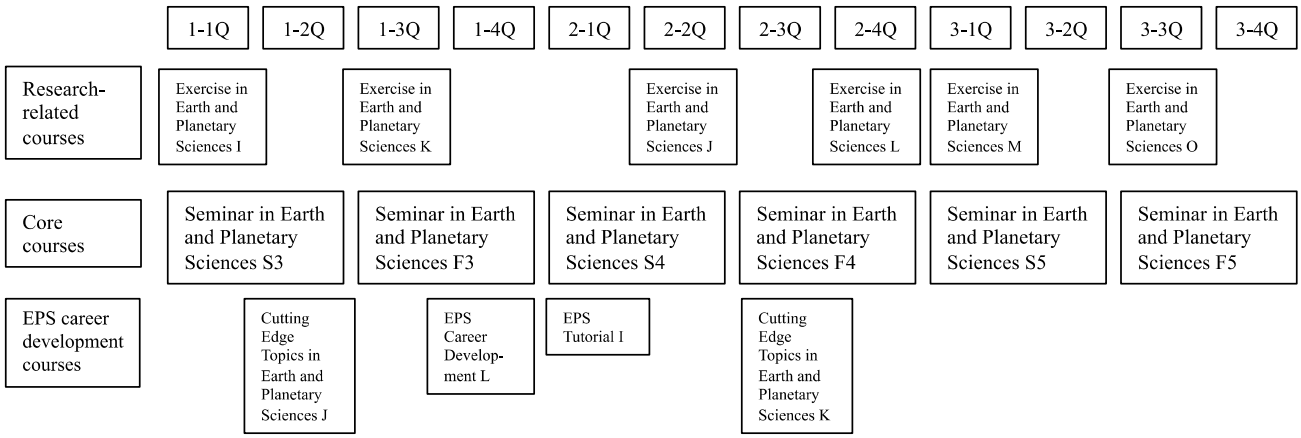
**＊GA: Graduate Attributes**

Students enrolled in the educational program for leading graduate schools may be offered courses recognized as equivalent to Career Development Courses besides those listed as such in the “Liberal Arts and Basic Science Courses” in the Guide to Graduate Education and International Graduate Program. For details about available courses or completion requirements, please refer to the Study Guide of the Academy that offers the relevant program.

## 8. Overview of Curriculum System

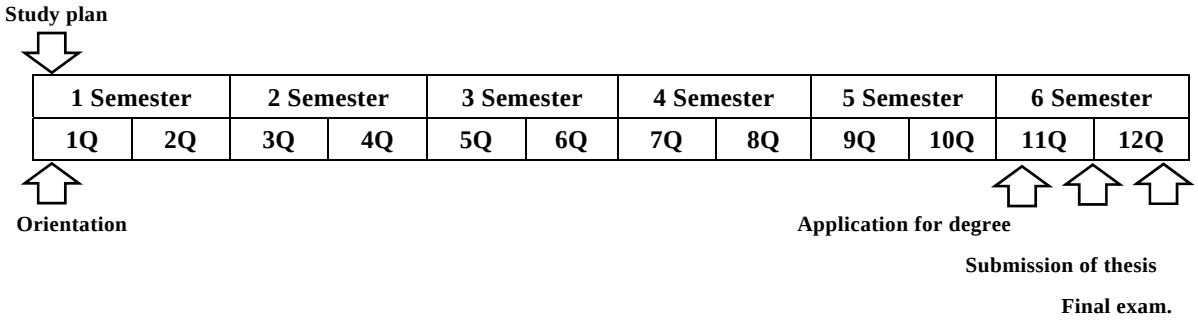



## 9. Example of a Standard Curriculum



## 10. Research Related to the Completion of Doctoral Theses

Through the doctoral thesis research, the candidate must develop the abilities for pointing out the issues to be solved, analyzing the situations, and proposing the solution. At the same time, communication skills in English are also gained to publish research results in international journals.




Following requirements must be met for the qualification

- The thesis should be original and is confirmed to be the world level of research which would contribute to the development of the field of earth and planetary sciences.
- At least one research paper, in which the candidate has a major contribution, is published or accepted in a refereed international journal.
- The candidate must have English ability to promote international collaborations.

<u>The thesis review procedure</u>

Preliminary evaluations of the submitted thesis are carried out on the basis of a hearing of the thesis presentation and the contents of the thesis. When the thesis passes the preliminary screening, the candidate submits a complete version of the thesis to the review committee. After the thesis presentation by the candidate, the thesis is reviewed by the committee and the final exam follows. The review committee consists of at least five faculty members in the Earth and Planetary Sciences course.