Graduate Major in Nuclear Engineering

【Master's Degree Program】

1. Outline

Growing attention has been placed on nuclear energy as an ultimate measure for reduction of fossil fuel consumption and CO_2 emission. Under the circumstances of global warming and the price hike of oil, gas and coal, a number of countries have been considering the implementation of nuclear power plants. The key factor of the nuclear energy development is the development of human resources. Our original course of international nuclear engineering has been established in 1993. Since then, a number of students have joined us from many countries and graduated from our course. They are actively contributing to the development of industries and technologies in Japan or in their own countries. This graduate course provides with core curriculum for nuclear reactor engineering and fuel cycle technologies and also covers extended nuclear energy, such as laser and particle beams, accelerator, plasma sciences, nuclear fusion, energy and environment, and social relations.

2. Competencies Developed

The curriculum is structured to allow students to acquire advanced specialized knowledge of nuclear engineering, broad vision and education, and a strong sense of ethics and responsibility based on the systematic or comprehensive knowledge of science and engineering learned in the Undergraduate Program. It also enables students to acquire more advanced specialized knowledge, logical dialogue skills, writing skills, practical problem-solving ability, and creativity through Research Seminars and master's thesis research.

3. Learning Goals

The goals provided in the course to obtain the competencies described in the curriculum are as follows:

A) Highly specialized knowledge to understand the essence of challenges in nuclear engineering

B) Broad education and wide view acquired by energy/environment-related classes as well as internship programs

C) Mastery of high ethics and societal responsibilities needed for nuclear engineers

D) Mastery of skills to solve practical problems by interactive classes

E) Master thesis writing guided by academic advisors

F) Mastery of skills to deploy discussion with academic presentations and scientific communications

4. IGP Completion Requirements

The following requirements must be met to complete the Master's Degree Program of this major.

1. Attain a total of 30 credits or more from 400- and 500-level courses.
2. From the courses specified in the Graduate Major in Nuclear Engineering curriculum,
    - 8 credits acquired from Research Seminars;
    - a minimum of 21 credits acquired from courses of Research Seminars, Research-Related Courses, and Major Courses
    - 8 credits acquired from required Major Courses
    - 1 credit acquired from restricted elective Major Courses
    - a minimum of 5 credits acquired from Liberal Arts and Basic Science Courses (3 credits from Humanities and Social Science Courses of which 2 credits must be from 400-level courses and 1 credit from 500-level courses, and 2 credits from Career Development Courses).
3. Pass the master's thesis review and defense.

Table M1 shows course categories and the number of credits required to complete the Master's 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 M1. Graduate Major in Nuclear Engineering Completion Requirements

Course category		<Required courses> Required credits	<Electives> Minimum credits required	Minimum credits required	Associated learning goals	Comments
Liberal arts and basic science courses	**Humanities and social science courses**		•2 credits from 400-level •1 credit from 500-level	5 credits	B	
	Entrepreneurship Courses		2 credits		C	All Graduate Attributes (GA) should be acquired. (Refer to Section 7 for the definition of GA.)
	Other courses				B	
Core courses	**Research seminars**	Seminar in Nuclear Engineering S1 Seminar in Nuclear Engineering F1 Seminar in Nuclear Engineering S2 Seminar in Nuclear Engineering F2 A total of 8 credits, 2 credits each from the above courses.		21 credits	B,D,E,F	
	Research-related courses				B	
	Major courses	8 credits	1 credit from Restricted electives Group A		A,B	
	Major courses and Research-related Courses <u>outside</u> the Graduate Major in Nuclear Engineering standard curriculum				B	

Total required credits	**A minimum of 30 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.** **・For details of the Liberal Arts and Basic Science Courses, please refer to the relevant sections.**

5. IGP Courses

Table M2 shows the Core Courses of the Master's 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 M2. Core Courses of the Graduate Major in Nuclear Engineering

Course category		Course number	Course title			Credits	Competencies	Learning goals	Comments
Research seminars	400 Level	NCL.Z491.R	◎	★	Seminar in Nuclear Engineering S1	0-2-0	1,2,3,4,5	A,B,D,F	
		NCL.Z492.R	◎	★	Seminar in Nuclear Engineering F1	0-2-0	1,2,3,4,5	A,D,F	
	500 level	NCL.Z591.R	◎	★	Seminar in Nuclear Engineering S2	0-2-0	1,2,3,4,5	A,D,F	
		NCL.Z592.R	◎	★	Seminar in Nuclear Engineering F2	0-2-0	1,2,3,4,5	A,D,F	
Research-related courses	500 level	NCL.I501.L			Internship in Nuclear Engineering I	0-0-1	3,4,5	B	
		NCL.I502.L			Internship in Nuclear Engineering II	0-0-2	3,4,5	B	
		NCL.I503.L			Internship in Nuclear Reactor Decommissioning I	0-0-1	3,4,5	B	
		NCL.I504.L			Internship in Nuclear Reactor Decommissioning II	0-0-2	3,4,5	B	
		NCL.I505.L		★	International Internship in Nuclear Engineering I	0-0-2	1,2,3,4,5	B	
		NCL.I506.L		★	International Internship in Nuclear Engineering II	0-0-2	1,2,3,4,5	B	
		NCL.I507.L		★	International Internship in Nuclear Engineering III	0-0-2	1,2,3,4,5	B	
		NCL.I508.L		★	International Internship in Nuclear Engineering IV	0-0-2	1,2,3,4,5	B	

Major courses	**400 level**	NCL.A402.L		★	Nuclear Fusion Reactor Engineering	2-0-0	1	A	
		NCL.A403.L		★	Particle Accelerator Engineering	1-0-0	1	A	
		NCL.B401.L		★	Radiation Biology and Medicine	2-0-0	1	A	
		NCL.C401.R	◎	★	Nuclear Fuel Cycle Engineering	2-0-0	1	A	
		NCL.C402.L		★	Radioactive Waste Management and Disposal Engineering	1-0-0	1	A	
		NCL.C403.L		★	Nuclear Chemical Engineering	1-0-0	1	A	
		NCL.D401.A	○	★	Experiments for Material Engineering in Nuclear Non-proliferation and Decommissioning A	0-0-1	1,5	A	Either NCL.D401.A or NCL.D402.A can be earned.
		NCL.D402.A	○	★	Experiments for Material Engineering in Nuclear Non-proliferation and Decommissioning B	0-0-1	1,5	A	Either NCL.D401.A or NCL.D402.A can be earned.
		NCL.D404.L			Nuclear Reactor Decommissioning	1-0-0	1	A	
		NCL.D405.A	○	★	Experiments for Chemistry in Nuclear Non-proliferation, Fuel Debris and Back-end Fuel Cycle A	0-0-1	1	A	Either NCL.D405.A or NCL.D406.A can be earned.
		NCL.D406.A	○	★	Experiments for Chemistry in Nuclear Non-proliferation, Fuel Debris and Back-end Fuel Cycle B	0-0-1	1	A	Either NCL.D405.A or NCL.D406.A can be earned.
		NCL.D407.A	○	★	Experiment on Thermalhydraulic and Severe Accident Engineering	1-0-1	1,5	A	Only for the students who did not earn “Experiment on Severe Accident Engineering”
		NCL.F402.L			Nuclear Regulation and Ethics	1-0-0	1,5	B	
		NCL.F451.L			Nuclear Engineering Science I	2-0-0	1	A	
		NCL.F452.L			Nuclear Engineering Science II	2-0-0	1,5	A	
		NCL.F454.L			Safety and Regional Symbiosis for Nuclear Energy	2-0-0	3,4,5	B	

		NCL.N401.L		★	Basic Nuclear Physics	2-0-0	1,5	A	
		NCL.N402.R	◎	★	Nuclear Reactor Theory I	1-1-0	1,5	A	
		NCL.N403.L		★	Nuclear Materials and Structures	2-0-0	1	A	
		NCL.N405.L		★	Nuclear Reactor Thermal-hydraulics	2-0-0	1	A	
		NCL.N406.R	◎	★	Nuclear Reactor Theory II	1-1-0	1,5	A	
		NCL.N407.R	◎	★	Nuclear System Safety Engineering	2-0-0	1	A	
		NCL.N410.A	○	★	Nuclear Reactor Physics, Radiation Measurement and Nuclear Security Laboratory	0-0-2	1,5	A	Only for the students who did not earn “Nuclear Reactor Physics Laboratory”
		NCL.N411.L		★	Innovative Nuclear Systems Design Project	0-2-0	1,3,4, 5	A,D,F	
		NCL.O401.L		★	Nuclear Non-proliferation and Security	2-0-0	1,4,5	B	
		NCL.O402.L		★	Materials simulation	2-0-0	1,5	B	(TCM.A402)
		NCL.O404.L		★	Materials Informatics	2-0-0	1,5	B	(TCM.A404)
		NCL.O406.L		★	Interdisciplinary scientific principles of energy 1	1-0-0	1,5	B	(ESI.A401)
		NCL.O407.L		★	Interdisciplinary scientific principles of energy 2	1-0-0	1,5	B	(ESI.A402)
		NCL.O408.L		★	Energy system theory	1-0-0	1,5	B	(ESI.A407)
		NCL.O409.L		★	Marketing for Value Creation	1-0-0	1,5	B	(ENI.H401)
		NCL.O410.L		★	Finance and Data Analysis in Energy Markets	1-0-0	1,5	B	(ENI.H402)
		NCL.O411.L		★	Economic Development and Energy Policies	1-0-0	1,5	B	(ENI.H403)
		NCL.O412.L		★	Economy of energy system	1-0-0	1,5	B	(ESI.A408)
		NCL.O413.L			Special lecture of economics and politics in energy	1-0-0	1,5	B	(ESI.B436)
	500 level	NCL.B501.L			Radiation Health Effects and Protection Exercise	0-1-1	1,3	A	

		NCL.O513.L		★	Energy Green Transformation	2-0-0	1,4	A	Only for the students who did not earn “Special Lecture in Nuclear Engineering III, IV”.

Note：

• ◎：Required course, ○：Restricted elective, ★: Classes in English, O：odd academic years, Ｅ：even academic years

• Competencies: 1 = Specialist skills, 2 = Liberal arts skills, 3 = Communication skills, 4 = Applied skills (inquisitive thinking and/or problem-finding skills), 5 = Applied skills (practical and/or problem-solving skills)

•【 】Course offered by another graduate major

• 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 (Nuclear fusion and accelerator engineering), B (Radiation biology and medicine), C (Nuclear fuel cycle engineering), D (Nuclear reactor decommissioning engineering), F (Basic nuclear engineering), I (Internships), M (Medical engineering), N (Nuclear reactor engineering), O (Wide and advanced nuclear engineering), U (Leading Graduate School (U-ATOM) subjects), Z (Research seminars).

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

None

7. IGP Entrepreneurship Courses and IGP Courses That Can Be Counted as Entrepreneurship Courses

In order to fulfill the completion requirements for the master’s degree program, students must attain at least two credits in Entrepreneurship Courses, and should satisfy all of the Graduate Attributes (GAs) specified in Table M-1 of the “Entrepreneurship Courses” listed as “Liberal Arts and Basic Science Courses” in the Guide to Graduate Education and International Graduate Program, as well as shown below. Students will be evaluated in regards to GA achievements at the time of their degree completion. For courses with two GAs, both GAs stipulated for the courses are considered to be acquired if students attain the corresponding credits for those courses.

Entrepreneurship Courses and Major Courses that enable students to acquire GAs and are recognized as equivalent to Entrepreneurship Courses, offered by the Graduate Major, are listed in Table M3 below. Students can also acquire GAs and credits by taking the Entrepreneurship Courses offered by the Center for Entrepreneurship Education (CEE) listed as “Liberal Arts and Basic Science Courses” in the Guide to Graduate Education and International Graduate Program.

As there are some Entrepreneurship Courses without GAs, please check carefully before registering for them.

However, it must be noted that credits attained from courses that are recognized as equivalent to Entrepreneurship Courses can be counted towards the completion requirements of the master’s degree program, either for Major Courses or for Entrepreneurship Courses (not for both). Nevertheless, even in cases where credits pertaining to courses that are not considered as Entrepreneurship Courses are attained, the associated GAs may be considered by the Graduate Major to have been acquired.

For Graduate Attributes, refer to the Guide to Entrepreneurship Courses.

The Graduate Attributes of the Master's Degree Program are listed in Table M-1 as follows:

GA0M: You can clearly plan your own career and recognize the abilities necessary for realizing it while considering ethics and relevance to societal problems.

GA1M: You can acquire the knowledge, skills, ethics and entrepreneurship necessary for realizing your planned career and contribute to societal problem-solving while collaborating with other experts

Table M3. Courses of the Graduate Major in Nuclear Engineering recognized as equivalent to Entrepreneurship Courses, and Entrepreneurship Courses

Course category	Course number	Course title	Credits	GA*	Learning goals	Comments
Courses that can be counted as Entrepreneurship Courses	NCL.F402.L	Nuclear Regulation and Ethics	1-0-0	GA1M	B	
Entrepreneurship Courses	NCL.R401	Master's Recurrent Program 1 (Nuclear Engineering)	0-0-1	GA0M GA1M		Entrepreneurship Course offered by the Graduate Major in Nuclear Engineering. (Cannot be counted for Major Courses)
	NCL.R402	Master's Recurrent Program 2 (Nuclear Engineering)	0-0-2	GA0M GA1M		

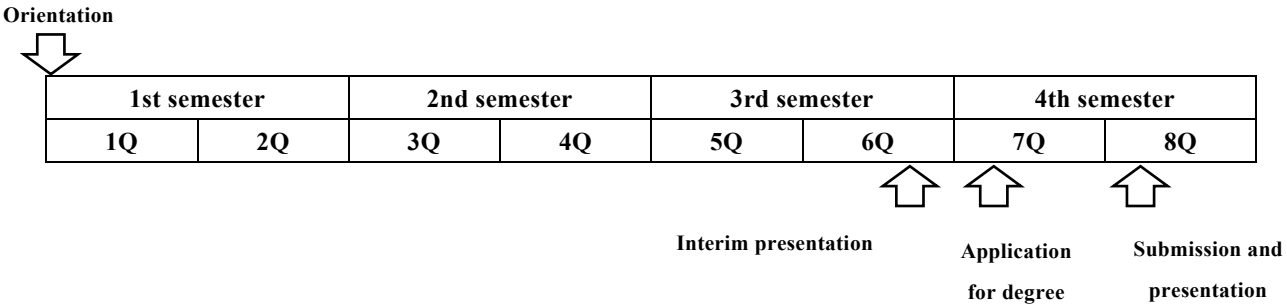
Credits in Entrepreneurship Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.

＊GA: Graduate Attributes

The Tokyo Tech Academy for Leadership (ToTAL), WISE Programs, or Center of Data Science and Artificial Intelligence may offer courses that are recognized as equivalent to Entrepreneurship Courses in addition to those listed as such under “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 or center that offers the relevant program.

8. Research Related to the Completion of Master Theses

In the research related to the completion of master thesis, the students experience a series of research processes, and acquire abilities to identify, to investigate, and to solve new issues. The procedure is as follows:



・interim presentation

On the 6th quarter, an interim presentation is examined to clarify background and objective of the research in terms of career formation.

・criterion for judgment

Master thesis must be the original including new scientific knowledge in the nuclear engineering or valuable knowledge contributed to the progress of the nuclear engineering.

・judgement procedure of master thesis

The referee board consists of more than 3 referees. After the pre-review by the referees, the thesis is finally evaluated though the oral presentation. A student wishing to go on to the doctor course is examined by 5 or more referees.

【Doctoral Degree Program】

1. Outline

Growing attention has been placed on nuclear energy as an ultimate measure for reduction of fossil fuel consumption and CO2 emission. Under the circumstances of global warming and the price hike of oil, gas and coal, a number of countries have been considering the implementation of nuclear power plants. The key factor of the nuclear energy development is the development of human resources. Our original course of international nuclear engineering has been established in 1993. Since then, a number of students have joined us from many countries and graduated from our course. They are actively contributing to the development of industries and technologies in Japan or in their own countries. This graduate course provides with core curriculum for nuclear reactor engineering and fuel cycle technologies and also covers extended nuclear energy, such as beam, accelerator, plasma sciences, nuclear fusion, energy and environment, and social relations.

2. Competencies Developed

The curriculum is designed to allow students to polish what they have learned in the Master's Program, including advanced specialized knowledge of nuclear engineering, broad vision and education, a sense of ethics and social responsibility, logical dialogue skills, writing skills, practical problem-solving skills, and creativity. Furthermore, it enables students to acquire the abilities to discover problems and research them, to create new knowledge, to disseminate, to pioneer and lead new fields, and to develop leadership with which they can play an active role in international society.

3. Learning Goals

The goals provided in the course to obtain the competencies described in the curriculum are as follows:

A) Abilities to create and to disseminate new knowledge by the use of the advanced specialized knowledge of nuclear engineering

B) Abilities to resolve practical issues under deep understanding of nuclear engineering

C) To develop leadership skills, high ethics, and societal responsibilities

D) Doctoral thesis writing guided by academic advisors

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. From the courses specified in the Graduate Major in Nuclear Engineering curriculum,
    - a minimum of 18 credits acquired from courses of Research Seminars, Research-Related Courses, and Major Courses
    - 12 credits acquired from Research Seminars (If the student completes the doctor study in less

than 12 quarters, the required credit is reduced according to the number of spent quarters.)

- a minimum of 6 credits acquired from Major Courses; and
- a minimum of 6 credits acquired from Liberal Arts and Basic Science Courses

  (2 credits from Humanities and Social Science Courses, and 4 credits from Entrepreneurship Courses).

3. Give the oral presentation in English in the interim presentation meeting.
4. Pass the doctoral thesis review and defense.
5. Achieve the score of 730 or more in TOEIC standard in an external official English language test.

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 Nuclear Engineering Completion Requirements

Course category		<Required courses> Required credits	<Electives> 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	
	Entrepreneurship 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 Nuclear Engineering S3 Seminar in Nuclear Engineering F3 Seminar in Nuclear Engineering S4 Seminar in Nuclear Engineering F4 Seminar in Nuclear Engineering S5 Seminar in Nuclear Engineering F5 A total of 12 credits, 2 credits each from the above courses.		18 credits	A,B	
	Research-related courses				B	
	Major courses		6 credits		A,B	
	Major courses and Research-related courses <u>outside</u> the Graduate Major in Nuclear Engineering 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.				

	• **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. Core courses listed in the Comments column are those provided by other majors and are recognized as equivalent to the corresponding Major Courses or Research-Related Courses of the standard curriculum of this major.

Table D2. Core Courses of the Graduate Major in Nuclear Engineering

Course category		Course number	Course title			Credits	Competencies	Learning goals	Comments
Research seminars	600 level	NCL.Z691.R	◎	★	Seminar in Nuclear Engineering S3	0-2-0	1,2,3,4,5	A,D	
		NCL.Z692.R	◎	★	Seminar in Nuclear Engineering F3	0-2-0	1,2,3,4,5	A,D	
		NCL.Z693.R	◎	★	Seminar in Nuclear Engineering S4	0-2-0	1,2,3,4,5	A,D	
		NCL.Z694.R	◎	★	Seminar in Nuclear Engineering F4	0-2-0	1,2,3,4,5	A,D	
		NCL.Z695.R	◎	★	Seminar in Nuclear Engineering S5	0-2-0	1,2,3,4,5	A,D	
		NCL.Z696.R	◎	★	Seminar in Nuclear Engineering F5	0-2-0	1,2,3,4,5	A,D	
Research-related courses	600 level	NCL.I601.L		★	Nuclear Engineering Off-Campus Project	0-0-4	1,2,3,4,5	B	
		NCL.I602.L			Special Internship in Nuclear Engineering I	0-0-1	1,2,3,4,5	B	
		NCL.I603.L			Special Internship in Nuclear Engineering II	0-0-2	1,2,3,4,5	B	
		NCL.I604.L		★	International Special Internship in Nuclear Engineering I	0-0-2	1,2,3,4,5	B	
		NCL.I605.L		★	International Special Internship in Nuclear Engineering II	0-0-2	1,2,3,4,5	B	
		NCL.I606.L		★	International Special Internship in Nuclear Engineering III	0-0-2	1,2,3,4,5	B	
		NCL.I607.L		★	International Special Internship in Nuclear Engineering IV	0-0-2	1,2,3,4,5	B	

Major courses	**600 level**	NCL.A601.L		★	Special Lecture on Accelerator and Fusion Reactor Technology I	1-0-0	1	A	
		NCL.A602.L		★	Special Lecture on Accelerator and Fusion Reactor Technology II	1-0-0	1	A	
		NCL.A603.L		★	Special Lecture on Accelerator and Fusion Reactor Technology III	1-0-0	1	A	
		NCL.C601.L		★	Special Lecture on Nuclear Fuel Cycle I	1-0-0	1	A	
		NCL.C602.L		★	Special Lecture on Nuclear Fuel Cycle II	1-0-0	1	A	
		NCL.C603.L		★	Special Lecture on Nuclear Fuel Cycle III	1-0-0	1	A	
		NCL.C604.L		★	Nuclear Fuel Cycle Engineering Special Laboratory	0-0-2	1,5	A	
		NCL.D601.L		★	Experiment on Thermalhydraulic and Severe Accident Special Laboratory	0-0-2	1,5	A,B	
		NCL.N601.L		★	Special Lecture on Nuclear Reactor Technology I	1-0-0	1	A	
		NCL.N602.L		★	Special Lecture on Nuclear Reactor Technology II	1-0-0	1	A	
		NCL.N603.L		★	Special Lecture on Nuclear Reactor Technology III	1-0-0	1	A	
		NCL.N606.L		★	Nuclear Material Special Laboratory	0-0-2	1	A,B	
		NCL.N608.L		★	Nuclear Reactor Physics, Radiation Measurement and Nuclear Security Special Laboratory	0-0-2	1,5	A,B	
		NCL.N609.L		★	Innovative Nuclear Systems Design Special Project	0-2-0	1,5	A,B	
		NCL.O601.L		O	Special Lecture on Radiation management I	1-0-0	1,5	A	Odd academic years
		NCL.O602.L		O	Special Lecture on Radiation Management II	1-0-0	1,5	A	Odd academic years
		NCL.O606.L		★	InfoSyEnergy Product-service design	1-0-0	1,5	B	(ENI.A602)
		NCL.O607.L		★	InfoSyEnergy Policy-making workshop	0-1-0	1,5	B	(ENI.A603)
		NCL.O608.L		★	Nuclear Plant Cyber Security Exercise	0-1-0	1,5	A,B	
		NCL.O609.L		★	Nuclear Plant Physical Security Exercise	0-1-0	1,5	A,B	
		NCL.O610.L		★	Nuclear Disaster Response Exercise	1-1-0	1,5	A,B	
		NCL.I610.L			Cooperative Education through Research	0-0-4	1,3,4,5	B	

					Internships of Nuclear Engineering				
		NCL.O611.L			Nuclear Innovator Cultivation Camp	0-0-2	1,3,4,5	B	

Note：

• ◎：Required course, ○：Restricted elective, ★: Classes in English, O：odd academic years, E：even academic years

• Competencies: 1 = Specialist skills, 2 = Liberal arts skills, 3 = Communication skills, 4 = Applied skills (inquisitive thinking and/or problem-finding skills), 5 = Applied skills (practical and/or problem-solving skills)

• 【 】Course offered by another graduate major

• 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.D600.R): A (Nuclear fusion and accelerator engineering), C (Nuclear fuel cycle engineering), I (Internships), N (Nuclear reactor engineering), U (Leading Graduate School (U-ATOM) subjects), Z (Research seminars).

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

None

7. IGP Entrepreneurship Courses and IGP Courses That Can Be Counted as Entrepreneurship Courses

In order to fulfill the completion requirements for the doctoral degree program, students must attain at least four credits in Entrepreneurship Courses, and should satisfy all of the Graduate Attributes (GAs) specified in Table D-1 of the "Entrepreneurship Courses" listed as "Liberal Arts and Basic Science Courses" in the Guide to Graduate Education and International Graduate Program, as well as shown below. Students will be evaluated in regards to GA achievements at the time of their degree completion. For courses with two GAs, both GAs stipulated for the courses are considered to be acquired if students attain the corresponding credits for those courses.

Entrepreneurship Courses and Major Courses that enable students to acquire GAs and are recognized as equivalent to Entrepreneurship Courses, offered by the Graduate Major, are listed in Table D3 below. Students can also acquire GAs and credits by taking the Entrepreneurship Courses offered by the Center for Entrepreneurship Education (CEE) listed as "Liberal Arts and Basic Science Courses" in the Guide to Graduate Education and International Graduate Program.

As there are some Entrepreneurship Courses without GAs, please check carefully before registering for them.

However, it must be noted that credits attained from courses that are recognized as Entrepreneurship Courses can be counted towards the completion requirements of the doctoral degree program, either for Major Courses or for Entrepreneurship Courses (not for both). Nevertheless, even in cases where credits pertaining to courses that are not considered as Entrepreneurship Courses are attained, the associated GAs may be considered by the Graduate Major to have been acquired.

For Graduate Attributes, refer to the Guide to Entrepreneurship Courses.
The Graduate Attributes of the Doctoral Degree Program are listed in Table D-1 as follows:

GA0D: You can clearly design your own career and contribute to realizing scientific, technological, or social innovation through a comprehensive understanding of the knowledge, skills, social responsibilities and ethics required to become an active member of academia and/or industry.

GA1D: You can lead in realizing scientific, technological, or social innovation by acquiring advanced leadership skills, entrepreneurship, knowledge and expertise, and by developing social responsibility necessary for materializing your designed career.

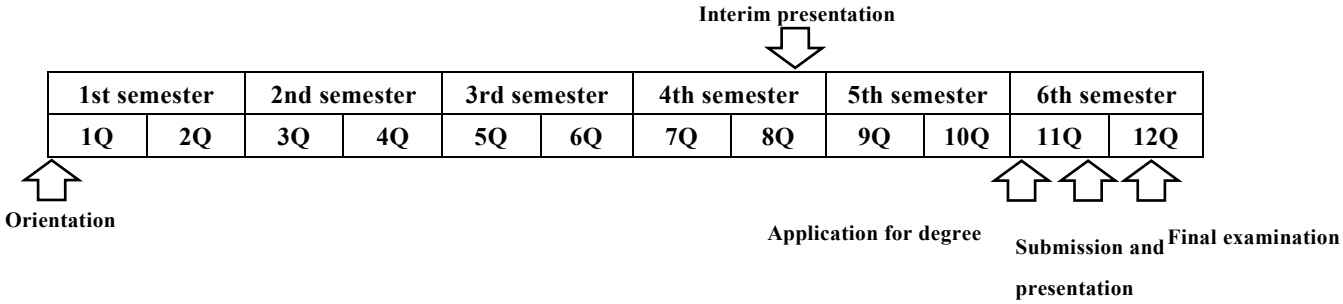
Table B1. Courses of the Graduate Major in Nuclear Engineering recognized as equivalent to Entrepreneurship Courses, and Entrepreneurship Courses

Course category	Course number	Course title			Credits	GA*	Learning goals	Comments
Courses that can be counted as Entrepreneurship Courses	NCL.I610.L			Cooperative Education through Research Internships of Nuclear Engineering	0-0-4	GA1D	B	
Entrepreneurship Courses	NCL.R601			Doctoral Recurrent Program 1 (Nuclear Engineering)	0-0-1	GA0D GA1D		Entrepreneurship Course offered by the Graduate Major in Nuclear Engineering. (Cannot be counted for Major Courses)
	NCL.R602			Doctoral Recurrent Program 2 (Nuclear Engineering)	0-0-2	GA0D GA1D		
	NCL.R603			Doctoral Recurrent Program 3 (Nuclear Engineering)	0-0-3	GA0D GA1D		
	NCL.R604			Doctoral Recurrent Program 4 (Nuclear Engineering)	0-0-4	GA0D GA1D		
Credits in Entrepreneurship 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**								

The Tokyo Tech Academy for Leadership (ToTAL), WISE Programs, or Center of Data Science and Artificial Intelligence may offer courses that are recognized as equivalent to Entrepreneurship Courses in addition to those listed as such under “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 or center that offers the relevant program.

8. Research Related to the Completion of Doctoral Theses

In the research related to the completion of doctoral thesis, the students acquire abilities to solve and to discover problems through the learning design and process. English communication skill equal to or higher than TOEIC 730 is also required.



・interim presentation

On the 8th[h] quarter, an interim presentation is examined to clarify target and completion for the research.

・criterion for judgment

Doctoral thesis must be the original including creative and new scientific knowledge in the nuclear engineering, and its main part must be published or have equivalent level in the international scientific journals.

・judgement procedure of doctoral thesis

The referee board consists of more than 5 referees. After the oral presentation and the pre-review by the referees, the thesis is finally evaluated. Scholastic ability is also examined in the finale examination.