Graduate Major in Engineering Sciences and Design

Graduate major in Engineering Sciences and Design includes various aspects of Mechanical Engineering, System and Control Engineering, Information and Communications Engineering, Industrial Engineering and Economics (School of Engineering), Architecture and Building Engineering, Civil and Environmental Engineering, and Transdisciplinary Science engineering (School of Environment and Society). Taking a 'design' point of view, this major aims to foster creativity in engineering students so that they can generate useful solutions and products across a variety of cases and contexts.

【Master's Degree Program】

1. Outline

The purpose of this major is the cultivation of engineering design abilities, i.e.

(1) Students will develop a broad perspective without being bound to the frame of current science and technology.
(2) Students will acquire the ability to find solutions to a variety of real-life challenges.
(3) Students will contribute to the creation of new technologies, values, and concepts required to improve our society.

2. Competencies Developed in the Program

Students will acquire the following skills and abilities:

(1) Knowledge, ethics, and a logical mindset that enables their success in science and technological research fields.
(2) Fundamental skills for engineering design.
(3) Self-learning skills for research and innovation.
(4) Communication skills for research and innovation.
(5) Practical abilities for research and facilitation in engineering design.

3. Learning Goals

To acquire the aforementioned competencies, students will participate in the following classes and projects:

(A) Fundamentals of engineering design

Students learn design thinking fundamentals through group work and acquire knowledge and skills in various engineering fields related to engineering design.

(B) Problem-Based Learning (PBL)

Students experience planning and carrying out an engineering design project inside/outside the classroom.

(C) Theory of design

Students learn academic knowledge and skills related to engineering design.

(D) Design of artifacts

Students learn knowledge and skills in various engineering fields, as well as the fundamentals of design engineering.

(E) Design of social systems

Students learn engineering design knowledge and skills as applied to the creation of software, services, and social systems.

(F) Design of human environment

Students learn about the design process, with an approach centered on people.

(G) Master's thesis

Through research seminars and surveying academic papers, students complete a research project and submit a thesis for their Master's degree.

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 Engineering Sciences and Design curriculum:
   - 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).
   - a minimum of 22 credits acquired from Core Courses (6 credits must be from Research Seminars, 3 credits must be acquired from “Engineering Design Challenge” and “Design Thinking Fundamentals”, minimum 4 credits from B subject group, minimum 6 credits selecting 2 and more subject groups from C, D, E, F).
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. Completion Requirements for the Graduate Major in Engineering Sciences and Design

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	C	
	Career Development Courses		2 credits		C, D	All Graduate Attributes (GA) should be acquired. (Refer to Section 7 for the definition of GA.)
	Other courses					
Core Courses	**Research Seminars**	Seminar in Engineering Design S1 Seminar in Engineering Design F1 Seminar in Engineering Design S2 Seminar in Engineering Design F2 A total of 6 credits		22 credits	G	
	Research-Related Courses and Major Courses	Engineering Design Challenge 1 credit Design Thinking Fundamentals 2 credits	•Minimum 4 credits from B subject group •Minimum 6 credits selecting 2 and more subject groups from C, D, E, F		A,B,C,D,E,F	
	Major Courses and Research-Related Courses <u>outside</u> the Graduate Major in Engineering Sciences and Design standard curriculum					
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.** **・Subject group: Please refer to course numbers.** **A : Fundamentals of engineering design B : PBL (Problem Based Learning) C : Theory of design D : Design of artifacts E : Design of social systems F : Design of human environment**

5. IGP Courses

Table M2 shows the Core Courses of the master's degree program in 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 Engineering Sciences and Design

Course Category		Course Number	Course Title			Credits	Competencies	Learning Goals	Comments
Research Seminars	400 level	ESD.Z491.R	◎		Seminar in Engineering Design S1	0-1-0	1	G	Offered in English as needed
		ESD.Z492.R	◎		Seminar in Engineering Design F1	0-1-0	1	G	Offered in English as needed
	500 level	ESD.Z591.R	◎		Seminar in Engineering Design S2	0-2-0	1	G	Offered in English as needed
		ESD.Z592.R	◎		Seminar in Engineering Design F2	0-2-0	1	G	Offered in English as needed
Research-Related Courses	500 level	ESD.B509.L		★	Problem Based Learning A	0-1-1	1,2,3,4,5	B	
		ESD.B510.L		★	Problem Based Learning B	0-1-1	1,2,3,4,5	B	
		ESD.B511.L		★	Problem Based Learning C	0-1-1	1,2,3,4,5	B	
		ESD.B512.L		★	Problem Based Learning D	0-1-1	1,2,3,4,5	B	
Major Courses	400 level	ESD.A401.R	◎	★	Engineering Design Challenge	1-0-0	1,2,4	A	
		ESD.A402.R	◎	★	Design Thinking Fundamentals	1-1-0	3,4,5	A	
		ESD.B401.L		★	Engineering Design Advanced	0-1-1	3,4,5	B	
		ESD.B402.L		★	Engineering Design Project	0-2-2	3,4,5	B	
		ESD.D404.L		★	Design of Medical and Welfare Device	1-0-0	1,5	D,F	
		ESD.D405.L		★	Materials and Design for Engineering Design	1-0-0	1,4,5	D	
		ESD.D406.L		★	Prototyping Methodology for Engineering Design	0-1-0	1,4,5	D	
		ESD.F403.L		★	UX / Interaction Design	1-1-0	2,3,5	F	
		ESD.F404.L		★	Affective Engineering / Emotional Design	1-0-0	1,3,4,5	F	
		ESD.F401.L		★ O	Introduction to Biomedical Instrumentation	1-0-0	1,2	F	【Human Centered Science and Biomedical Engineering】 (HCB.M463) Held only in odd academic years
		ESD.F402.L		★ E	Introduction to Neural Engineering	1-0-0	1,2	F	【Human Centered Science and

									Biomedical Engineering】 (HCB.M464) Held only in even academic years
		ESD.F406.L		★	Materials Simulation	2-0-0	1,5	F	【Tokyo Tech Academy for Convergence of Materials and Informatics】(TCM.A402) $
		ESD.F408.L		★	Materials Informatics	2-0-0	1,5	F	【Tokyo Tech Academy for Convergence of Materials and Informatics】(TCM.A404) $
		ESD.D491.L		★	Interdisciplinary Scientific Principles of Energy 1	1-0-0	1,4,5	D	【Energy Science and Engineering】(ENR.A401.A)
		ESD.D492.L		★	Interdisciplinary Scientific Principles of Energy 2	1-0-0	1,4,5	D	【Energy Science and Engineering】(ENR.A402.A)
		ESD.D493.L		★	Energy System Theory	1-0-0	1,4	D	【Energy Science and Engineering】(ENR.A407.A)
		ESD.E494.L		★	Marketing for Value Creation	1-0-0	1,2,4	E	【Tokyo Tech Academy of Energy and Informatics】(ENI.H401)
		ESD.E495.L		★	Finance and Data Analysis in Energy Markets	1-0-0	1,4,5	E	【Tokyo Tech Academy of Energy and Informatics】(ENI.H402)
		ESD.E496.L		★	Economy of Energy System	1-0-0	1,4,5	E	【Energy Science and Engineering】(ENR.A408.A)
	500 level	ESD.B505.L			Short term Research Project M1	0-0-1	1,2,3,5	B,G	Offered in English as needed
		ESD.B506.L			Short term Research Project M2	0-0-1	1,2,3,5	B,G	Offered in English as needed
		ESD.B507.L			Short term Research Project M3	0-0-1	1,2,3,5	B,G	Offered in English as needed
		ESD.B508.L			Short term Research Project M4	0-0-1	1,2,3,5	B,G	Offered in English as needed
		ESD.C503.L		★	Design Theories	1-1-0	1,2,3,4,5	C	
		ESD.D501.L		★	Mechano-System Design	2-0-0	1,5	D	
		ESD.D503.L		★	Civil Engineering Design I	1-1-0	1,2	D	
		ESD.D504.L		★	Civil Engineering Design II	1-1-0	1,2	D	
		ESD.D506.L		★	Application of Systems Engineering	1-1-0	1,2,5	D	
		ESD.D505.L		★	Introduction to Systems Engineering	1-0-0	1,2,5	D	【Global Engineering for Development, Environment and Society】 (GEG.T503)
		ESD.D507.L		★	Virtual Reality and Interaction	2-0-0	1,2,4	D	【Information and Communications Engineering】(ICT.H507)
		ESD.F502.L		★	Advanced Measurement of Sensory Information	2-0-0	1,5	F	【Information and Communications Engineering】(ICT.H517)

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 : Fundamentals of engineering design, B : PBL (Problem Based Learning), C : Theory of design, D : Design of artifacts, E : Design of social systems, F : Design of human environment, Z: Research seminars
$ The Tokyo Tech Academy for Convergence of Materials and Informatics (TAC-MI) courses are not exclusive to students enrolled in TAC-MI. However, as the courses involve the use of TSUBAME, capacity is limited. Registration by non-TAC-MI students may not always be accepted.

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 master's degree program, students must attain at least 2 credits in Career Development Courses, and should satisfy all of the Graduate Attributes (GA) specified in Table MA-1 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 Table M3 below.

However, it must be noted that credits attained from these courses can be counted towards the completion requirements of master's degree program, either for the Major Courses or for the Career Development Courses (i.e., not for both). Nevertheless, even in the cases from those mentioned above where attained credits pertaining to these courses are not considered as Career Development Courses, their associated GAs are always considered to have been acquired.

For Graduate Attributes, refer to the Guide to the Career Development Courses.
The Graduate Attributes of the Master's Degree Program are listed in Table MA-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, and ethics 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 Engineering Sciences and Design Recognized as Equivalent to Career Development Courses

Course Category	Course number	Course Title			Credits	GA*	Learning Goals	Comments
Courses that Can Be Counted as Career Development Courses	ESD.B401.L		★	Engineering Design Advanced	0-1-1	GA0M/ GA1M	B	
	ESD.B402.L		★	Engineering Design Project	0-2-2	GA0M/ GA1M	B	
	ESD.B505.L			Short term Research Project M1	0-0-1	GA0M	B,G	Offered in English as needed
	ESD.B506.L			Short term Research Project M2	0-0-1	GA0M	B,G	Offered in English as needed
	ESD.B507.L			Short term Research Project M3	0-0-1	GA0M	B,G	Offered in English as needed
	ESD.B508.L			Short term Research Project M4	0-0-1	GA0M	B,G	Offered in English as needed
	ESD.B509.L		★	Problem Based Learning A	0-1-1	GA1M	B	
	ESD.B510.L		★	Problem Based Learning B	0-1-1	GA1M	B	
	ESD.B511.L		★	Problem Based Learning C	0-1-1	GA1M	B	
	ESD.B512.L		★	Problem Based Learning D	0-1-1	GA1M	B	

★: Classes in English

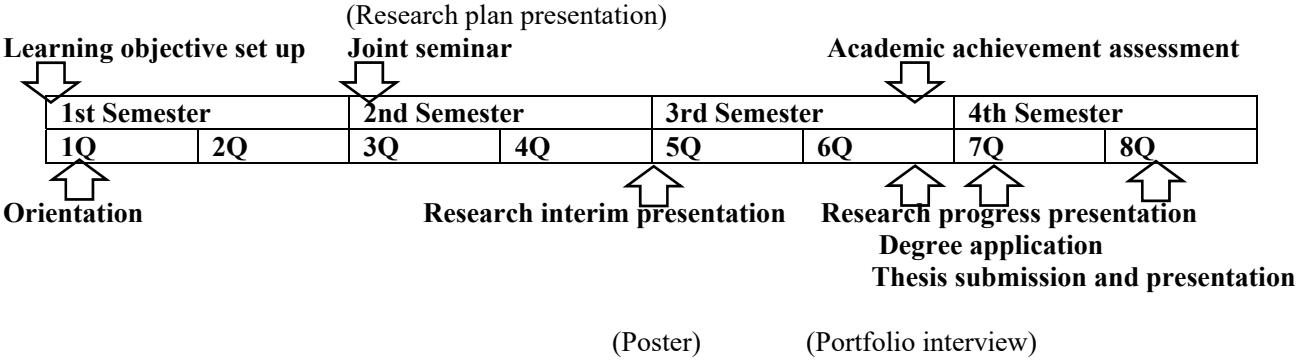
Credits in Career Development Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.

＊GA: Graduate Attributes

8. Research Process for Master's thesis

Research for Master's Thesis: Model diagram

In going through the research process for their master's theses, students will cultivate abilities to address key issues based on previous research from their own points of view through practical experience of conducting a series of research processes.



・ Research plan presentation・Research interim presentation

To make good research outcomes, it is important to undertake research systematically and to check its progression on a regular basis. For the sake of gaining a clear understanding of the research background and purpose, as well as to have an overhead view of engineering design research and to direct the research process, master's students are required to present their research plan in the third quarter. Then, students will make an interim presentation in the fifth quarter as well as a presentation of their research progress while gaining experience and feedback from laboratories working in related-research fields in the sixth quarter.

・Criteria of master's thesis assessment

Master's theses should include either new findings in the academic area of engineering design or useful findings which contribute to developing solutions and value creation for related technology. Also, theses should be written by students themselves and should include their own considerations.

・Process of master's thesis assessment

An assessment committee consists of 2 judges and supervisor(s). Before the final assessment and evaluation, judges conduct peer reviews in advance followed by students' oral presentations. Assessments for students who are willing to proceed to doctor's course will be judged by more than five judges, including three professors who are faculty in the program.

【Doctoral Degree Program】

1. Outline

The purpose of this major is the cultivation of advanced engineering design abilities, i.e.
(1) Students will develop a broad perspective without being bound to the frame of science and technology.
(2) Students will acquire the ability to find solutions to a variety of real-life challenges.
(3) Students will contribute to the creation of new technologies, values and concepts, required to improve our society.

2. Competencies Developed

Students will acquire the following high-level skills and abilities:
(1) A mindset to challenge outstanding problems in science, technology, and ethics.
(2) An ability to collaborate with other researchers who have different cultures and philosophies.
(3) International communication and management abilities to progress their research and innovate.
(4) An ability to create new concepts for technology and innovate by taking a broad perspective.
(5) Design abilities to advance their research through a Doctoral thesis and practical projects.

3. Learning Goals

To acquire the aforementioned competencies, students will participate in the following classes and projects:

(A) Teaching methodologies

Participating in a project class and PBL for master's courses or undergraduate courses, students will learn teaching methodologies, including mentoring and facilitation under the instruction of their supervisor.

(B) Problem-Based Learning (PBL)

Students experience planning and carrying out an engineering design project inside/outside the classroom (recommended to be undertaken abroad as foreign exchange students).

(C) Expertise in engineering sciences and design

Students learn academic knowledge and skills for education related to engineering sciences and design.

(D) Doctoral thesis

Through research seminars and surveying academic papers, students complete a research project and submit a thesis for their Doctoral degree.

4. IGP Completion Requirements

All of the following requirements must be met to complete the doctoral degree program of this major:

1. Attain 24 credits or more from 600-level courses in total.

2. From the courses specified in the Graduate Major in Engineering Sciences and Design curriculum, attain credits as regulated as below:

- 12 credits from Research Seminars.
- 1 or more credit(s) from Pedagogical Seminars for Graduate Students.
- 2 credits as Engineering Science & Design Presentation (interim assessment) (Note that this requirement is applied for students enrolled in or after April, 2019).
- 6 credits or more from Liberal Arts and Basic Science Courses; the credits must satisfy, in details, 2 credits or more in 600-level courses from Humanities and Social Science Courses, and 4 credits or more from Career Development Courses.

3. Pass the doctoral thesis 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. Completion Requirements for the Graduate Major in Engineering Sciences and Design

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	
	Career Development Courses		4 credits		C, D	All Graduate Attributes (GA) should be acquired. (Refer to Section 7 for the definition of GA.)
	Other courses					
Core Courses	Research Seminars	Research Seminar in Engineering Design S3 Research Seminar in Engineering Design F3 Research Seminar in Engineering Design S4 Research Seminar in Engineering Design F4 Research Seminar in Engineering Design S5 Research Seminar in Engineering Design F5 A total of 12 credits			C, D	
	Research-Related Courses and Major Courses	Engineering Science & Design Presentation 2 credits	Pedagogical Seminar subject group 1 credit		A, B, C, D	
	Major Courses and Research-Related Courses <u>outside</u> the Graduate Major in Engineering Sciences and Design 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. 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 Engineering Sciences and Design

Course Category		Course Number			Course Title	Credits	Competencies	Learning Goals	Comments
Research Seminars	600 level	ESD.Z691.R	◎		Seminar in Engineering Design S3	0-2-0	1	D	Offered in English as needed
		ESD.Z692.R	◎		Seminar in Engineering Design F3	0-2-0	1	D	Offered in English as needed
		ESD.Z693.R	◎		Seminar in Engineering Design S4	0-2-0	1	D	Offered in English as needed
		ESD.Z694.R	◎		Seminar in Engineering Design F4	0-2-0	1	D	Offered in English as needed
		ESD.Z695.R	◎		Seminar in Engineering Design S5	0-2-0	1	D	Offered in English as needed
		ESD.Z696.R	◎		Seminar in Engineering Design F5	0-2-0	1	D	Offered in English as needed
Research-Related Courses	600 level	ESD.B609.L		★	Problem Based Learning E	0-0-1	1,2,3,5	B	
		ESD.B610.L		★	Problem Based Learning F	0-0-1	1,2,3,5	B	
		ESD.B611.L		★	Problem Based Learning G	0-0-1	1,2,3,5	B	
		ESD.B612.L		★	Problem Based Learning H	0-0-1	1,2,3,5	B	
		ESD.S610.L			Research Dialog	0-0-1	1,3,4	B,C,D	Offered in English as needed
		ESD.S611.R	◎	★	Engineering Science & Design Presentation	0-1-1	1,3,4,5	C,D	Offered in Japanese as needed
Major Courses	600 level	ESD.A601.L			Pedagogical Seminar for Graduate Students A	0-0-1	3,5	A	Offered in English as needed
		ESD.A602.L			Pedagogical Seminar for Graduate Students B	0-0-1	3,5	A	Offered in English as needed
		ESD.A603.L			Pedagogical Seminar for Graduate Students C	0-0-1	3,5	A	Offered in English as needed
		ESD.A604.L			Pedagogical Seminar for Graduate Students D	0-0-1	3,5	A	Offered in English as needed
		ESD.B613.L		★	Long-term Problem Based Learning D1	0-1-1	1,2,3,5	B,D	
		ESD.B614.L		★	Long-term Problem Based Learning D2	0-1-1	1,2,3,5	B,D	
		ESD.B615.L		★	Long-term Problem Based Learning D3	0-1-1	1,2,3,5	B,D	
		ESD.B616.L		★	Long-term Problem Based Learning D4	0-1-1	1,2,3,5	B,D	
		ESD.S601.L			Business Practice D1	0-0-1	1,4	B,C,D	Offered in English as needed
		ESD.S602.L			Business Practice D2	0-0-1	1,4	B,C,D	Offered in English as needed
		ESD.S603.L			Business Practice D3	0-0-1	1,4	B,C,D	Offered in English as needed
		ESD.S604.L			Business Practice D4	0-0-1	1,4	B,C,D	Offered in English as needed
		ESD.C691.L		★	InfoSyEnergy Product-service Design	1-0-0	1,3,4,5	C	【Tokyo Tech Academy of Energy and Informatics】(ENI.A602)
		ESD.B692.L		★	InfoSyEnergy Policy-making Workshop	1-0-0	1,3,4,5	B	【Tokyo Tech Academy of Energy and Informatics】(ENI.A603)
		ESD.B617.L			Cooperative Education through Research Internships of Engineering Sciences and Design	0-0-4	1,3,4,5	B,D	

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 : Teaching methodologies, B : PBL (Problem Based Learning), C : Expertise in engineering sciences and design, S: Research related activities, Z: Research seminars

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 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 below.

However, it must be noted that credits attained from these courses can be counted towards the completion requirements of doctoral degree program, either for the Major Courses or for the Career Development Courses (i.e., not for both). Nevertheless, even in the cases from those mentioned above where attained credits pertaining to these courses are not considered as Career Development Courses, their associated GAs are always considered to have been acquired.

For Graduate Attributes, refer to the Guide to the Career Development Courses.
The Graduate Attributes of the Doctoral Degree Program are listed in Table A-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 the advanced leadership skills, entrepreneurial skills, knowledge and expertise, and by developing social responsibility necessary for materializing your designed career.

Table D3. Courses of the Graduate Major in Engineering Sciences and Design Recognized as Equivalent to Career Development Courses

Course Category	Course Number	Course Title			Credits	GA*	Learning Goals	Comments
Courses that Can Be Counted as Career Development Courses	ESD.A601.L			Pedagogical Seminar for Graduate Students A	0-0-1	GA1D	A	Offered in English as needed
	ESD.A602.L			Pedagogical Seminar for Graduate Students B	0-0-1	GA1D	A	Offered in English as needed
	ESD.A603.L			Pedagogical Seminar for Graduate Students C	0-0-1	GA1D	A	Offered in English as needed
	ESD.A604.L			Pedagogical Seminar for Graduate Students D	0-0-1	GA1D	A	Offered in English as needed
	ESD.B609.L		★	Problem Based Learning E	0-0-1	GA0D	B	
	ESD.B610.L		★	Problem Based Learning F	0-0-1	GA0D	B	
	ESD.B611.L		★	Problem Based Learning G	0-0-1	GA0D	B	

	ESD.B612.L		★	Problem Based Learning H	0-0-1	GA0D	B	
	ESD.B613.L		★	Long-term Problem Based Learning D1	0-1-1	GA1D	B,D	
	ESD.B614.L		★	Long-term Problem Based Learning D2	0-1-1	GA1D	B,D	
	ESD.B615.L		★	Long-term Problem Based Learning D3	0-1-1	GA1D	B,D	
	ESD.B616.L		★	Long-term Problem Based Learning D4	0-1-1	GA1D	B,D	
	ESD.S601.L			Business Practice D1	0-0-1	GA1D	B,C,D	Offered in English as needed
	ESD.S602.L			Business Practice D2	0-0-1	GA1D	B,C,D	Offered in English as needed
	ESD.S603.L			Business Practice D3	0-0-1	GA1D	B,C,D	Offered in English as needed
	ESD.S604.L			Business Practice D4	0-0-1	GA1D	B,C,D	Offered in English as needed
	ESD.S610.L			Research Dialog	0-0-1	GA1D	B,C,D	Offered in English as needed
	ESD.B617.L			Cooperative Education through Research Internships of Engineering Sciences and Design	0-0-4	GA1D	B,D	

★: Classes in English

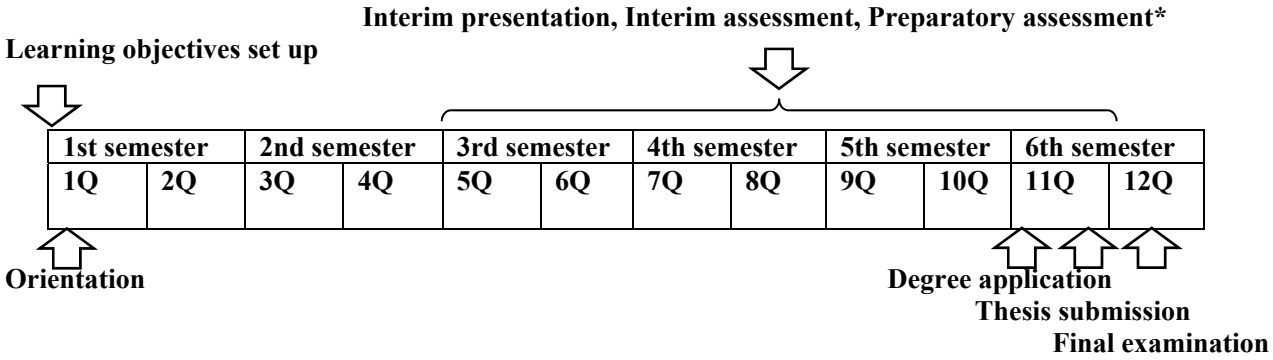
Credits in Career Development Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.

＊GA: Graduate Attributes

Students enrolled in the educational program for leading graduate schools, the Tokyo Tech Academy for Leadership (ToTAL) or WISE Programs 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. Research for Doctoral Theses: Model Diagram

In carrying out research for their doctoral thesis, students will cultivate the ability to address problems presented by previous research from their points of view as well as generate original findings related to key problems in the field. The steps to achieve these goals are described below.



Note that the above is a model diagram, and the details of Doctoral thesis assessment will be decided separately.

・Criteria of doctoral thesis assessment

Doctoral theses should include new and original findings in the academic area of engineering design. Also, the main part of the thesis should be published in either an international journal or be equivalent in quality to that.

・Process of doctoral thesis assessment

An assessment committee consists of five or more judges including three or more ESD course faculty members. It is strongly recommended that the committee includes several external judges from other universities and research institutes as extra judges. Students are allowed to submit papers for publication after they pass interim assessments and preparatory assessments*. Final assessments and evaluations are conducted after students' oral presentations and peer reviews by judges in advance.
* Preparatory assessment may be omitted in some cases according to the decision of ESD course steering committee.