Graduate Major in Industrial Engineering and Economics

【Master's Degree Program】

1. Outline

Based on the fundamental knowledge in industrial engineering and economics, students learn advanced knowledge and skills in mathematical engineering, economics, business administration, and industrial engineering management technology fields. This program aims to cultivate people with deep insights in technology, organization and economy, and with abilities to identify, inquire, and resolve problems in the world.

2. Competencies Developed

In order to pursue the course goal, this program aims to develop the following competencies.

・Fundamental knowledge to freely utilize mathematical engineering, information, and engineering technologies.

・Knowledge and viewpoints of industrial engineering and economics in order to comprehend management activities and programs in economics.

・Ability for deeper insight in technology and organization, and for discovering, analyzing and solving essential problems.

・Conceptual ability for structuring and modeling problems.

・Ability in explaining, documenting and communicating in English or Japanese language.

・Ability to pursue researches towards new problems.

3. Learning Goals

In order to develop the competences described above, students learn the following in this program.

A) Fundamental knowledge in industrial engineering and economics.

Learn fundamental knowledge of industrial engineering and economics at graduate level in order to utilize mathematical, information, and engineering technology freely.

B) Application of industrial engineering and economics

Learn knowledge and viewpoints of industrial engineering and economics necessary to understand management activities and economic problems.

C) Broad viewpoints and own initiative for learning

Develop insights on technology and organization, ability for discovering, analyzing, and solving essential problems, as well as conceptual ability for structuring and modeling problems.

D) Experience of engagement with society

Pseudo-experience engagement with society and learning of engineering ethics through lectures by practitioners.

E) Strengthen communication ability

Develop ability to conduct research on new problems through research projects for master thesis, and ability for explaining and communicating information in English/Japanese languages through colloquium and seminars.

4. IGP Completion Requirements

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

1. A total of 32 credits or more acquired from 400- and 500-level courses.

2. From the courses specified in this Graduate Major curriculum,

    • 8 credits acquired from Research Seminars;

    ・2 credits acquired from Reading in Industrial Engineering and Economics;

    • a minimum of 12 credits acquired from Major Courses; and

    • a minimum of 5 credits acquired from Liberal Arts and Basic Science Courses

    (3 credits from the 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. Graduate Major in Industrial Engineering and Economics 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	C	
	Career development courses		2 credits		C, D	
	Other courses					
Core courses	Research seminars	Seminar in IEE S1 Seminar in IEE F1 Seminar in IEE S2 Seminar in IEE F2 A total of 8 credits, 2 credits each from the above courses.		22 credits	A, B, C, D, E	
	Research-related courses	Reading in IEE S Reading in IEE F A total of 2 credits, 1 credit each from the above courses.			A, B, C, E	
	Major courses		12 credits		A, B, C, D, E	
	Major courses and Research-related courses <u>outside</u> the Graduate Major in Industrial Engineering and Economics standard curriculum					
Total required credits		A minimum of 32 credits in addition to meeting the above conditions				

Note	• **Japanese Language and Culture Courses offered to International Students can be recognized as Humanities and Social Science Courses of the corresponding course level.** • **As for Liberal Arts and Basic Science Courses, please refer to the relevant pages.**

5. IGP Courses

Table M2. Core Courses of the Graduate Major in Industrial Engineering and Economics

Course category		Course number	Course			Credits	Competencies	Learning goals	Comments
Research seminars	**400 level**	IEE.Z491.R	◎		Seminar in Industrial Engineering and Economics S1	0-2-0	2,3,5	A,B,C	
		IEE.Z492.R	◎		Seminar in Industrial Engineering and Economics F1	0-2-0	2,3,5	A,B,C	
	500 level	IEE.Z591.R	◎		Seminar in Industrial Engineering and Economics S2	0-2-0	2,3,5	B,C,D,E	
		IEE.Z592.R	◎		Seminar in Industrial Engineering and Economics F2	0-2-0	2,3,5	B,C,D,E	
Research-related courses	**400 level**	IEE.E401.R	◎		Reading in Industrial Engineering and Economics S	0-1-0	2,3	A,C,E	
		IEE.E402.R	◎		Reading in Industrial Engineering and Economics F	0-1-0	2,3	A,C,E	
	500 level	IEE.E501.L			Academic Presentation in Industrial Engineering and Economics S	0-1-0	1,2	B,E	
		IEE.E502.L			Academic Presentation in Industrial Engineering and Economics F	0-1-0	1,2	B,E	
		IEE.E503.L			International Workshop Presentation (Abroad)	0-0-1	1,2	B,E	Credits from this course are not included in 22 credits of core courses required for completion
		IEE.E504.L			International Workshop Presentation (Domestic)	0-0-1	1,2	B,E	Credits from this course are not included in 22 credits of core courses required for completion
Major courses	**400 level**	IEE.C432.L			Applied Cognitive Ergonomics	2-0-0	2,3,4,5	A	☐
		IEE.D432.L			Financial Statement Analysis and Valuation	2-0-0	1,2,3,4,5	A	☐
		IEE.D433.L			Corporate Transformation	2-0-0	2,3	A	☐

		IEE.D434.L			Corporate Finance and Governance	2-0-0	1,2,3,4, 5	A	☐
	500 level	IEE.C501.L			Design Thinking	1-1-0	1,2,4,5	B,C,D,E	☐
		IEE.C530.L			Design Business	1-1-0	1,2,3,4, 5	B	☐
		IEE.C531.L			Enterprise Engineering	2-0-0	2,3,4	B	☐

Note：

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

・☐：Course is recognized as an Academy for Co-creative Education of Environment and Energy Science, Leading Graduate School (ACEEES) course.

• 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 (mathematical engineering), B (economics), C (business administration), D (industrial engineering management technology), E (others), Z (research seminars)

6. IGP Courses That Can be Recognized as Humanities and Social Science Courses

None

7. IGP Courses That Can be Recognized as Career Development Courses

As a general rule, students who would like their Career Development Courses to contribute to completion requirements of their master's degree program need to satisfy all of the specified Graduate Attributes ("GA"), including the attainment of at least two course credits, listed in Table MA-1 of the "Guide to Graduate Education and International Graduate Program (Liberal Arts and Basic Science Courses) - Career Development Courses". The status of the GA will be evaluated at the time of degree completion.

In addition to Career Development Courses, there are Major Courses that can also be recognized as such — shown below in Table M3 — which may go toward fulfilling the GA requirements.

However, note that when the corresponding Major Courses are recognized and accredited as Career Development Courses, their credits cannot be counted a second time (as Major Courses) towards degree completion requirements.

Table M3. Courses of the Graduate Major in Industrial Engineering and Economics that can be recognized as Career Development Courses

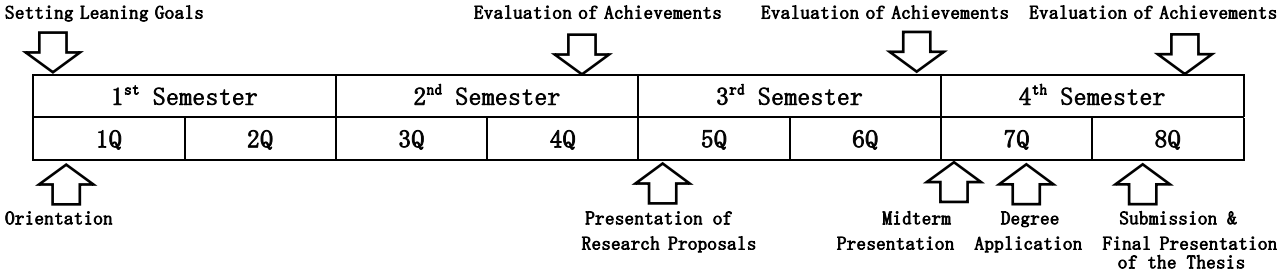
Course category	Course number	Course			Credits	GA*	Learning goals	Comments
can be recognized as Career Development Courses	IEE.C433.L			Advanced Course of Management	2-0-0	C0M C1M	A,C,D,E	
	IEE.C532.L			Management of Technology and Intellectual Property	2-0-0	C1M	B,C,D	

To satisfy the Career Development requirement, credits may be acquired from courses listed above as well as from those listed under Career Development Courses (see the Liberal Arts and Basic Science Courses Guide).

＊GA：Graduate Attribute

8. Research Related to the Completion of Master Theses

Master thesis research aims to develop fundamental knowledge to comprehend management and economic activities, ability to find new research problems, ability to analyze problems and find solutions, and ability in explaining, documenting and communicating information through a series of research activities. The schedule for the completion of the master thesis is given as follows:



Presentation of Research Proposals and Midterm Presentation

The objectives of these presentations are to enable students to recognize backgrounds and goals of their own researches from the viewpoint of career development. After presentations of research proposals, students can apply for 600-level major courses if their academic advisors confirm their progresses and admit taking these courses. However, notice that any credit of 600-level course is not counted in completing requirements for the Master's Degree Program of this major.

Review Standards for Master Theses

The Master's Degree thesis of this major should include new knowledge in academic fields of industrial engineering and economics or useful knowledge to contribute developments of management technologies. Each student should write his or her thesis by him or herself and the thesis should contain his or her original ideas.

Methods of Reviewing Master Theses

The thesis committee consists of at least three faculty members. After the preliminary reviews of the thesis by the committee members, each student gives an oral presentation and the committee conducts the final review and evaluation of the thesis. The thesis committee for a student applying for the Doctoral Program should consist of five faculty members.

【Doctoral Degree Program】

1. Outline

Based on the advanced and latest knowledge in industrial engineering and economics, students develop ability to identify problems in management, production, or economics from the viewpoint of science and technology, and solve the problems utilizing approaches of mathematical engineering, economics, business administration, and industrial engineering management technology. This program aims to cultivate people with abilities to pursue researches on cutting-edge topics in industrial engineering and economics, to publish results obtained from research to the world, and to contribute to the society.

2. Competencies Developed

In order to pursue the course goal, this program aims to develop the following competencies at higher levels than the master's degree program.

・Ability to find and analyze problems in management and economic activities utilizing mathematical engineering, information, and engineering technologies.

・Ability to propose new solutions for technological, organizational, and economic problems from the viewpoints of industrial engineering and economics.

・Ability in explaining, documenting and communicating in English or Japanese language.

・Ability to pursue researches towards new problems.

・Ability to publish results of researches on cutting-edge topics in industrial engineering and economics to the world.

・Leadership to propose and pursue projects.

3. Learning Goals

In order to develop the competences described above, students learn the following in this program.

A) Fundamental knowledge in industrial engineering and economics.

Develop ability to discover, analyze problems in management and economic activities utilizing mathematical, information, and engineering technology.

B) Application of industrial engineering and economics

Develop abilities to propose new solutions for problems in technological, organizational, and economic problems from the viewpoints of industrial engineering and economics.

C) Broad viewpoints and own initiative for learning

Develop leadership to propose and pursue projects.

D) Experience of engagement with society

Develop ability to publish results of researches on cutting-edge topics in industrial engineering and economics to the world.

E) Strengthen communication ability

Develop ability to conduct research on new problems through research projects for doctorate dissertation, and ability for explaining and communicating information in English/Japanese languages through seminars.

4. IGP Completion Requirements

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

1. A total of 24 credits or more acquired from 600-level courses.
2. From the courses specified in this Graduate Major curriculum,
    - 12 credits acquired from Research Seminars;
    - a minimum of 18 credits acquired from Core 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 Career Development Courses).
3. Pass the doctorate dissertation review, its defense, and final examination.

Table D1. Graduate Major in Industrial Engineering and Economics 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 sciences courses		2 credits	6 credits	C	
	Career development courses		4 credits		C, D	
	Other courses					
Core courses	Research seminars	Research Seminar in IEE S3 Research Seminar in IEE F3 Research Seminar in IEE S4 Research Seminar in IEE F4 Research Seminar in IEE S5 Research Seminar in IEE F5 A total of 12 credits, 2 credits each from the above courses.		18 credits	C, D, E	
	Research-related courses				B, C, D, E	
	Major courses				A, B, C, D, E	
	Major courses and Research-related courses <u>outside</u> the Graduate Major in Industrial Engineering and Economics standard curriculum					
Total required credits		A minimum of 24 credits in addition to meeting the above conditions				
Note		・Japanese Language and Culture Courses offered to International Students can be recognized as Humanities and Social Science Courses of the corresponding course level. ・As for Liberal Arts and Basic Science Courses, please refer to the relevant pages.				

5. IGP Courses

Table D2. Core Courses of the Graduate Major in Industrial Engineering and Economics

Course category		Course number	Course			Credits	Competencies	Learning goals	Comments
Research seminars	600 level	IEE.Z691.R	◎		Seminar in Industrial Engineering and Economics S3	0-2-0	2,3,5	C,D,E	
		IEE.Z692.R	◎		Seminar in Industrial Engineering and Economics F3	0-2-0	2,3,5	C,D,E	
		IEE.Z693.R	◎		Seminar in Industrial Engineering and Economics S4	0-2-0	2,3,5	C,D,E	
		IEE.Z694.R	◎		Seminar in Industrial Engineering and Economics F4	0-2-0	2,3,5	C,D,E	
		IEE.Z695.R	◎		Seminar in Industrial Engineering and Economics S5	0-2-0	2,3,5	C,D,E	
		IEE.Z696.R	◎		Seminar in Industrial Engineering and Economics F5	0-2-0	2,3,5	C,D,E	
Research-related courses	600 level	IEE.E606.L			Industrial Engineering Off-Campus Project S	0-0-2	2,4,5	B,C,D	
		IEE.E607.L			Industrial Engineering Off-Campus Project F	0-0-2	2,4,5	B,C,D	
		IEE.E608.L			Presentation in Industrial Engineering S	0-2-0	1,2	B,C,E	
		IEE.E609.L			Presentation in Industrial Engineering F	0-2-0	1,2	B,C,E	
Major courses	600 level	IEE.E601.L			Advanced Course for Educational Practice in Industrial Engineering S	0-2-0	2,5	A,B,C,E	
		IEE.E602.L			Advanced Course for Educational Practice in Industrial Engineering F	0-2-0	2,5	A,B,C,E	
		IEE.E603.L			Technical Reading in Industrial Engineering	0-2-0	2,3,5	A,B,C,E	
		IEE.E604.L			Practical Training at Companies (Industrial Engineering) S	0-0-2	2,4,5	B,C,D	
		IEE.E605.L			Practical Training at Companies (Industrial Engineering) F	0-0-2	2,4,5	B,C,D	

Note：

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

・□：Course is recognized as an Academy for Co-creative Education of Environment and Energy Science, Leading Graduate School (ACEEES) course.

• 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 (mathematical engineering), B (economics), C (business administration), D (industrial engineering management technology), E (others), R (research seminars)

6. IGP Courses That Can be Recognized as Humanities and Social Science Courses

None

7. IGP Courses That Can be Recognized as Career Development Courses

As a general rule, students who would like their Career Development Courses to contribute to completion requirements of their doctoral degree program need to satisfy all of the specified Graduate Attributes ("GA"), including the attainment of at least four course credits, listed in Table A-1 or A-2 of the "Guide to Graduate Education and International Graduate Program (Liberal Arts and Basic Science Courses) - Career Development Courses". The status of the GA will be evaluated at the time of degree completion.

In addition to Career Development Courses, there are Major Courses that can also be recognized as such — shown below in Table D3 — which may go toward fulfilling the GA requirements.

However, note that when the corresponding Major Courses are recognized and accredited as Career Development Courses, their credits cannot be counted a second time (as Major Courses) towards degree completion requirements.

Table D3-1. Courses of the Graduate Major in Industrial Engineering and Economics that can be recognized as Career Development Courses in the Academic Leader Program (ALP)

Course category	Course number	Course			Credits	GA*	Learning goals	Comments
can be recognized as Career Development Courses	IEE.E606.L			Industrial Engineering Off-Campus Project S	0-0-2	A0D, A1D, A2D, A3D	B,C,D	
	IEE.E607.L			Industrial Engineering Off-Campus Project F	0-0-2	A0D, A1D, A2D, A3D	B,C,D	
	IEE.E608.L			Presentation in Industrial Engineering S	0-2-0	A0D, A1D, A2D, A3D	B,C,E	
	IEE.E609.L			Presentation in Industrial Engineering F	0-2-0	A0D, A1D, A2D, A3D	B,C,E	
	IEE.E604.L			Practical Training at Companies (Industrial Engineering) S	0-0-2	A0D, A3D	B,C,D	
	IEE.E605.L			Practical Training at Companies (Industrial Engineering) F	0-0-2	A0D, A3D	B,C,D	

To satisfy the Career Development requirement, credits may be acquired from courses listed above as well as from those listed under Career Development Courses (see the Liberal Arts and Basic Science Courses Guide).

＊GA：Graduate Attribute

Table D3-2. Courses of the Graduate Major in Industrial Engineering and Economics that can be recognized as Career Development Courses in the Productive Leader Program (PLP)

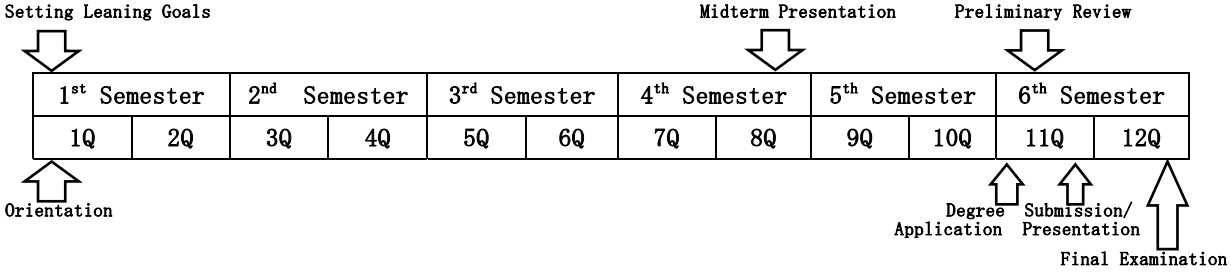
Course category	Course number	Course			Credits	GA*	Learning goals	Comments
can be recognized as Career Development Courses	IEE.E606.L			Industrial Engineering Off-Campus Project S	0-0-2	P0D, P1D, P2D, P3D	B,C,D	
	IEE.E607.L			Industrial Engineering Off-Campus Project F	0-0-2	P0D, P1D, P2D, P3D	B,C,D	
	IEE.E608.L			Presentation in Industrial Engineering S	0-2-0	P2D, P3D	B,C,E	
	IEE.E609.L			Presentation in Industrial Engineering F	0-2-0	P2D, P3D	B,C,E	
	IEE.E604.L			Practical Training at Companies (Industrial Engineering) S	0-0-2	P0D, P1D, P2D, P3D	B,C,D	
	IEE.E605.L			Practical Training at Companies (Industrial Engineering) F	0-0-2	P0D, P1D, P2D, P3D	B,C,D	

To satisfy the Career Development requirement, credits may be acquired from courses listed above as well as from those listed under Career Development Courses (see the Liberal Arts and Basic Science Courses Guide).

＊GA：Graduate Attribute

8. Research Related to the Completion of Doctoral Theses

Doctoral thesis research aims to develop ability to find new research problems, ability to find solutions to problems, and ability in explaining, documenting and communicating information in English. The schedule for the completion of the doctoral thesis is given as follows:



Review Standards for Doctoral Theses

The Doctoral Degree thesis of this major should make new, original and sufficient contributions to the fields of industrial engineering and/or economics. Each student should write his or her thesis by him or herself and the major parts of the thesis should be published or publishable in international refereed academic journals.

Methods of Reviewing Doctoral Theses

The thesis committee consists of at least five faculty members. It is recommended that the committee positively includes members outside Tokyo Tech such as in universities, research institutions, and firms. After passing the midterm presentation and preliminary review, each student submits the thesis and gives an oral presentation, and the committee conducts the final review and evaluation of the thesis. The final examination includes a reading comprehension test on related articles in English in order to confirm abilities in comprehending academic materials in related fields.