Graduate major in Artificial Intelligence

Master's Degree Program

1. IGP（C） Outline

We aim to foster individuals who possess a wide range of basic expertise related to artificial intelligence, such as basic mathematical science, computation theory, and modeling, and can apply these specialized abilities to solve difficult problems by collaborating with members of differing backgrounds and different areas of expertise.

2. Competencies Developed

After completing the program, students will acquire the following competencies:

- Ability to solve real-world problems by applying specialized knowledge of artificial intelligence to develop new artificial intelligence technology
- Ability to grasp complicated real-world subjects in an abstract manner
- Ability to accurately express and communicate one's thoughts and research contents
- Ability to collaborate with members of differing backgrounds and specialties to solve problems

3. Learning Goals

A) Advanced courses in artificial intelligence

B) Applied courses in artificial intelligence

C) Courses for developing broad perspectives and self-determination

D) Courses for learning social relations and science and engineering ethics

E) Courses for improving communicative competence

4. IGP（C）Completion Requirements

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

1. A total of 30 credits or more acquired from 400- and 500-level courses.
2. From the courses specified in the Artificial Intelligence Graduate Major curriculum,
    - eight credits acquired from Research Seminars;
    - two credits acquired from Workshop on Artificial Intelligence I and II;
    - a minimum of eight credits acquired from Major Courses; and
    - a minimum of five credits acquired from Liberal Arts and Basic Science Courses (Three credits from the Humanities and Social Sciences Courses of which two credits must be from 400-level courses and one credit from 500-level courses, and two credits from Career Development Courses).
3. Pass the master's thesis review and defence.

Table M1. Artificial Intelligence Graduate Major 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 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 on Artificial Intelligence S1 Seminar on Artificial Intelligence F1 Seminar on Artificial Intelligence S2 Seminar on Artificial Intelligence F2 A total of 8 credits, 2 credits each from the above courses.			C, D, E	
	Research-Related Courses	2 credits of Workshop on Artificial Intelligence I and II			D, E	
	Major Courses		8 credits from Major Courses		A, B, C, D, E	
	Major Courses and Research-Related Courses outside the Artificial Intelligence Graduate Major standard curriculum					
Total required credits		A minimum of 30 credits in addition to meeting the above conditions				

5. Courses

Table M2. Core Courses of the Artificial Intelligence Graduate Major

Course category		Course Number			Course	credits	Competencies	Learning goals	Comments
Research seminars	400 level	ART.Z491.R	◎		Seminar on Artificial Intelligence S1	0-2-0	2345	E	
		ART.Z492.R	◎		Seminar on Artificial Intelligence F1	0-2-0	2345	E	
	500 level	ART.Z591.R	◎		Seminar on Artificial Intelligence S2	0-2-0	2345	E	
		ART.Z592.R	◎		Seminar on Artificial Intelligence F2	0-2-0	2345	E	
Research-related courses	400 level	ART.U471.L			Internship A (Computing)	0-0-2		C, D, E	
		ART.U481.R	◎		Workshop on Artificial Intelligence I	0-0-1		B, E	
		ART.U482.R	◎		Workshop on Artificial Intelligence II	0-0-1		B, E	
	500 level	ART.U571.L			Internship B (Computing)	0-0-2		C, D, E	
Major courses	400 level	ART.T401.L		O	Analysis on Continuous Systems	2-0-0		A	
		ART.T402.L			Mathematical Optimization: Theory and Algorithms	2-0-0		A	
		ART.T403.L			Statistical Learning Theory	2-0-0		A	
		ART.T404.L		E	Logical Foundations of Computing	2-0-0		A	
		ART.T405.L		O	Theory of Algorithms	2-0-0		A	
		ART.T406.L		E	Distributed Algorithms	2-0-0		A	
		ART.T407.L		O	High Performance Computing	2-0-0		A	
		ART.T421.L			Human Computer Interaction	2-0-0		A	

		ART.T434.B	B ○		International Project for System Development	0-0-2	123	B,E	
		ART.T451.L			Mathematics of Discrete Systems	2-0-0	35	A	
		ART.T458.L			Machine Learning	2-0-0	3	A	
		ART.T460.L			Speech Information Processing	2-0-0	35	A	
		ART.T462.L		O	Complex Networks	2-0-0	35	A	
	500 level	ART.T541.L			Intelligent Systems	2-0-0	35	A	
		ART.T542.L			Studies of Social and Economic Systems	2-0-0		A	
		ART.T543.L			Bioinformatics	2-0-0	34	A	
		ART.T546.L			Design Theory in Biological Systems	2-0-0		A	
		ART.T548.L			Advanced Artificial Intelligence	2-0-0	3	A	

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
•【 】Course offered under another graduate major.

6. Courses That Can Be Taken as Humanities and Social Sciences Courses

None

7. Courses That Can Be Taken as Career Development Courses

Table M4. Courses That Can Be Taken as Career Development Courses for the ○○ Graduate Major

Course category	**Course Number**	**Course**			**credits**	**GA ＊**	**Learning goals**	**Comments**
can be taken as Career Development Courses	ART.T434.L			International Project for System Development	0-0-2	C1M	B,D,E	
	ART.U471.L			Internship A (Computing)	0-0-2	C0M	B,D,E	
	ART.U472.L			English Presentation Skills A (Computing)	2-0-0	C1M	E	
	ART.U571.L			Internship B (Computing)	0-0-2	C1M	B,D,E	

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

Doctor's Degree Program

1. IGP（C） Outline

We aim to develop individuals who have the ability to apply their expertise in artificial intelligence, define complicated real-world problems precisely, and lead a team of members of differing backgrounds and specialties to solve problems.

2. Competencies Developed

After completing the program, students will acquire the following competencies:

- **Ability to pioneer and define new problems in the field of artificial intelligence, and to formulate a research plan**
- **Ability to grasp complicated real-world subjects in an abstract manner and discern its essence**
- **Ability to lead a team of members of differing backgrounds and specialties to solve problems**
- **Ability to disseminate research findings internationally and to lead the field of artificial intelligence**

3. Learning Goals

A) Courses for developing ability to find and solve problems

B) Courses for developing creativity and communicative competence

C) Courses for developing leadership ability

D) Courses for developing entrepreneurship

E) Courses for developing negotiation ability

4. IGP（C）Completion Requirements

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

1. A total of 24 credits or more acquired from 600--level courses.
2. From the courses specified in the Artificial Intelligence Graduate Major curriculum,
   - Twelve credits acquired from Research Seminars;
   - a minimum of six credits acquired from Liberal Arts and Basic Science Courses

     (Three credits from the Humanities and Social Sciences Courses of which two credits must be from from 600-level courses, and four credits from Career Development Courses).
3. Pass the PhD thesis review and defense.

Table D1. Artificial Intelligence Graduate Major 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 from 600-level	6 credits	B	
	Career Development Courses		4 credits		C,D	
	Other courses					
Core Courses	Research Seminars	Seminar on Artificial Intelligence S3 Seminar on Artificial Intelligence F3 Seminar on Artificial Intelligence S4 Seminar on Artificial Intelligence F4 Seminar on Artificial Intelligence S5 Seminar on Artificial Intelligence F5 A total of twelve credits, two credits each from the above courses.			A, B, C, D, E	
	Research-Related Courses					
	Major Courses					
	Major Courses and Research-Related Courses outside the Artificial Intelligence Graduate Major standard curriculum					
Total required credits		A minimum of 24 credits in addition to meeting the above conditions				

5. Courses(授業科目：必須項目)

Table D2. Core Courses of the ○○ Graduate Major

Course category		Course Number			Course	credits	Competencies	Learning goals	Comments
Research seminars	600 level	ART.Z691.R	◎		Seminar on Artificial Intelligence S3	0-0-1	2345	A,B	
		ART.Z692.R	◎		Seminar on Artificial Intelligence F3	0-0-1	2345	A,B	
		ART.Z693.R	◎		Seminar on Artificial Intelligence S4	0-0-1	2345	A,B	
		ART.Z694.R	◎		Seminar on Artificial Intelligence F4	0-0-1	2345	A,B	
		ART.Z695.R	◎		Seminar on Artificial Intelligence S5	0-0-1	2345	A,B	
		ART.Z696.R	◎		Seminar on Artificial Intelligence F5	0-0-1	2345	A,B	
Research-related courses	600 level	ART.T671.L			Internship C (Computing)	0-0-2		C,D,E	
		ART.T672.L			English Presentation Skills B (Computing)	2-0-0		E	
		ART.U681.L			Forum on Artificial Intelligence S3	0-0-1		B,C,D	
		ART.U682.L			Forum on Artificial Intelligence F3	0-0-1		B,C,D	
		ART.U683.L			Forum on Artificial Intelligence S4	0-0-1		B,C,D	
		ART.U684.L			Forum on Artificial Intelligence F4	0-0-1		B,C,D	
		ART.U685.L			Forum on Artificial Intelligence S5	0-0-1		B,C,D	
		ART.U686.L			Forum on Artificial Intelligence F5	0-0-1		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
•【 】Course offered under another graduate major.

6. Courses That Can Be Taken as Humanities and Social Sciences Courses

None

7. Courses That Can Be Taken as Career Development Courses

Table D4. Courses That Can Be Taken as Career Development Courses for the Artificial Intelligence Graduate Major

Course category	Course Number	Course			credits	GA *	Learning goals	Comments
can be taken as Career Development Courses	ART.T671.L			Internship C (Computing)	0-2-0	A0D,A1D, A2D,A3D	B,D,E	
	ART.T672.L			English Presentation Skills B (Computing)	2-0-0	A2D,A3D	E	
	ART.U681.L			Forum on Artificial Intelligence S3	0-0-1	A0D,A1D, A2D	A,B,C	
	ART.U682.L			Forum on Artificial Intelligence F3	0-0-1	A1D,A2D, A3D	A,B,C	
	ART.U683.L			Forum on Artificial Intelligence S4	0-0-1	A0D,A1D, A2D	A,B,C	
	ART.U684.L			Forum on Artificial Intelligence F4	0-0-1	A1D,A2D, A3D	A,B,C	
	ART.U685.L			Forum on Artificial Intelligence S5	0-0-1	A0D,A1D, A2D	A,B,C	
	ART.U686.L			Forum on Artificial Intelligence F5	0-0-1	A1D,A2D, A3D	A,B,C	

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