Graduate Major in Mathematical and Computing Science

【Master's Degree Program】

1. Outline

Master's Degree Program in Mathematical and Computing Science offers a broad range of advanced courses in the field of mathematical science and computer science. Our students develop skills and originality to contribute to the progress of mathematical science and computer science. They also enhance practical problem-solving skills to formulate mathematical models for modern, advanced, and complicated problems in global society and to solve the problems with advanced computer systems.

2. Competencies Developed

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

- Knowledge and skills relating to mathematical science
- Ability to accurately grasp the mathematical structures of research objects and logically describe them
- Ability to grasp a complicated real-life problem within a clear, mathematical framework and also realize its solution as an algorithm
- Knowledge and skills relating to computer science such as computer architecture and software systems
- Ability to propose an approach that fuses mathematical science and computer science
- Communication skills for writing, discussion, and presentation in a logical manner

3. Learning Goals

The master's degree program provides a curriculum to acquire the "Competencies Developed" mentioned above in an efficient and organized way. Through the curriculum, students are expected to:

A) Learn mathematical structures in practical problems and computer-aided approaches for mathematical researches

B) Learn mathematical models to formulate various problems and operational methods to solve them

C) Obtain deep knowledge and high expertise in computer science, including mathematical logic, algorithm, theory of computation, computer architecture, and software systems

D) Cultivate wide scopes and study proactively:

Acquire skills to study proactively through (1) small-group seminars in discussion styles with professors and other graduate students, (2) frequent communications among research groups, and (3) the process to complete the master's thesis.

E) Enhance communication skills:

Acquire writing abilities to write the master's thesis and develop abundant abilities for presentations through seminars in a research group and communications in joint researches.

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. A minimum of five credits acquired from Liberal Arts and Basic Science Courses (Three credits from Humanities and Social Science Courses of which two credits must be from 400-level courses and one credit from 500-level courses, and two credits from Entrepreneurship Courses).
3. From the courses specified in the Graduate Major in Mathematical and Computing Science curriculum,
   - four credits acquired from 400-level Research Seminars and four credits acquired from 500-level Research Seminars;
   - two credits acquired from Advanced Exercises and Experiments in Mathematical and Computing Science I and II; and
   - a minimum of eight credits acquired from Major Courses.

   Consequently, a minimum of 18 credits acquired from Core Courses.
4. 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 Mathematical and Computing Science 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	D	
	Entrepreneurship Courses		2 credits		D,E	All Graduate Attributes (GA) should be acquired. (Refer to Section 7 for the definition of GA.)
	Other courses					
Core courses	Research seminars	Seminar on Mathematical and Computing Science S1 Seminar on Mathematical and Computing Science F1 Seminar on Mathematical and Computing Science S2 Seminar on Mathematical and Computing Science F2 A total of 8 credits, 2 credits each from the above courses.		18 credits	A,B,C,D,E	
	Research-related courses	Advanced Exercises and Experiments in Mathematical and Computing Science I Advanced Exercises and Experiments in Mathematical and Computing Science II A total of 2 credits, 1 credit each from the above courses.			A,B,C,D,E	
	Major courses		8 credits		A,B,C,D	
	Major courses and Research-related courses outside the					

	Graduate Major in Mathematical and Computing Science 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.**				

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 Mathematical and Computing Science

Course category		Course number	Course title			Credits	Competencies	Learning goals	Comments
Research seminars	**400 level**	MCS.Z491.R	◎		Seminar on Mathematical and Computing Science S1	0-0-2	1,2,3,4,5	A,B,C,D,E	
		MCS.Z492.R	◎		Seminar on Mathematical and Computing Science F1	0-0-2	1,2,3,4,5	A,B,C,D,E	
	500 level	MCS.Z591.R	◎		Seminar on Mathematical and Computing Science S2	0-0-2	1,2,3,4,5	A,B,C,D,E	
		MCS.Z592.R	◎		Seminar on Mathematical and Computing Science F2	0-0-2	1,2,3,4,5	A,B,C,D,E	
Research-related courses	**400 level**	MCS.U471.L			Internship A (Computing)	0-0-2	3,4,5	D,E	【School of Computing】(XCO.U471) Only students affiliated with the School of Computing can take this course
		MCS.U481.R	◎		Advanced Exercises and Experiments in Mathematical and Computing Science I	0-0-1	1,2,3,4,5	A,B,C,D,E	
		MCS.U482.R	◎		Advanced Exercises and Experiments in Mathematical and Computing Science II	0-0-1	1.2,3,4,5	A,B,C,D,E	

	500 level	MCS.U571.L			Internship B (Computing)	0-0-2	3,4,5	D,E	【School of Computing】(XCO.U571) Only students affiliated with the School of Computing can take this course
Major courses	**400 level**	MCS.U472.L			English Presentation Skills A (Computing)	2-0-0	3	E	【School of Computing】(XCO.U472) Only students affiliated with the School of Computing can take this course
		MCS.T496.L		E	Advanced Topics in Computing AE	1-0-0	1,2	A,B,C,D,E	【School of Computing】(XCO.T496)
		MCS.T497.L		O	Advanced Topics in Computing AO	1-0-0	1,2	A,B,C,D,E	【School of Computing】(XCO.T497)
		MCS.T498.L		E	Advanced Topics in Computing BE	1-0-0	1,2	A,B,C,D,E	【School of Computing】(XCO.T498)
		MCS.T499.L		O	Advanced Topics in Computing BO	1-0-0	1,2	A,B,C,D,E	【School of Computing】(XCO.T499)
		MCS.T401.L		O	Analysis on Continuous Systems	2-0-0	1	A	
		MCS.T403.L			Statistical Learning Theory	2-0-0	1,5	B	
		MCS.T405.L		O	Theory of Algorithms	2-0-0	1	C	
		MCS.T408.L		E	Discrete, Algebraic and Geometric Structures	2-0-0	1,2,4,5	A	
		MCS.T410.L		E	Applied Probability	2-0-0	1,5	B	
		MCS.T412.L		E	Information Visualization	2-0-0	1,3,5	C	
		MCS.T416.L		E	Logic and Computation	2-0-0	1	C	
		MCS.T417.L		O	Topics in Algebra	2-0-0	1,2,5	A	

		MCS.T418.L		O	Practical Parallel Computing	2-0-0	1,5	C	
		MCS.T419.L		E	Stochastic Differential Equations	2-0-0	1,5	B	
		MCS.M421.L		E	Discrete Optimization	2-0-0	1	B	
		MCS.M422.L		O	Statistical Mechanics for Information Processing	2-0-0	1,5	B	
		MCS.M426.L		E	Topics in Geometry	2-0-0	1,2,5	A	
		MCS.M427.L		O	Topological Data Analysis	2-0-0	1,4	A,B,C	
		MCS.M428.L		E	Programming Language Theory	2-0-0	1,3	C	
		MCS.M429.L		E	Distributed Systems	2-0-0	1,5	C	
		MCS.M430.L			Cryptocurrency and Blockchain Technology	2-0-0	1,4	C	
		MCS.T441.L			Internet Infrastructure	2-0-0	1,3,4,5	C	【Course of Computer Science】 (CSC.T441)
		MCS.T442.L			Internet Applications	2-0-0	1,2,3,4, 5	C	【Course of Computer Science】 (CSC.T442)
	500 level	MCS.T503.L		O	Programming Language Design	2-0-0	1,3	C	
		MCS.T506.L		O	Mathematical Models and Computer Science,	2-0-0	1,5	C	
		MCS.T509.L		O	Software Verification	2-0-0	1	C	

Note：

• ◎：Required course, 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

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 Mathematical and Computing Science 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	MCS.U471.L			Internship A (Computing)	0-0-2	GA0M / GA1M	D,E	【School of Computing】(XCO.U471) Only students affiliated with the School of Computing can take this course
	MCS.U472.L			English Presentation Skills A (Computing)	2-0-0	GA0M / GA1M	E	【School of Computing】(XCO.U472) Only students affiliated with

								the School of Computing can take this course
	MCS.U571.L			Internship B (Computing)	0-0-2	GA0M / GA1M	D,E	【School of Computing】(XCO.U571) Only students affiliated with the School of Computing can take this course
Entrepreneurship Courses	XCO.U480			Master's Recurrent Program 1 of school of computing	0-0-1	GA0M GA1M		Entrepreneurship Course offered by School of Computing. (Cannot be counted for Major Courses)
	XCO.U479			Master's Recurrent Program 2 of school of computing	0-0-2	GA0M GA1M		

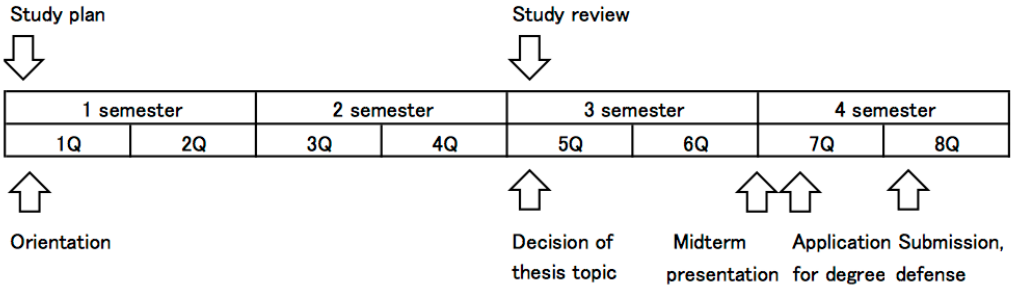
Credits in Entrepreneurship Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.

＊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

・A relevant research time line is shown in the following diagram.



・Criteria for thesis examination

Master's thesis should include new knowledge in the fields of mathematical science and computer science or useful knowledge contributing to developments of those fields. Each student should write his or her thesis by him- or herself and the thesis should contain his or her original ideas.

・Procedure for thesis examination

The examination committee is comprised of 3 or more referees. After the peer review by the referees done in advance, an oral presentation is made and a final examination and evaluation are performed. Examinations of candidates for the doctor’s program are performed by 5 referees.

【Doctoral Degree Program】

1. Outline

We develop talent who can deepen and start their own research based on a firm understanding and knowledge of mathematical science and computer science, and who have the research skills to propose and lead new approaches for solving various problems of modern society, as well as capable talent who open and drive forward new frontiers of science and technology as leaders who can succeed internationally in research institutes and companies.

2. Competencies Developed

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

- The advanced insight and broad, systematic knowledge of an expert in mathematical science and computer science
- The flexible and diverse ideas, inquisitive spirit, and originality to continuously deepen and expand research topics
- The creativity to pioneer and promote new research topics
- The daring spirit to propose solutions to problems beleaguering our information society through research, and the high, professional ethical values to contribute to society
- The ability to publish one's own research findings in the forms of academic papers, conference presentations, and participation in various competitions, as well as the ability to compose papers and present and argue one's findings convincingly

3. Learning Goals

The doctoral degree program provides a curriculum to acquire the “Competencies Developed” mentioned above based on the competencies developed in the master’s degree program. Through the curriculum, students are expected to:

A) Deepen their understanding of mathematical structures in practical problems and computer-aided approaches for mathematical researches.

B) Obtain ability to construct advanced mathematical models to analyze various problems and design methods to solve them

C) Enhance knowledge and expertise in computer science, including mathematical logic, algorithm, theory of computation, computer architecture, and software systems

D) Cultivate wide scopes and study proactively:

Acquire skills to study proactively through discussion with advisors and communications with domestic and international researchers and to launch a new research project.

E) Enhance communication skills:

Acquire writing abilities to compose the doctoral thesis and develop abundant abilities for presentations through communication with international researchers and presentation at seminars and conferences.

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. A minimum of six credits acquired from 600-level Liberal Arts and Basic Science Courses (Two credits from Humanities and Social Science Courses and four credits from Entrepreneurship Courses).
3. From the courses specified in the Graduate Major in Mathematical and Computing Science curriculum, 12 credits acquired from 600-level Research Seminars.
4. Pass the doctoral dissertation review and defense.

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

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

Table D1. Graduate Major in Mathematical and Computing Science 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	D	
	Entrepreneurship Courses		4 credits		D,E	All Graduate Attributes (GA) should be acquired. (Refer to Section 7 for the definition of GA.)
	Other courses					
Core courses	Research seminars	Seminar on Mathematical and Computing Science S3 Seminar on Mathematical and Computing Science F3 Seminar on Mathematical and Computing Science S4 Seminar on Mathematical and Computing Science F4 Seminar on Mathematical and Computing Science S5 Seminar on Mathematical and Computing Science F5 A total of 12 credits, 2 credits each from the above courses.		12 credits	A,B,C,D,E	
	Research-related courses					
	Major courses					
	Major Courses and Research-related courses <u>outside</u> the Graduate Major in Mathematical and Computing Science					

	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 Mathematical and Computing Science

Course category		**Course number**			**Course title**	**Credits**	**Competencies**	**Learning goals**	**Comments**
Research seminars	**600 level**	MCS.Z691.R	◎		Seminar on Mathematical and Computing Science S3	0-2-0	1,2,3,4,5	A,B,C,D,E	
		MCS.Z692.R	◎		Seminar on Mathematical and Computing Science F3	0-2-0	1,2,3,4,5	A,B,C,D,E	
		MCS.Z693.R	◎		Seminar on Mathematical and Computing Science S4	0-2-0	1,2,3,4,5	A,B,C,D,E	
		MCS.Z694.R	◎		Seminar on Mathematical and Computing Science F4	0-2-0	1,2,3,4,5	A,B,C,D,E	
		MCS.Z695.R	◎		Seminar on Mathematical and Computing Science S5	0-2-0	1,2,3,4,5	A,B,C,D,E	
		MCS.Z696.R	◎		Seminar on Mathematical and Computing Science F5	0-2-0	1,2,3,4,5	A,B,C,D,E	
Research-related courses	**600 level**	MCS.U671.L			Internship C (Computing)	0-0-2	3,4,5	D,E	【School of Computing】(XCO.U671) Only students affiliated with the School of Computing can take this course
		MCS.U672.L			English Presentation Skills B (Computing)	2-0-0	3	E	【School of Computing】

									(XCO.U672) Only students affiliated with the School of Computing can take this course
		MCS.X681.L			Forum on Computing S3	0-0-1	2,3,4,5	A,B,C,D,E	【School of Computing】 (XCO.U681) Only students affiliated with the School of Computing can take this course
		MCS.X682.L			Forum on Computing F3	0-0-1	2,3,4,5	A,B,C,D,E	【School of Computing】 (XCO.U682) Only students affiliated with the School of Computing can take this course
		MCS.X683.L			Forum on Computing S4	0-0-1	2,3,4,5	A,B,C,D,E	【School of Computing】 (XCO.U683) Only students affiliated with the School of Computing can take this course
		MCS.X684.L			Forum on Computing F4	0-0-1	2,3,4,5	A,B,C,D,E	【School of Computing】 (XCO.U684) Only students affiliated with the School of Computing can take this course
		MCS.X685.L			Forum on Computing S5	0-0-1	2,3,4,5	A,B,C,D,E	【School of Computing】 (XCO.U685) Only students affiliated with the School of

									Computing can take this course
		MCS.X686.L			Forum on Computing F5	0-0-1	2,3,4,5	A,B,C,D,E	【School of Computing】(XCO.U686) Only students affiliated with the School of Computing can take this course
Major courses	**600 level**	MCS.T601.L			Presentation Exercises on Mathematical and Computing Science I	0-1-0	1,2,3	A,B,C,D,E	
		MCS.T602.L			Presentation Exercises on Mathematical and Computing Science II	0-1-0	1,2,3	A,B,C,D,E	
		MCS.T603.L			Tutorial Exercises on Mathematical and Computing Science I	0-1-0	1,3	A,B,C,D,E	
		MCS.T604.L			Tutorial Exercises on Mathematical and Computing Science II	0-1-0	1,3	A,B,C,D,E	
		MCS.T605.L			Career Development in Mathematical and Computing Science	0-1-0	1,3	A,B,C,D,E	
		MCS.T673.L			Advanced Topics in Computing C	2-0-0	1,2	A,B,C,D,E	【School of Computing】(XCO.T673)
		MCS.T674.L			Advanced Topics in Computing D	2-0-0	1,2	A,B,C,D,E	【School of Computing】(XCO.T674)
		XCO.U697.L			Cooperative Education through Research Internships of Computing	0-0-4	1,3,4,5	D,E	

Note：

• ◎：Required course, 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

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 D3. Courses of the Graduate Major in Mathematical and Computing Science 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	MCS.U671.L	Internship C (Computing)	0-0-2	GA1D	D,E	【School of Computing】(XCO.U671) Only students affiliated with the School of Computing can take this course
	MCS.U672.L	English Presentation Skills B (Computing)	2-0-0	GA0D/ GA1D	E	【School of Computing】(XCO.U672) Only students affiliated with the School of Computing can take this course

	MCS.X681.L			Forum on Mathematical and Computing Science S3	0-0-1	GA0D/ GA1D	A,B,C,D,E	【School of Computing】 (XCO.U681) Only students affiliated with the School of Computing can take this course
	MCS.X682.L			Forum on Mathematical and Computing Science F3	0-0-1	GA1D	A,B,C,D,E	【School of Computing】 (XCO.U682) Only students affiliated with the School of Computing can take this course
	MCS.X683.L			Forum on Mathematical and Computing Science S4	0-0-1	GA0D/ GA1D	A,B,C,D,E	【School of Computing】 (XCO.U683) Only students affiliated with the School of Computing can take this course
	MCS.X684.L			Forum on Mathematical and Computing Science F4	0-0-1	GA1D	A,B,C,D,E	【School of Computing】 (XCO.U684) Only students affiliated with the School of Computing can take this course
	MCS.X685.L			Forum on Mathematical and Computing Science S5	0-0-1	GA0D/ GA1D	A,B,C,D,E	【School of Computing】 (XCO.U685) Only students affiliated with the School of Computing can take this course

	MCS.X686.L			Forum on Mathematical and Computing Science F5	0-0-1	GA1D	A,B,C,D,E	【School of Computing】 (XCO.U686) Only students affiliated with the School of Computing can take this course
	MCS.T601.L			Presentation Exercises on Mathematical and Computing Science I	0-1-0	GA1D	A,B,C,D,E	
	MCS.T602.L			Presentation Exercises on Mathematical and Computing Science II	0-1-0	GA1D	A,B,C,D,E	
	MCS.T603.L			Tutorial Exercises on Mathematical and Computing Science I	0-1-0	GA1D	A,B,C,D,E	
	MCS.T604.L			Tutorial Exercises on Mathematical and Computing Science II	0-1-0	GA1D	A,B,C,D,E	
	MCS.T605.L			Career Development in Mathematical and Computing Science	0-1-0	GA1D	A,B,C,D,E	
	XCO.U697.L			Cooperative Education through Research Internships of Computing	0-0-4	GA1D	D,E	
Entrepreneurship Courses	XCO.U699			Doctoral Recurrent Program 2 of school of computing	0-0-2	GA0D GA1D		Entrepreneurship Course offered by School of Computing. (Cannot be counted for Major Courses)
	XCO.U698			Doctoral Recurrent Program 4 of school of computing	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

・Criteria for thesis examination

Doctoral thesis must contain novelty, originality, and enough academic contribution in the field of mathematical science and computer science. The thesis must be published or contain enough contribution to be published in an international-level journal or elsewhere.

・Procedure for thesis examination

The examination committee is comprised of 5 or more referees, preferably including external referees from other universities and research institutes. After passing an interim evaluation and a preliminary thesis examination, a student must submit his or her thesis and give oral presentation. After the peer review by the referees done in advance, a final examination and evaluation are performed. In the final examination, the committee assesses knowledge and understanding on the research field by asking the examinee to explain related works.