Master's Program in Intelligent and Mechanical Interaction Systems

Master of Engineering

Program Educational Objectives

The Master's Program in Intelligent and Mechanical Interaction Systems investigates engineering systems based on mathematical models representing the complex phenomena of humans, society, and nature, as well as theories in various fields such as mathematics, physics, and informatics working in harmony to contribute to the real world. This program cultivates high-level professionals with the fundamental knowledge and ethical views in the field of engineering, who possess the technical expertise and the research abilities to identify and solve problems from a wide perspective.

Graduate Profile	Students develop advanced knowledge and skills in the field of Intelligent and Mechanical Interaction Systems in addition to fundamental knowledge and academic abilities appropriate for high-level professionals able to contribute to society by identifying and solving relevant problems in the field of engineering.

Diploma Policy

The degree of Master of Engineering is commenced to those who have fulfilled the requirements for the completion of the Master's programs, as set out in the Graduate School Regulations of the University of Tsukuba and related university regulations, and who are deemed to have the following competences.

	Competences	Evaluation perspectives
Knowledge and Skills	1. Knowledge application competence: Ability to contribute to society with advanced knowledge	①Can you apply knowledge gained through research and other activities in society? ②Can you identify new problems, even in other fields of expertise, based on broad knowledge?
	2. Management competence: Ability to appropriately address challenges from broad standpoints	①Can you take on major tasks with systematic planning? ②Can you understand and solve problems from multiple perspectives?
	3. Communication competence: Ability to accurately and clearly communicate expert knowledge	①Are you capable of efficient communication for research purposes? ②Can you discuss research or research-specific knowledge with experts from your own field and from other fields?
	4. Teamwork competence: Ability to work with a team and actively contribute to the achievement of goals	①Do you have experience cooperatively and actively working on challenges as part of a team? ②Have you helped promote projects and activities other than your own research?
	5. Internationality competence: Willingness to contribute to international society	①Are you aware of making contributions to international society and getting involved in international activities? ②Have you obtained the linguistic skills necessary for international information collection and action?
	6. Research skills: To possess the fundamental skills necessary to set up a compelling research topic in the field of Intelligent and Mechanical Interaction Systems and to be able to conduct the research and produce significant outcomes.	①To be able to set up a compelling research topic in the field of Intelligent and Mechanical Interaction Systems. ②To possess the fundamental skills necessary to conduct research in the field of Intelligent and Mechanical Interaction Systems. ③To be able to carry out research in the field of Intelligent and Mechanical Interaction Systems and produce significant outcomes.

	Competences	Evaluation perspectives
Knowledge and Skills	7. Specialized knowledge skills: The ability to develop fundamental knowledge and academic abilities appropriate for high-level professionals in the field of engineering and the advanced specialized knowledge to command the field of Intelligent and Mechanical Interaction Systems.	①To possess fundamental knowledge in the field of Systems and Information Engineering. ②To possess the mathematical knowledge and abilities widely used in the field of Intelligent and Mechanical Interaction Systems. ③To possess the advanced specialized knowledge needed to command the field of Intelligent and Mechanical Interaction Systems.
	8. Ethical skills: Ability to build an ethical view and ethics awareness appropriate for highly skilled professionals in the field of engineering.	①To understand and comply with research and engineering ethics. ②To obtain ethical knowledge of research involving human subjects and to understand and implement the procedures necessary for such research.
Guidelines for Assessing Learning Outcomes	The evaluation of learning outcomes is conducted through achievement evaluation based on the Achievement Evaluation Criteria Table, in order to objectively assess and verify the level of competence acquisition in accordance with the Diploma Policy at each stage. The stages and methods of the achievement evaluation are as follows. – In the Seminar in Intelligent and Mechanical Interaction Systems I, students will present the research outcomes of their first year. Their performance will be evaluated based on the presentation. – In the Seminar in Intelligent and Mechanical Interaction Systems II, students will present the research outcomes that will form the foundation of their master's thesis. Their performance will be evaluated based on the presentation. – The student's supervisor will review and verify the Achievement Evaluation self-check to ensure that all evaluation criteria are met. – Achievement Evaluation items are reviewed as part of the final examination, which is a requirement for the awarding of the degree. The examination is conducted by the Achievement Review Board, which confirms the evaluation plan prepared by the student's research supervisor in accordance with the Standards of Achievement Level Assessment.	

Guidelines for Assessing Learning Outcomes	<Criteria for the final examination> 1. (Generic competences) The student should have acquired knowledge utilization skills, management skills, communication skills, teamwork skills, and international skills appropriate to those who have completed the Master's Program in Intelligent and Mechanical Interaction Systems. 2. (Research ability) The student should have obtained the ability to set up an appropriate research topic, conduct the research, and produce signifi cant outcomes in the field of Intelligent and Mechanical Interaction Systems. 3. (Specialized knowledge) The student should have obtained fundamental knowledge and academic abilities appropriate for high-level professionals in the field of engineering and advanced specialized knowledge and operational skills in the field of Intelligent and Mechanical Interaction Systems. 4. (Ethical view) Th e student should have acquired an ethical perspective and ethical knowledge appropriate for high-level professionals in the area of engineering.
Evaluation Criteria for Degree Theses/ Dissertations	A thesis is accepted if it satisfies all the following criteria. <Criteria for thesis examination> 1. The dissertation should describe the significance and positioning of the research in the engineering field and should be based on the understanding of previous research in related fields. 2. The dissertation should contain original research outcomes that contribute to the development of the engineering field, and should be suitable for publication at academic conferences. 3. The reliability of the research results should be verified. 4. The research results should be appropriately discussed, and valid conclusions should be drawn from the discussions. 5. The background, purpose, methods, results, discussions, and conclusions of the dissertation should be summarized and organized in a format appropriate for a Master's degree thesis. <Required standards for thesis submission, the system of review board members, evaluation method, and review items > The Master's dissertation review board shall consist of one chief reviewer and two or more sub-reviewers who are faculty members of the Graduate School of Systems and Information Engineering degree programs. However, faculty members of other degree programs or other universities' graduate schools or laboratory researchers can serve as sub-reviewers when required. The chief reviewer must be the research supervisor of the student. The sub-reviewers must include faculty members from the Graduate School of Systems and Information Engineering degree programs. The Master's dissertation review board evaluates the thesis following the criteria for degree thesis review to provide a pass/fail judgment. The dissertation will be approved when it is deemed to have reached a Master's dissertation level regarding the five evaluation items described above, including an oral exam in the judgment.

Curriculum Policy

The curriculum is organized to cultivate high-level professionals who possess the specialized knowledge and research ability needed to identify and solve problems from a wide perspective extending over multiple areas of science and technology. Courses in the Intelligent and Mechanical Interaction Systems are designed to cover system design, human-machine-robot systems, measurement and control engineering, communication systems, as well as a wide range of fundamental knowledge and ethical view in the field of engineering.

Curriculum Design Framework	The primary goal of the curriculum is to develop research abilities in the field of Intelligent and Mechanical Interaction Systems. Students gain basic and specialized knowledge, ethical view, and competences through Major Subjects in the Degree Programs' Common Courses, as well as Major Subjects and Foundation Subjects for Major in the Degree Program's Courses. Whenever needed, the curriculum is supplemented by the Degree Programs' Common Courses, Inter-disciplinary Foundation Courses, and Graduate General Education Courses. – Students acquire the ability to implement knowledge mainly through Special Research Courses including: Research in Intelligent and Mechanical Interaction Systems I, II, Seminars (Seminar in Intelligent and Mechanical Interaction Systems I, II), and Collaboratory Research Workshops (Collaboratory Research Workshop in Intelligent and Mechanical Interaction Systems Ia, Ib, IIa, IIb). – Management competences are obtained through Special Research Seminars and Research Proposal Writing Workshops (Research Proposal Writing Workshop in Intelligent and Mechanical Interaction Systems I, II). – Communication competences are trained through Special Research, Seminars, and Research Presentation Workshops (Oral Presentation Workshop in Intelligent and Mechanical Interaction Systems Ia, Ib, IIa, IIb). – Teamwork competences are obtained through Special Research, Research Paper Presentation Workshops, Collaboratory Research Workshops, Laboratory Work (Laboratory Work in Intelligent Interaction Systems a, b, Laboratory Work in Mechanical Interaction Systems), teaching assistant experience, and external activities. – Competence in Internationality is gained mainly through Special Research, TOEIC Exercise (TOEIC Exercise in Intelligent and Mechanical Interaction Systems I, II), and Research Presentations in English. – Research ability is achieved through Special Research, Fundamentals of Intelligent and Mechanical Interaction Systems, Tools and Practices Subjects (Statistical Data Analysis for Intelligent and Mechanical Interaction Systems, Tools and Practices for Intelligent Interaction Systems a, b, Tools and Practices for Mechanical Interaction Systems), Foundation Subjects in Mathematics (Fundamentals of Mathematics in Intelligent and Mechanical Interaction Systems, Fundamental Theory of Intelligent Interaction Systems, Fundamental Mathematical System of Mechanical Interaction Systems), TOEIC Exercise, Laboratory Work, Collaboratory Research Workshops, and Research Proposal Writing Workshops.

Curriculum Design Framework	– Specialized knowledge is accomplished through Special Research, Foundation Subjects in Mathematics, Degree Programs' Common Courses (mainly in the field of Intelligent and Mechanical Interaction Systems), and Collaboratory Research Workshops. – An ethical view is principally gained through Special Research, Fundamentals Subjects, and e-learning courses for ethics.
Teaching and Learning Methods	– Students of various academic backgrounds focus on taking lectures to gain the fundamental knowledge and skills necessary for conducting research upon enrollment. At the same time, students are guided to learn how to identify socially and academically significant research topics by themselves. – Each student will learn independently more specialized knowledge and skills through courses while working on their research topic. In addition, by taking advantage of the multiple supervisor system, students will be able to receive guidance and participate in the research seminars of sub-supervisors and develop their abilities to analyze problems from a broader perspective. – Students are guided to present their research findings in seminars and academic conferences and seek the evaluations of many researchers from an early stage. Such interactions help students improve their presentation and communication abilities and empower them to drive forward their research and gain further advanced specialized knowledge and skills. – Concurrently, each student performs an Achievement Evaluation self-check as needed to encourage the acquisition of lacking knowledge or skills in order to complete the program.

Admission Policy

Desired Student Profile	We seek candidates who possess mathematical skills, English language skills, and mathematical thinking ability necessary for learning and researching in the field of Intelligent and Mechanical Interaction Systems. Students are expected to acquire research skills, specialized knowledge, and ethical view appropriate for a Master's degree holder and a researcher or professional in the field of Intelligent and Mechanical Interaction Systems.

Student Selection Process	The primary policy is to seek widely talented and outstanding applicants, regardless of whether they are from within the university, off-campus, or from the workforce. The selection process considers a variety of candidates through the Entrance Examination by Commendation, the General Entrance Examination, and a Special Selection Process for Working Individuals. The recruitment capacity is divided into multiple entrance examinations conducted within the same academic year. An oral examination is mandatory regardless of the type of entrance examination. In addition to these requirements, submission of the official academic transcripts will be needed for the August selection (General Entrance Examination and Special Selection Process for Working Individuals.). To prove foreign language proficiency, candidates are required to submit the score sheet of English language test (e.g. TOEIC, TOEFL). – The Entrance Examination by Commendation (conducted in July) seeks candidates who wish to enroll in the Master's Program in Intelligent and Mechanical Interaction Systems as their first choice, who have excelled academically, and possess the abilities necessary to conduct research in the field of Intelligent and Mechanical Interaction Systems. – The first General Entrance Examination (conducted in August) seeks candidates who possess robust academic abilities in mathematics and English, who have a clear reason for applying to the Master's Program in Intelligent and Mechanical Interaction Systems and excel in the specificity and inspiration with regard to the research plan. In the second general entrance examination (conducted in February), candidates are evaluated based on their graduation research (or equivalent) in addition to the requirements of the first general entrance examination. – The Special Selection Process for Working Individuals (conducted in August and February) evaluates the research or social experience of the candidates in addition to the evaluation items of the entrance examinations. The admission judgment is organized independently from that for the general entrance examination; therefore, the program actively accepts working individuals (or those with social experiences) who possess the motivation and abilities to join the program.

Learning Support Framework

Academic Support	To promote independent and effective learning, the program implements multiple support initiatives. The Achievement Evaluation self-check allow students to visualize their learning outcomes and assess their progress, while enabling academic supervisors to accurately monitor learning status and provide appropriate guidance. In addition, the Global Multi-Mentor System (GMMS), offers opportunities for interaction with external researchers, fostering multifaceted critique and discussion that advance students' research activities. The “Learning × Career” Hybrid Support System (LCHS) enhances research motivation by facilitating exchanges with corporate researchers and alumni, while also supporting students in developing a commitment to pursue specialized career paths, through progression to the doctoral program. Collectivelly, these support systems encourage autonomous learning, improve the quality of research, and guide students in designing career paths that effectively leverage their expertise.
Opportunities for Peer Interaction	To enhance students' motivation for learning and improve the quality of their research, the program provides structured opportunities for interaction among students. In graduate seminars, students take turns presenting their research topics to their peers in a clear and structured manner, followed by in-depth discussions. Full-day, face-to-face poster presentation sessions are organized, allowing all students to share their research outcomes and actively exchange opinions. These activities not only deepen mutual understanding among students but also foster the development of communication skills and critical thinking. Furthermore, both the Global Multi-Mentor System (GMMS) and the “Learning × Career” Hybrid Support System (LCHS) are designed to engage multiple students simultaneously. By facilitating dialogue with external researchers and industry professionals, these systems promote information sharing, collaborative learning, and mutual intellectual stimulation. Collectively, these initiatives strenghten peer effects, revitalizing the learning environment and advancing the overall quality of research.

Opportunities for Student–Faculty Interaction	To enhance students' motivation for learning and improve the quality of their research, structured opportunities for interaction with faculty members are provided. In graduate seminars, students present their research and receive constructive feedback and probing questions from faculty, allowing them to refine the focus, methodology, and logical structure of their studies. During face-to-face poster presentation sessions, faculty and students engage in discussions of research outcomes, contributing to greater accuracy and depth in research findings. Furthermore, group projects conducted within the Laboratory Work course enable students to collaborate closely under faculty supervision, cultivating practical research skills and teamwork abilities. In addition, the Graduate School Roundtable provides a forum for open dialogue between faculty and students, facilitating consultations on both research activities and career planning. Moreover, through the Global Multi-Mentor System (GMMS) and the “Learning × Career” Hybrid Support System (LCHS), faculty collaborate with external researchers and industry professionals to provide students with multidimensional guidance. Collectively, these initiatives foster close interaction between students and faculty members, enhancing the learning environment and advancing the quality and rigor of research.

Approaches to Assuring and Enhancing Educational Quality

To ensure the quality of education in the Master's Program and promote continuous improvement, multiple systems and mechanisms have been established. For newly appointed faculty members, Faculty Development (FD) programs provide support for enhancing teaching abilities, including guidance on educational content and instructional methods. In addition, regular faculty training sessions including FD focused on achievement evaluation, are conducted to further elevate the quality of educational activities. The Achievement Evaluation Committee evaluates students' learning outcomes and examines both the validity of the curriculum and the appropriateness of academic supervision. Furthermore, a PDCA Committee continuously monitors and improves all educational activities, incorporating feedback provided by industry representatives, obtained during poster presentation sessions. Through these coordinated efforts, the quality of education is maintained, and the framework for achieving the program's learning objectives is strengthened.