Master's Program in Engineering Mechanics and Energy

Master of Engineering

Program Educational Objectives

The Master's Program in Engineering Mechanics and Energy, which help students possess advanced specialized knowledge in engineering areas of machinery, architecture, social infrastructure, energy, aerospace, etc. and also to take a multidisciplinary approach to associated surrounding areas, cultivates researchers and highly specialized professionals capable of proposing their own solution methods for the essential problems that they extract and transmitting their outcomes effectively inside and outside Japan.

Graduate Profile	He or she should have interests in the areas of engineering such as machinery, architecture, social infrastructure, energy and aerospace and set their sights to be an engineer or researcher who has the fertile minds to contribute to mankind's strides. Furthermore, he or she should be willing to learn to take a multidisciplinary approach to associated surrounding areas in addition to gaining advanced specialized knowledge.

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 ability: Ability to extract problems in the areas of engineering mechanics and energy and propose and carry out solution methods	①If research tasks in the areas of engineering mechanics and energy are appropriately set up ②If the basic skills for conducting research in the areas of engineering mechanics and energy were gained ③ If research is carried out successfully in the areas of engineering mechanics and energy
	7. Specialized knowledge: Basic academic abilities, advanced specialized knowledge and command of them in the areas of engineering mechanics and energy	①If the basic specialized knowledge in the areas of systems and information engineering was gained ②If advanced specialized knowledge and command of it in the areas of engineering mechanics and energy were gained

<table>
<tr><td rowspan="2">Knowledge and Skills</td><td>Competences</td><td>Evaluation perspectives</td></tr>
<tr><td>8. Ethical view: Ethical view and ethical knowledge appropriate for highly specialized professionals in the areas of engineering</td><td>If researcher ethics and engineer ethics were understood and adhered by</td></tr>
<tr><td>Guidelines for Assessing Learning Outcomes</td><td colspan="2">The assessment of learning outcomes is conducted through achievement evaluation based on the Achievement Evaluation Sheet, allowing an objective evaluation of the extent to which students have acquired the competences specified in the Diploma Policy. The learning outcomes related to the master's thesis are evaluated at the following stages:
– In Seminar in Engineering Mechanics and Energy I (1st year), students present the research achieved during the first year and receive evaluation and feedback.
– In Seminar in Engineering Mechanics and Energy II (2nd year), students clarify the academic positioning of their research topics, present their research achieved during the second year, and receive evaluation and feedback.
– In both the spring and fall semesters, Achievement Evaluation Sheet is confirmed and evaluated.
– During the thesis examination and final defense, students present the content of their thesis and undergo a degree evaluation, while also being evaluated using the Achievement Evaluation Sheet.</td></tr>
<tr><td>Evaluation Criteria for Degree Theses/ Dissertations</td><td colspan="2">A thesis is accepted if all of the following evaluation items are proven to be met.
<Criteria for degree thesis review>
1. With the review of the research trends and preceding researches in the associated areas, the significance and positioning of the research must be clarified.
2. Original research findings that contribute to engineering strides must be contained.
3. Research findings must be sufficiently verified in reliability.
4. The conclusion of the research must be based on objective evidence and rational deduction.
5. All of the above items must be incorporated with an appropriate thesis structure and unequivocal descriptions.
In addition, the thesis must be accompanied by a theme that accurately explains the thesis content.
<Criteria for final exam>
The student is asked to explain his or her degree thesis content, and at his or her explanation, the above criteria 1 to 5 must be confirmed to be met. In addition, the student must have gained the following abilities, knowledge, etc.
1. Competence of knowledge application: Ability to put advanced knowledge to use in society
2. Management competence: Ability to appropriately address challenges from every angle
3. Communication competence: Ability to express expert knowledge accurately and clearly
4. Teamwork competence: Ability to cooperate and actively contribute to the achievement of goals as a team</td></tr>
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Evaluation Criteria for Degree Theses/ Dissertations	5. Competence in Internationality: Awareness to contribute to international society 6. Research ability: Ability to extract problems in the areas of engineering mechanics and energy and propose and carry out solution methods 7. Specialized knowledge: Basic academic abilities, advanced specialized knowledge and command of them in the areas of engineering mechanics and energy 8. Ethical view: Ethical view and ethical knowledge appropriate for highly specialized professionals in the areas of engineering <Level standards required for the degree thesis, review board members, review method and review items, etc.> A master's thesis review board must be organized with one chief reviewer and two or more sub-reviewers who are applicable faculty members of the Degree Programs in Systems and Information Engineering of the Graduate School. However, where required, faculty members of other Degree Programs or other university graduate schools or laboratory researchers, etc. can serve as sub-reviewers. The chief reviewer must be the research supervisory faculty member. The chief reviewer opens a master's thesis review board, and the board reviews the thesis in accordance with the criteria for degree thesis review to judge the acceptance of the thesis. The thesis passes if approved to be on a master's thesis level in all of the above evaluation items with the final (oral) exam included in the judgment.

Curriculum Policy

The curriculum is organized with the objective of fulfilling the Diploma Policy (DP).
More specifically, students deeply learn the foundations and leading-edge technologies in engineering areas of machinery, architecture, social infrastructure, energy, aerospace, etc. and also learn widely in multiple areas in science and technology so that the Program can cultivate human resources who have the big picture in mind that an ordinary vertically-sectioning engineering major would not give.

Curriculum Design Framework	The Master's Program in Engineering Mechanics and Energy organizes Major Subjects and Foundation Subjects for Major in Degree Programs' Common Courses, and Major Subjects and Foundation Subjects for Major in Program subjects. In addition to the required subjects of 12 credits, Foundation Subjects for Major and Major Subjects are organized in the areas of “mechanics, disaster prevention and reliability engineering”, “solid mechanics and materials engineering”, “fluids and environment engineering” and “thermal fluid and energy engineering”. Students need to take 18 credits or more from these subjects. The required Major Subjects serve to cultivate presentation and communication abilities and a wide viewpoint, and from Degree Programs' Common Courses, students learn the foundations and leading-edge technologies of each of the areas.

	Moreover, to deepen the knowledge about the actual problems in engineering mechanics and energy, the curriculum also organizes the project subjects, which help students understand the process from identifying to solving problems using engineering means and develop means to provide a solution. Students attain the requirements enumerated in DP by incorporating the learning in these subjects and the research of each student's area of expertise into a master's thesis. Note that students are encouraged to take subjects offered in other Degree Programs, Graduate General Education Courses, Inter-disciplinary Foundation Courses, etc. that aim to develop a wider range of knowledge and research ability. (Generic knowledge and ability) – Competence of knowledge application is gained through Degree Programs' Common Courses, Program subjects, special researches, special seminars, etc. – Management competence is gained through special researches, special seminars, drawing up master's thesis research plans, etc. – Communication competence is gained through special researches, special seminars, Internship, academic conference presentations, etc.. – Teamwork competence is gained through special researches, special seminars, internships, teaching assistant experience, laboratory activities, etc. – Competence in Internationality is gained through special researches, special seminars, internships, EME international seminar series, joint research with foreigners (including international students), international conference presentations, English research paper publication, etc. (Specialized knowledge and ability) – Research ability is gained through special seminars, special researches, academic conference presentations, research paper publication, master's thesis, etc. – Advanced knowledge in the area of expertise is gained through Degree Programs' Common Courses, Program subjects, academic conference presentations, research paper publication, master's thesis, etc. – A cross-disciplinary point of view is gained through Degree Programs' Common Courses and Program subjects, special researches, special seminars, etc. – The ability to extract problems and propose their own solution methods is gained through special seminars, special researches, etc. – The ability to transmit outcomes inside and outside Japan is gained through special seminars, special researches, academic conference presentations, master's thesis, etc. – Ethical view is gained through special seminars, special researches, e-learning for ethics, etc.

Teaching and Learning Methods	– Students learn in accordance with the curriculum model for subjects. – Each student learns under their initiative for more specialized knowledge and skills through classes, etc. while working on research tasks. – Students set up research tasks in each area of expertise and proceed with a master's thesis research under the advice of supervisory faculty members. – Students are supervised to present obtained research findings in seminars, academic conferences, etc. and to seek the evaluations of many researchers. This helps students improve their presentation and communication abilities and also empowers them to drive forward their research and gain more advanced specialized knowledge and skills.

Admission Policy

Desired Student Profile	We seek potential engineers or researchers with the fertile minds to contribute to mankind's strides, who have an interest in machinery, architecture, social infrastructure, energy, aerospace, and such other engineering areas, based on a bachelor's degree level of sufficient academic abilities in mathematics, physics and English.
Student Selection Process	The entrance exams are designed to be convenient for those who graduated from other universities, working individuals and international students so that the Program actively accepts outstanding human resources outside Tsukuba. To select out enrollments, diverse candidates are sought through recommendation entrance exam, general entrance exam and special entrance exam for adults or other enrollment selection methods. The opportunity of entrance exam is offered multiple times in the same year with the split of the number of persons admitted. In the general selection process, candidates are evaluated based on the result of oral exam, and the foreign language proficiency proven by the TOEIC official score certificate, the TOEFL official score reports, etc. In the recommendation entrance exam and special entrance exam for adults, candidates are comprehensively evaluated with oral exam results. – In the recommendation entrance exam, the candidates must remarkably excel academically and possess the sufficient knowledge and research abilities in the areas of engineering mechanics and energy. – The general entrance exam selects those who possess the basic academic abilities and research abilities that enable the completion of a bachelor's degree program in engineering with honors. – The special entrance exam for adults evaluates the achievements and experiences as an adult member of society in addition to the above basic academic abilities and research abilities.

Learning Support Framework

Academic Support	The supervisror provides both laboratory-based activities and individual guidance, consistently monitoring the student's progress. The co-supervisors meet with the student in both the spring and fall semesters to receive reports and provide advice regarding course enrollment plans, research plans and their progress, as well as career paths (mainly job-hunting). In these meetings, the student presents Achievement Evaluation Sheet and Course and Research Plan Sheet, thereby objectifying their own situation before entering into the discussion.
Opportunities for Peer Interaction	Students make research presentations and engage in question-and-answer sessions during Daigakuin Seminar, thereby gaining an understanding of the research activities undertaken by their peers while also receiving mutual feedback and critique. A student-faculty meeting is held for all students in the degree program, providing a forum for sharing common awareness of issues and improvements regarding learning progress and student life. Many students also enroll in project-based learning (PBL) courses, where they have opportunities to collaborate with other participants in tackling assigned tasks.
Opportunities for Student–Faculty Interaction	The supervisor conducts both laboratory-based activities and individual guidance, maintaining continuous oversight of each student's progress. The co-supervisors meet with students in the spring and fall semesters to receive reports and provide advice on course enrollment plans, research plans and their progress, as well as career paths (primarily job-hunting). In addition, a student-faculty meeting is held for all students in the degree program, where opinions are exchanged on lectures, research, student life, and related matters.

Approaches to Assuring and Enhancing Educational Quality

The PDCA Committee verifies the implementation status of confirmation and feedback from their supervisor and co-supervisors, and monitors to ensure that both supervisors and students are carrying them out properly. Evidence supporting the Achievement Evaluation Sheet and course grade assessments are collected and stored, and are utilized for improving course content, syllabi, and achievement assessment methods. Appropriate measures are also taken in response to requests raised by students at the student-faculty meeting.