

Doctoral Program in Engineering Mechanics and Energy

■ Doctor of Philosophy in Engineering

Program Educational Objectives

The Doctoral Program in Engineering Mechanics and Energy, which helps students possess advanced specialized knowledge in engineering areas of machinery, architecture, social infrastructure, energy, aerospace, etc. as well as the ability to take a multidisciplinary approach to associated surrounding areas and to internationally provide information, cultivates university faculty members, researchers and highly specialized professionals who play a role in taking the lead in the society by administering and operating research projects appropriately and can appropriately supervise potential younger talents learning in the areas of engineering.

Graduate Profile	He or she should possess a wide range of knowledge in the areas of engineering such as machinery, architecture, social infrastructure, energy and aerospace, set their sights to be an engineer or researcher who has the fertile minds to contribute to mankind's strides, take a multidisciplinary approach to associated surrounding areas while possessing advanced specialized knowledge, and be capable of take the lead in being active in the areas.
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Diploma Policy

The degree of Doctor of Philosophy in Engineering is commenced to those who have fulfilled the requirements for the completion of the Doctoral 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.

Knowledge and Skills	Competences	Evaluation perspectives
	1. Knowledge creation competence: Ability to create new knowledge that can contribute to future society	① Are there any research findings that can be considered new knowledge? ② Can we expect you to create knowledge that will contribute to future society?
	2. Management competence: Ability to plan and implement measures to identify and solve challenges from a higher perspective	① Can you make and implement long-term plans for critical challenges? ② Can you identify challenges, even in other areas of expertise, and solve them from a higher perspective?
	3. Communication competence: Ability to express the true nature of academic findings positively and clearly	① Can you explain the true nature of research content and specialized knowledge clearly and logically to researchers from different areas and to people other than researchers? ② Do you proactively share your findings with researchers and experts from your field of expertise and accurately answer questions?
	4. Leadership competence: Ability to have objectives get accomplished under your leadership	① Can you set attractive and compelling goals? ② Are you capable of building systems to realize goals and accomplish objectives as the leader?
	5. Internationality competence: Possession of a high level of awareness and motivation to be internationally active and contribute to international society	① Do you have strong awareness and motivation to contribute to international society and international activities? ② Have you obtained adequate linguistic skills for international information collection and action?

	Competences	Evaluation perspectives
Knowledge and Skills	6. Research ability: Ability to extract leading-edge problems in the areas of engineering mechanics and energy and propose and carry out solution methods	① If leading-edge research tasks in the areas of engineering mechanics and energy are set up independently and appropriately ② If the basic and applied skills for conducting leading-edge research in the areas of engineering mechanics and energy were gained ③ If leading-edge research in the areas of engineering mechanics and energy is carried out independently and successfully
	7. Specialized knowledge: Basic academic abilities, leading-edge advanced specialized knowledge and command of them in the areas of engineering mechanics and energy	① If the basic specialized knowledge in the areas of systems and information engineering was gained ② If leading-edge advanced specialized knowledge and command of it in the areas of engineering mechanics and energy were gained
	8. Ethical view: Ethical view and ethical knowledge appropriate for highly specialized professionals in the areas of engineering	If researcher ethics and engineer ethics were understood and adhered by
Guidelines for Assessing Learning Outcomes	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: <ul style="list-style-type: none"> - In Seminar in Engineering Mechanics and Energy, students present the research and receive evaluation and feedback. - In the preliminary thesis examination, the student presents an overview of their thesis and receives 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. 	

<p>Evaluation Criteria for Degree Theses/ Dissertations</p>	<p>A thesis is accepted if all of the following evaluation items are proven to be met.</p> <p><Criteria for degree thesis review></p> <ol style="list-style-type: none"> 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. <p><Criteria for final exam></p> <p>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.</p> <ol style="list-style-type: none"> 1. Competence of knowledge creation: Ability to create new knowledge to be able to contribute to future society 2. Management competence: Ability to plan and implement measures to identify and solve challenges from a higher perspective 3. Communication competence: Ability to express the nature of academic findings positively and clearly 4. Leadership competence: Ability to accomplish objectives under one's leadership 5. Competence in Internationality: High level of awareness and motivation to be internationally active and contribute to international society 6. Research ability: Ability to extract leading-edge problems in the areas of engineering mechanics and energy and propose and carry out solution methods 7. Specialized knowledge: Basic academic abilities, leading-edge 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
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<p>Evaluation Criteria for Degree Theses/ Dissertations</p>	<p><Level standards required for the degree thesis, review board members, review method and review items, etc.></p> <p>The examiners of the Doctoral Dissertation Review Committee shall consist of one main examiner and at least three associate examiners; the main examiner shall be the research advisor of this research group, and at least two associate examiners shall be the faculty members in charge of the graduate school. Note that not all of the examiners for the main and associate examiners shall be faculty members of the Degree Program in Engineering Mechanics and Energy, but at least one examiner from any of the following categories shall be added: other degree programs, other research groups, or external examiners.</p> <p>The chief reviewer opens a doctoral dissertation review board, and the board reviews the dissertation in accordance with the criteria for degree dissertation review to judge the acceptance of the dissertation.</p> <p>The dissertation passes if approved to be on a doctoral dissertation level in all of the above evaluation items with the final (oral) exam included in the judgment.</p>
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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.

<p>Curriculum Design Framework</p>	<p>The required subjects are organized to develop advanced research ability for engineering mechanics and energy as the first objective of the curriculum.</p> <p>In addition to Major Subjects, students are required to earn 2 credits or more from Degree Programs' Common Courses, subjects offered in other Degree Programs, Inter-disciplinary Foundation Courses and Graduate General Education Courses to gain a wider range of knowledge and research ability.</p> <p>The required subjects are organized to cultivate presentation and communication abilities and a wide perspective.</p> <p>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 doctoral dissertation.</p> <p>In addition, the opportunities to serve as a teaching assistant of lectures in the Master's Program or Colleges are actively offered to gain experience to supervise potential younger talents.</p>
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<p>Curriculum Design Framework</p>	<p>(Generic knowledge and ability)</p> <ul style="list-style-type: none"> - Competence of knowledge creation is gained through Major Subjects, special researches, special seminars, doctoral dissertation creation, and academic conference presentations in Degree Programs' Common Courses and Program subjects, etc. - Management competence is gained through special researches, special seminars, achievement self-check, drawing up doctoral dissertation research plans, etc. - Communication competence is gained through special researches, special seminars, internships, academic conference presentations, poster presentations, etc. - Leadership competence is gained through special researches, special seminars, internships, teaching assistant (graduate school seminars, etc.) experience, project participation 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. <p>(Specialized knowledge and ability)</p> <ul style="list-style-type: none"> - Research ability is gained through special seminars, special researches, academic conference presentations, research paper publication, doctoral dissertation, etc. - Advanced knowledge in the area of expertise is gained through specialized subjects in Degree Programs' Common Courses and Program subjects, academic conference presentations, research paper publication, doctoral dissertation, etc. - A cross-disciplinary point of view is gained through Degree Programs' Common Courses, special seminars, special researches, academic conference presentations, etc. - The ability to extract problems and propose solution methods is gained through special researches, special seminars, internships, project participation experience, laboratory activities, etc. - The ability to transmit outcomes inside and outside Japan is gained through special researches, special seminars, internships, joint research with foreigners (including international students), international conference presentations, English research paper publication, etc. - The ability to administer and operate research projects is gained through special researches, special seminars, internships, project participation experience, laboratory activities, etc. - Ethical view is gained through special seminars, special researches, e-learning for ethics, etc.
<p>Teaching and Learning Methods</p>	<ul style="list-style-type: none"> - Students learn in accordance with the curriculum model for subjects. - Students set up research tasks in each area of expertise and proceed with a doctoral dissertation research under the advice of supervisory faculty members. - Students present obtained research findings at seminars, academic conferences, etc. Being evaluated in those opportunities, students get hints to improve or develop their research.

Admission Policy

<p>Desired Student Profile</p>	<p>We seek potential engineers or researchers with the fertile minds to contribute to mankind's strides and with the goal to actively take the lead in relevant areas, who have a master's degree or have the prospect of earning it, possess the sufficient academic abilities in the areas associated with engineering mechanics and energy, and have an interest in machinery, architecture, social infrastructure, energy, aerospace, and such other engineering areas.</p>
<p>Student Selection Process</p>	<p>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. In the general entrance exam and special entrance exam for adults, candidates make a presentation about the content of research that they have conducted so far and also about the future research plan, and then are asked questions about associated matters.</p> <ul style="list-style-type: none"> - The internal assessment selection selects those who are expected to complete the Master's Program in Engineering Mechanics and Energy, who possess especially high fundamental abilities and research abilities. - The general entrance exam selects those who possess the basic academic abilities and research abilities that enable the completion of a master'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

<p>Academic Support</p>	<p>The supervisor 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.</p>
<p>Opportunities for Peer Interaction</p>	<p>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 serve as teaching assistants, through which they not only provide guidance to course participants but also gain opportunities to interact with students from other laboratories.</p>

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.
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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.