Master's Program in Engineering Sciences

Name of the degree to be conferred	Master of Engineering
Educational purpose	In the diverse areas of engineering which range from substances, materials, devices to measurement technologies, the Master's Program in Engineering Sciences is designed to cultivate highly specialized professionals who base themselves on their sufficient fundamental abilities in science and have the applied engineering ability and the ability to make use of it to address diverse problems in reality using supple flexibility, create original technologies and cultivate potential younger talents.
Vision of human resources development	In the diverse areas of engineering which range from substances, materials, devices to measurement technologies, the Program helps students develop sufficient fundamental abilities in science and cultivates highly specialized professionals who possess the high research and development ability to contribute to the society through the Program's education and research activities by way of a system of multiple supervisory faculty members with a wide variety of values. <Subprogram in Applied Physics> Highly specialized professionals with advanced specialized knowledge and abilities who lead research, technological development and engineering practice at the world's level in the areas of applied instrumentation, nanotechnology and electronic devices founded on the natural science around physics <Subprogram in Materials Science> Highly specialized professionals who possess the deep knowledge in the areas of expertise in materials engineering such as quantum physics of solid state, theoretical quantum physics, materials physics, and materials chemistry and biomaterials engineering and can contribute to the society through advanced research ability

Competencies specified in diploma policy	Evaluation perspectives
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. Fundamental engineering ability: Basic knowledge and academic abilities appropriate to highly specialized professionals in the areas of engineering	If one has interests in global trends in the areas of engineering and if knowledge was gained
7. Basic academic abilities indispensable for the comprehension in the areas of engineering	If mathematical knowledge and abilities widely used in engineering were gained
8. Specialized knowledge: Basic knowledge required for the comprehension in the areas in engineering	If one has interests in research trends in the areas of engineering and if specialized knowledge was widely gained
9. Ethical view: Ethical view required of highly specialized professionals in the areas of engineering	If researcher ethics, engineer ethics, and human research ethics as well as formalities and/or procedures necessary for research were sufficiently understood

10. Insight and problem-solving ability required to solve problems in practice in the areas of engineering	If papers or other materials in English in the areas of engineering are understood and research is carried out with the accomplishment of significant results

Dissertation evaluation criteria

【Review board members】

Set up with one chief reviewer and two or more sub-reviewers.

【Review method】

Preliminary review, thesis review and the final exam are administered in accordance with the method defined by each Subprogram.

1) Subprogram in Applied Physics

The thesis review board administers thesis review and final exam.

2) Subprogram in Materials Science

The thesis review board administers thesis review and final exam to evaluate if the student possesses the academic abilities and knowledge that become the foundations of all areas of materials engineering and the specialized knowledge of any of the areas of materials engineering and has successfully carried out research with a required level of results along with a specific theme in any of the areas of materials engineering.

【Review items】

1. The setup of research tasks and the selection of research methods must be appropriate.
2. The interpretation of results and the development of line of reasoning before reaching the conclusion must be appropriate and unequivocal.
3. The preceding researches related to research tasks must be grasped and understood with appropriate appraisal and citation.
4. With adherence to research ethics, the obtained results and conclusions must be verifiable by third parties.
5. Academic significance must be identifiable in the outcomes of research tasks.

【Level standards required for the degree thesis】

All of the above evaluation items and the criteria defined by each Subprogram must be met.

1) Subprogram in Applied Physics

The thesis passes as a master's thesis with the final exam included in the judgment.

2) Subprogram in Materials Science

The curriculum objectives defined in article 2, clause 3 of the school rules of Graduate Education at University of Tsukuba must be fulfilled. With this fulfillment, the thesis passes as a master's thesis with the final exam included in the judgment.

Curriculum Policy

The curriculum is organized with Foundation Subjects for Major, Major Subjects, laboratory seminars, etc., graduate school seminars, and research activities for the areas founded on the natural science around physics, which are the areas of applied instrumentation, nanotechnology and electronic devices, and the areas of expertise in materials engineering such as quantum physics of solid state, theoretical quantum physics, materials physics, and materials chemistry and biomaterials engineering.

The Program is designed to provide students with education and research supervision to develop a breadth of basic skills in pure and applied sciences and to have the big picture in mind in science and technology, which extends over natural science and engineering, as well as the generic knowledge and ability that support students to be active in diverse social scenes, along with the research ability, specialized knowledge and ethics in each area of expertise.

Curriculum organization policy	In order to cultivate the basic skills and wide perspectives as well as generic knowledge and ability in associated areas with the student's major at the core, Colloquium on Pure and Applied Sciences (1 credit) must be taken as a required subject from Degree Programs' Common Courses, and students are encouraged to take other Degree Programs' Common Courses, Inter-disciplinary Foundation Courses and Graduate General Education Courses. The research supervision takes a multiple-instruction scheme to develop a research ability that exerts multifaceted perspectives. ・Foundation Subjects for Major are organized with Common Foundation Subjects on a Subprogram basis so that the base subjects, which serve as the foundation of the areas of technology now and in the future, are expanded from the College level. ・With Major Subjects, students gain deep specialized knowledge in specific areas in Subprograms. <Subprogram in Applied Physics> ・Students take Major Subjects for the specialized disciplines commonly required in each area of specialty. In the seminar of each laboratory, which permits the participation of other laboratories' students, more specialized contents are learned. ・In graduate school seminars, students make presentations about the outcomes of daily routine research activities. In this setting, students cultivate their logic forming skill, communication skill and communication ability.

	<Subprogram in Materials Science> ・The Subprogram is composed of the four areas of "quantum physics of solid state", "theoretical quantum physics", "materials physics" and "materials chemistry and biomaterials". Each area's "Research IA, IB, IIA, IIB" (a total of 12 credits) are required subjects. In these subjects, in addition to the research activities according to each student's theme for master's thesis creation, students are required to make a research presentation once a year in "Program Seminar", in which the students and faculty members in the major participate. ・By this, students understand the significance, outcomes and position of the research theme that each one has respectively worked on and gain the presentation and communication abilities of explaining using their own words. ・Basic academic abilities and the deep specialized knowledge in specific areas are gained with Foundation Subjects for Major and Major Subjects. ・A wide perspective is acquired with specialized subjects of other Programs or other Courses, and Graduate General Education Courses.
Learning methods・Processes	・In the Subprogram in Applied Physics, students take Biological and Medical Engineering and Material and Device Physics for Nanoscience in addition to Quantum Mechanics, Statistical Mechanics, Electromagnetism and Solid State Physics, which are common Foundation Subjects for Major, so that the base subjects, which serve as the foundations of these areas now and in the future, can be expanded from the College level. In the Subprogram in Materials Science, students take "Materials Chemistry" and "Chemical Biology" so that the base subjects serving as the foundations of the four areas of "quantum physics of solid state", "theoretical quantum physics", "materials physics" and "materials chemistry and biomaterials" can be expanded from the College level. ・For the details on Major Subjects, see below. <Subprogram in Applied Physics> ・With Major Subjects (Introductory Sciences in Advanced Surface Measurements, Charged Particle and Plasma Engineering Science, Advanced Instrumentation I, Device Engineering, etc.), students learn for the specialized disciplines commonly required in each area of specialty. ・Through the research activities and seminar presentations in Research IA, etc. in the area, students gain the fundamental abilities indispensable for the understanding and expansion of the advanced areas of specialty, as well as the highly specialized fundamental abilities required of the area's researchers or highly specialized professionals, practical insight and ability to act, wide perspective, problem-solving ability, and the presentation and communication abilities to debate with experts in the world. <Subprogram in Materials Science> ・With Major Subjects (Introduction to Optical Properties of Solids, Group Theory in Molecules and Solids, Special Topics on Functional Materials, Polymer Chemistry, Energy Materials and Environmental Materials, Advanced Biomaterials Science, etc.), students seek to gain the specialized knowledge universally required in the area. ・Through the research activities and seminar presentations in Research IA, etc. in the area, students acquire the abilities required of highly specialized professionals, such as highly specialized fundamental abilities, practical ability, broad perspective, problem-solving ability and information provision ability.
Evaluation of learning outcomes	The learning with General Foundation Subjects, Foundation Subjects for Major and Major Subjects and the master's thesis are evaluated by the thesis review board, and the outcomes of learning are evaluated with the final exam. <Subprogram in Applied Physics> ・The outcomes concerning the specialized knowledge and communication ability necessary for engineering research and applied development are evaluated in each Major Subjects and special research (laboratory seminars, research activities, graduate school seminars). ・Particularly in graduate school seminars, not only research and presentation qualities but also the abilities to respond to questions and ask questions are evaluated. Note that the objectiveness of evaluation is ensured with numerical evaluation conducted by all faculty members participating in the seminar in addition to the supervisory faculty member. ・For thesis review and final exam, a thesis review board is set up with one chief reviewer and two or more sub-reviewers. In this review board, the student is evaluated by written examination and also evaluated orally to thereby ensure the level of research, the quality of thesis and the objectiveness of evaluation.

	<Subprogram in Materials Science> ・The learning of Foundation Subjects for Major and Major Subjects are evaluated in the acquisition of basic academic abilities and knowledge and the acquisition of specialized knowledge in each area. ・The research activities that each student performs to create a master's thesis with their respective themes as part of the required subjects "Research IA, IB, IIA, IIB" in each area take a system of supervision in which one student is supervised by chief supervisory and sub-supervisory faculty members as a total of two faculty members. In daily research supervision, these multiple faculty members evaluate the student to see the acquisition of the ability to carry out individual themes of research and obtain outcomes. ・Similarly, in the "Program Seminar" as part of "Research IA, IB, IIA, IIB" , students are required to make a research presentation once a year so that the ability to independently explain the significance, findings and positions of the research theme is evaluated. ・For thesis review and final exam, a thesis review board is set up with one chief reviewer and two or more sub-reviewers to evaluate if "the student possesses the academic abilities and knowledge that become the foundations of all areas of materials engineering and the specialized knowledge of any of the areas of materials engineering and has successfully carried out research with a required level of results along with a specific theme in any of the areas of materials engineering" . For this evaluation, the following five items are examined: ① Appropriateness of research theme and thesis subject ② Comprehension of research background, ③ Thesis content (methods, results, conclusion) and its academic and/or social significance, ④ Style of thesis presentation, expressions, rational discussions, ⑤ Adherence to research ethics.
Admission Policy	
Desired students	We seek students who have the motivation to expand their learning in this area with their robust basic academic abilities and English proficiency necessary for learning advanced engineering, as well as extensive and deep curiosity, mental capability that spares no effort to make their purposes, high ethical view, robust disciplinary bases and sufficient communication ability.
Selection policy	The base parameters for the selection of candidates are basic academic abilities and basic knowledge as well as the deep insight based on them. Those who have the motivation and concentration for carrying out research proactively and enthusiastically are selected through written and oral exams.