

## Doctoral Program in Computer Science

Name of the degree to be conferred	Doctor of Philosophy in Engineering
Educational purpose	The Doctoral Program in Computer Science organizes its education and research to cultivate human resources with the deep expertise in diverse areas of computer science and with the knowledge, specialized research ability and practical work ability that work on an international level. Graduates through the program should possess both ingenuity and flexibility and can use all of these to contribute to solving the problems in a specific field by informatics approaches.
Vision of human resources development	To develop researchers and highly skilled professionals who possesses specialized knowledge and leading-edge engineering abilities in a wide range of areas in computer science as well as the high communication and presentation abilities for his or her area of expertise and the advanced abilities for carrying out research and development and can apply these knowledge and abilities to lead various problems in the real world to reach solutions.
Competencies specified in diploma policy	Evaluation perspectives
1. Knowledge creation competence: Ability to create new knowledge that can contribute to future society	①Are there any research findings that can be considered new knowledge? ②Can 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	①Can you make and implement long-term plans for critical challenges? ②Can 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	①Can 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? ②Do 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	①Can you set attractive and compelling goals? ②Are 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	①Do you have strong awareness and motivation to contribute to international society and international activities? ②Have you obtained adequate linguistic skills for international information collection and action?
6. Research ability: Ability to identify new tasks in new areas in one's own right, then independently draw up a plan to solve them and steadily execute it with the backup of leading-edge advanced specialized knowledge and skills in a wide range of areas in computer science	①Whether new problems are identified in the areas of computer science, and whether appropriate research tasks are set up for them ②Whether advanced specialized skills for conducting research and development in the areas of computer science are gained ③Whether research plans are drawn up for new types of problems in the areas of computer science and steadily carried out with effective outcomes ④Whether English is used in the presentations and discussions of research outcomes in international scenes.
7. Specialized knowledge: Leading-edge advanced specialized knowledge and skills in a wide range of areas in computer science, and the ability to use them	①Whether the specialized knowledge in the areas of systems and information engineering was gained ②Whether the leading-edge specialized knowledge and skills in the areas of computer science were gained ③Whether the specialized knowledge and skills that one possesses are appropriately used
8. Ethical view: Refined ethical view in a wide range of areas in computer science	①Whether researcher ethics and engineer ethics were understood and adhered by. ②Whether human research ethics as well as formalities and/or procedures necessary for research were understood. ③Whether one has deep interests and knowledge about ethical problems in the areas of computer science.

### Dissertation evaluation criteria

A thesis is accepted if all of the following evaluation standards are met.

<Criteria for degree thesis review>

1. Whether the dissertation provides a clear description of the significance and positioning of the research based on the understanding of international research trends and previous studies in the areas of computer science

2. Whether the novelty, creativity and applied values that contribute to make academic and social strides in the areas of computer science are sufficiently contained in the research outcomes well enough to be presented as an academic paper
3. Whether the research results are adequately discussed and sufficiently verified in reliability
4. Whether research backgrounds, purposes, methods, results, discussions and the line of reasoning are developed logically and demonstratively
5. Whether the dissertation is organized in a format and style of presentation appropriate as a doctoral dissertation with sentence expressions appropriately used and literatures, graphics, etc. correctly cited with proper referencing.

<Criteria for final exam>

**【Research ability】** Whether leading-edge specialized knowledge and skills in a wide range of areas in computer science were gained

**【Research ability】** Whether a new area of tasks was identified in one's own right, and whether a plan to solve them was drawn up and executed steadily

**【Specialized knowledge】** Whether the advanced specialized knowledge and skills in a wide range of areas in computer science, and the ability to use them were gained

**【Ethical view】** Whether the refined ethical view in a wide range of areas in computer science was gained

**【Communication competence】** Whether the ability to express things accurately and clearly and make advanced debates of expertise was gained

<Level standards required for the degree thesis, review board members, review method and review items, etc.>

A doctoral dissertation review board must be formed by five or more reviewers, with at least three being professors.

The chief reviewer and two or more sub-reviewers must be faculty members of the Degree Programs in Systems and Information Engineering.

The chief reviewer must be the professor (research supervisor). Note that the chief reviewer and sub-reviewers must be not formed by faculty members only from the Program in Computer Science but must include at least one external reviewer or reviewer from other programs.

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.

The dissertation passes if approved to be on a doctoral dissertation level in all of the above evaluation items 1 to 5 with the final (oral) exam included in the judgement.

## Curriculum Policy

The curriculum is organized to provide students with the specialized knowledge and research ability in mathematical informatics engineering, intelligence software, software systems, computer engineering, media engineering and intelligence/information engineering, which cover from the basal technologies intended for the generation, processing and utilization of "information", such as computers, networks and security, to the applied technologies, such as web applications, user interfaces, speech recognition/image analysis and high-performance computing. In addition, students gain a wide range of basic knowledge and ethical view in the areas of engineering. The Program also offers research supervision toward the creation of a doctoral dissertation and thereby cultivates human resources who can identify and solve problems from a wide perspective extending over multiple areas in science and technology.

Curriculum organization policy	<ul style="list-style-type: none"> <li>• The Doctoral Program in Computer Science organizes "required subjects" and "Major Subjects".</li> <li>• With "required subjects", students are engaged in research activities under the advice of supervisors and conduct surveys, etc. of associated areas.</li> </ul> <p>With these research activities, students gain Competence of knowledge application, Management competence, Communication competence, Teamwork competence, fundamental engineering ability, the knowledge and skills in the areas of informatics, inquisitive quality for the area of expertise, presentation ability, and the knowledge and skills in science and technology.</p> <ul style="list-style-type: none"> <li>• With "research seminar", students gain communication skills, Competence in Internationality and develop presentation abilities through research presentations and debates in English.</li> <li>• With "Research Internship I/II", students gain Management competence, Communication competence, Leadership competence, Competence in Internationality, the knowledge and skills in the areas of informatics, inquisitive quality for the area of expertise and presentation ability by being engaged in research activities at other universities, laboratories, etc.</li> <li>• With "Internship in Cross-disciplinary Laboratories I/II", students gain Communication competence, inquisitive quality for the area of expertise, presentation ability, knowledge and engineering skills in science and technology by being engaged in research activities at laboratories in science and technology.</li> <li>• Deep specialized knowledge and engineering abilities in diverse areas are gained through "Graduate General Education Courses", "Interdisciplinary Foundation Courses", "Degree Programs' Common Courses", etc.</li> <li>• Management competence is gained through TA (Teaching Assistant) and TF (Teaching Fellow) activities, supervising the research activities of junior students in their laboratories.</li> </ul>
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Learning methods Processes	<ul style="list-style-type: none"> <li>· Each student sets up research tasks in their respective areas of expertise and proceeds with conducting research under the advice of supervisors.</li> <li>· With the research seminar, each student makes a presentation of interim results of their research in English and receives feedback from participating faculty members and students. Through this exercise, students get their research brushed up and improve their skills of presenting and debating in English.</li> <li>· To show research findings and to hone the skills of writing papers and making presentations, students publish their research outcomes to a domestic or overseas peer-reviewed journal or an international peer-reviewed conference.</li> <li>· "Research Internship I/II", through which students are engaged in research work at a company, university, research institute, etc., gives students opportunities to gain research experience from different environments while improving their communications skills, etc.</li> <li>· "Internship in Cross-disciplinary Laboratories I/II", through which students are engaged in research work at a company, university, research institute, etc. in the areas of science and technology that are different from the area of expertise of each student, fleshes out the knowledge of different areas and improves communication skills, etc.</li> </ul>
Evaluation of learning outcomes	<ul style="list-style-type: none"> <li>· Learning outcomes are evaluated based on the "achievement evaluation sheet".</li> <li>· At the end of the first and second years, students check the achievement evaluation sheet together with supervisors to check the achievements at that point of time.</li> <li>· In the required subjects "Research in Computer Science" and "Computer Science Seminar A", students have their research progress checked by supervisors.</li> <li>· In "Computer Science Seminar B", each student makes a mid-term presentation of their research and receives evaluation.</li> <li>· In the final exam, the achievements are examined in accordance with the separately defined final thesis examination criteria, and the review board checks the achievement evaluation sheet.</li> </ul>

#### Admission Policy

Desired students	<p>The Doctoral Program in Computer Science widely seeks candidates from inside and outside Japan. The candidates should possess the specialized knowledge and engineering skills in the areas of information science, and have a great interest in any of the problem realms in engineering science and a keen desire to gain the specialized knowledge, engineering skills, specialized research and development abilities and practical abilities.</p>
Selection policy	<ul style="list-style-type: none"> <li>· To accept outstanding and diverse human resources inside and outside Tsukuba, candidates are solicited through multiple entrance exam channels including internal assessment selection, general entrance exam and special selection of working students at different timings and different numbers of students admitted.</li> <li>· Irrespective of the type of entrance exam, an oral exam is mandatory.</li> <li>· The internal assessment selection selects those who are expected to complete the Master's Program in Computer Science and who possess high fundamental abilities and academic research abilities.</li> <li>· In the general entrance exam, the potential students to be selected out must possess certain fundamental abilities and research abilities.</li> <li>· The special selection for working students evaluates the achievements and experiences as an adult member of society in addition to fundamental abilities and academic research abilities.</li> </ul>