Graduate School / Faculty of

Information Science and Electrical Engineering

ISEE Kyushu University

2020·2021

isee

Information Science and Electrical Engineering
Kyushu University

CONTENTS

I & E Technologies Realize the Advanced Information Society

The Graduate School of Information Science and Electrical Engineering (ISEE) was established in 1996 offering both information science (I) and electrical/electronics (E) technology as the basis for a modern advanced information society. In 2000, the graduate school was reorganized and divided into the Graduate School (the education body) and the Faculty (the research body). This new two-body system provides flexibility in adaptation to new demands.

ISEE has been working in collaboration and cooperation with other new graduate schools such as the Graduate School of Systems Life Sciences and the Graduate School of Integrated Frontier Sciences. ISEE also provides leadership over a broad range of innovative research areas and maintains various research institutes and centers such as the Education and Research Center for Mathematical and Data Science, the Research and Development Center for Five-Sense Devices, the System LSI Research Center, the Research Institute of Superconductor Science and Systems, the Center of Plasma Nano-Interface Engineering.

ISEE has a double degree program with E-JUST (Egypt-Japan University of Science and Technology) involving close and active exchange and collaboration between students and researchers. ISEE has many other international education and research partners such as University of Toulouse, the German Research Center for Artificial Intelligence, Indian Institutes of Technology, and so on. ISEE encourages graduate students to study abroad under the global course and support programs.

The Graduate School and Faculty of ISEE aim to contribute to the realization of a safe and secure society by utilizing I & E technologies, and to cultivate high expertise, superior research and development ability, and international outlook in the next generation of researchers and engineers.

Distinguished Professor
Dean of Faculty and Graduate School of
 Information Science and Electrical Engineering
Masaharu Shiratani, Dr. Eng.

Overview

The Aims of the Graduate School of Information Science and Electrical Engineering

Information science as an academic discipline has become as important as physics and mathematics to the basic methodologies of science. The progress of information science, especially the increased applicability of Information and Communications Technology (ICT), has not only raised the productivity of the entire industrial field but has also brought great changes to our economy, society, and culture.

The discipline of electrical engineering has a long history and embraces a wide variety of industrial fields. It has produced highly functional, complicated, and large-scale electrical and electronic systems which provide the basis for many kinds of information and social systems. Therefore, it is expected that the fields of electrical and electronic engineering will develop in close cooperation with information science. In order to meet this expectation, the Graduate School of Information Science and Electrical Engineering cultivates researchers and engineers of the next generation in the field of information and electricity-electronics (*i & e*), who have advanced research ability and a broad range of expertise.
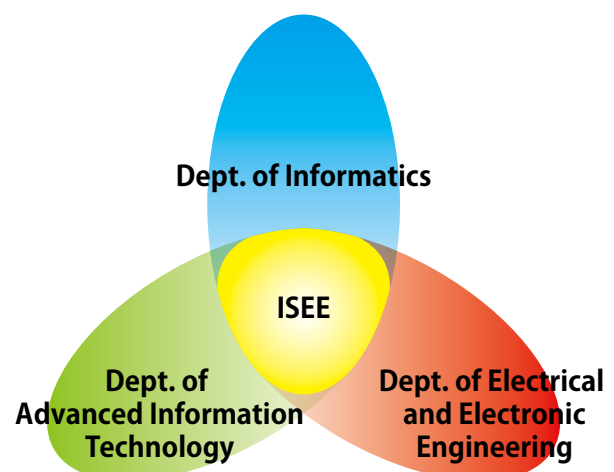
The Structure of the Graduate School of Information Science and Electrical Engineering

The Graduate School of Information Science and Electrical Engineering (ISEE) consists of the following three departments joined for the purpose of achieving the goal mentioned above:
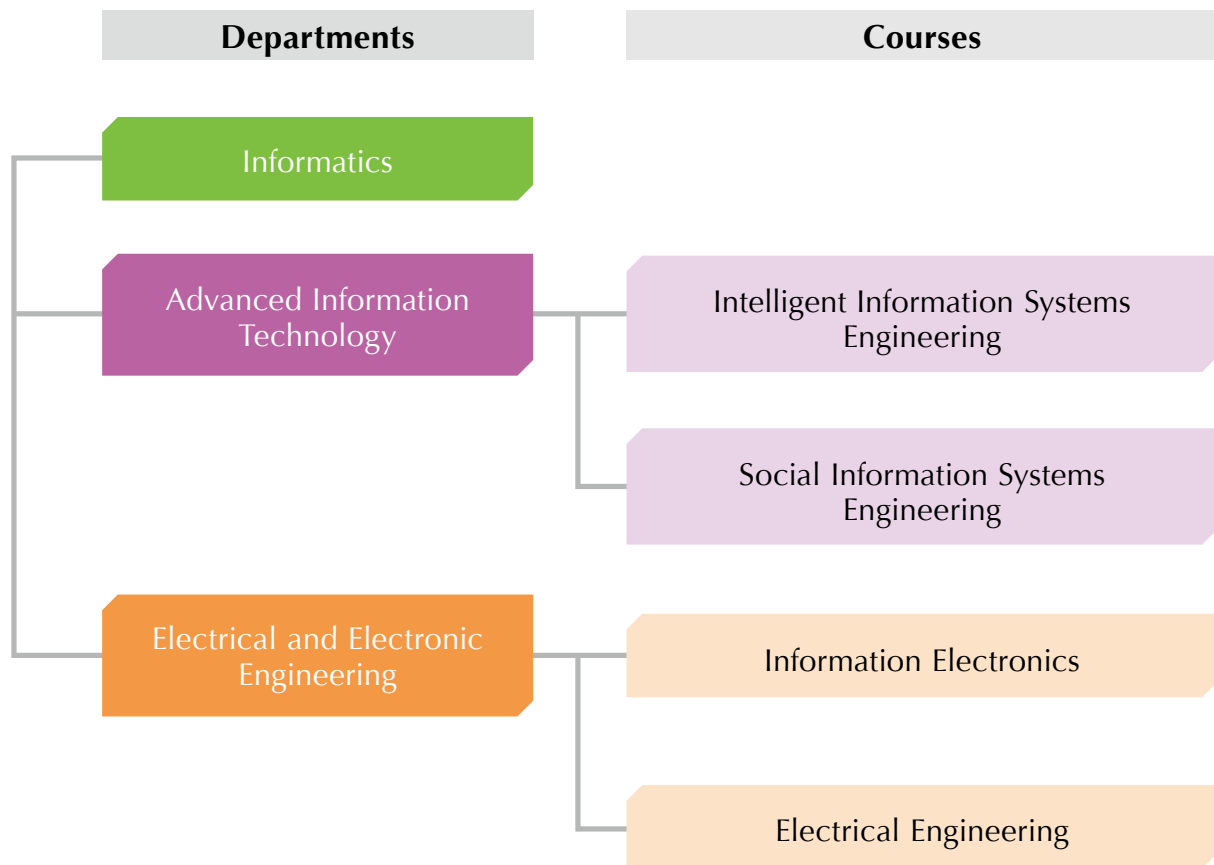
● **The Department of Informatics** facilitates the study of Information Science from the perspective of the theoretical foundations of the sciences and the tools of science to provide us with a deeper understanding of "information."

● **The Department of Advanced Information Technology** aims to create sophisticated systems designed to support a variety of human social activities by combining computer engineering, communications technology and real-world information processing. To provide effective education for acquisition of expertise in this field, the department offers two separate courses of study: the Social Information Systems Engineering Course and the Intelligent Information Systems Engineering Course.

● **The Department of Electrical and Electronic Engineering** aims to construct the bases of the industrial and social systems for the advanced information society by combining electrical, electronic and communications engineering. The department offers two courses of study: the Information Electronics Course and the Electrical Engineering Course.

These three departments cooperate with one another to conduct comprehensive educational programs ranging from the fundamentals to the applications of our new academic discipline, Information Science and Electrical Engineering. Following Kyushu University's strategic scheme for University Reform and Activation, the ISEE founded the following two independent Departments: Department of Giga Photon Next GLP in 2011 and Department of I & E Visionaries in 2012.

Departments and Their Quota of Students

Departments	Courses
Informatics	
Advanced Information Technology	Intelligent Information Systems Engineering
	Social Information Systems Engineering
Electrical and Electronic Engineering	Information Electronics
	Electrical Engineering

Quota of Students

Departments	Doctoral Course	Master's Course
Department of Informatics	14	40
Department of Advanced Information Technology (Intelligent Information Systems Engineering Course) (Social Information Systems Engineering Course)	15	45 (25) (20)
Department of Electrical and Electronic Engineering (Information Electronics Course) (Electrical Engineering Course)	16	55 (27) (28)
Total	45	140

Department of Informatics

"Information" is the foundation of the human intellect and sensibilities and plays a central role in natural and artificial systems. Informatics is the study of "information" from the viewpoint of the foundations of sciences. Through systematic education and research in this new fundamental science and by supporting not only science and engineering but also the humanities from the viewpoint of informatics, the Department of Informatics aims to nurture researchers and engineers who have advanced expertise and are capable of contributing to the information society.

For the achievement of this goal, the department comprises three divisions: The Division of Mathematical Informatics, the Division of Intelligence Science, and the Division of Computational Science. The Division of Mathematical Informatics offers studies in the field of Informatics, especially regarding the construction and analysis of mathematical models related to information. The Division of Intelligence Science offers studies in cognitive science as well as the fundamental theories of information theory and their applications to intelligent systems, with an aim to exploring the principles of human intellectual information processing. The Division of Computational Science (operating in cooperation with the Research Institute for Information Technology at Kyushu University) offers studies of the foundations of computational science that span the field of simulation.

Informatics is an emerging synthetic science concerning information which encompasses traditional information science and those fields of the humanities with foundations in information science. Within these divisions, the department aims to explore new methodologies and perspectives in informatics and establish the basis for creative development of informatics.

Department of Advanced Information Technology

Department of Advanced Information Technology

The Department of Advanced Information Technology investigates computer technology, information and communications technology, and real-time information processing technology for the realization of an advanced information society.

The divisions in this department are: Advanced Information and Communications Technology, Advanced Software Engineering, Real World Robotics, Advanced Distributed Processing Systems, Information Communication Engineering (E-JUST), and Practical Embedded Software Development Engineering.

The Department of Advanced Information Technology offers two courses with different curriculum policies: The Intelligent Information Systems Engineering Course and the Social Information Systems Engineering Course.

(1) Intelligent Information Systems Engineering Course
The aim of the Intelligent Information Systems Engineering Course is to provide graduates who can research and develop frontier technologies for the advanced information society. To this purpose, the course covers a broad spectrum of knowledge and skills relating to hardware, software, communications technology, and real-time information processing.

(2) Social Information Systems Engineering Course
The aim of the Social Information Systems Engineering Course is to provide graduates who can carry out practical projects for developing (namely, planning, designing, building, and managing) various advanced information systems. To this goal, the course fully utilizes project-based learning (PBL).

Department of Electrical and Electronic Engineering

The Department of Electrical and Electronic Engineering offers education programs which help students to systematically understand the basics and acquire advanced knowledge of electrical engineering, electronics and communications technology. The purpose of this department is to provide education aimed at enabling research engineers to create new values for the future based on the certain knowledge of information and communications technology and electrical systems. These would be, for example, an engineer who creates a low energy consuming electrical system that contributes to a solution to the global warming issue or an engineer who creates new information technology-based social systems that provide safety and comfort for human life. To enhance this goal, the department offers the following two educational courses:

(1) Information Electronics Course
This course is designed to prepare the researchers and highly skilled engineers who will create the next generation electronics and new applications and those who will contribute to sustainable growth of the electronics related industry through research and development of advanced electronic devices and integrated electronics. This program is managed by the faculty members of the Department of Electronics and I&E Visionaries, Faculty of Information Science and Electrical Engineering.

(2) Electrical Engineering Course
The field of electrical and electronic systems based on electromagnetic phenomena is the key technology fundamental to the support of our society and its infrastructure. Nowadays, the field is rapidly advancing and diversifying its applications by merging with splendid high technologies including superconductivity, information and control technologies based on a new paradigm, and digital technologies focused on advanced intelligent systems. The department is composed of four divisions: Measurement and Control Engineering, Applied Energy Engineering, Superconductive Systems Engineering, and Energy and Environment. With reference to the above, the department offers advanced education and research programs in each division, not only for Master's and Doctoral course students but also for professional engineering trainees entrusted by industries and foreign countries.

Department of I&E Visionaries

I&E Quantum Computer Science and Technology Group

We make the theoretical study on the physical, engineering problems arising from the control of qubits in quantum computing and quantum sensing. Regarding quantum computation: we study the mathematical structure of several quantum information devices. For instance, the (artificial) 2-level atom controlled with light or microwave is among them. We also make the theoretical research on the modeling of the system of the part from the low phases of quantum compiler to the quantum architecture. Regarding quantum sensing: we study on the computer-control technology such as the control technology of the NVC sensor and the noise-filtering technology to detect faint quantum information buried in several noises. We uphold this theme in the development of the measurement device with the quantum sensor. We aim for implementation of the computer-control technology in the measurement device.
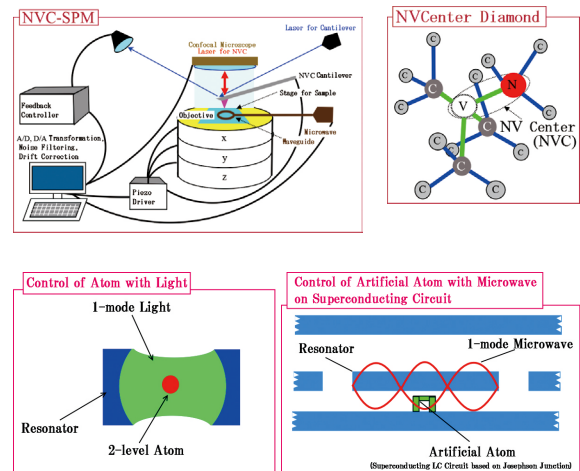
I&E Analog LSI & System Group

Demand of a reliable high speed wireless technology that transfers the data/information economically at low power has been increasing faster than ever. This is inherent not only of next generation smart phones/iPhones but also to realize the Cyber Physical Systems (CPS) and Internet of things (IoT)) where semiconductor or LSI technology plays a vital role in the hardware design for the interface between physical and cyber layers. To counter this scenario, we have been investigating the possibility of a paradigm shift from a battery-inherent to a battery-free wireless and embedded sensor system. The fundamental techniques include the development of the ultra-low power and low voltage analog/high frequency integrated circuits in CMOS technology, and on the other hand, efforts are going to apply the carrier frequency (of a cell phone) to transfer not only the signal/data but also the power to realize a wire/battery-free and self-powered system to replace the conventional batteries in the future wireless and embedded sensor systems.
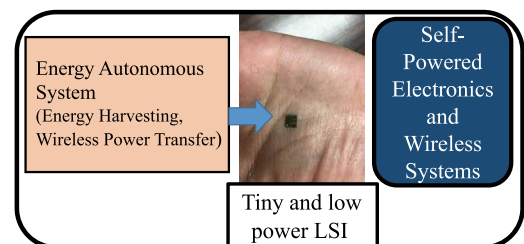
I&E Excitonics Research Group

We are developing a new class of transistor "exciton transistor (EXOT)" with a new semiconducting material, $(ZnO)_x(InN)_{1-x}$. Exciton - an electrically neutral quasiparticle- is a bound state of an electron-hole pair attracted by the electrostatic Coulomb force. The most interesting feature of an exciton is that it can be generated by and converted back into a photon within a short time. Thus, EXOTs bring great improvements to the speed of electronic–optical (E/O) conversion along with significant miniaturizations of E/O converters. They will replace electric wiring on computer chips with optics, and lead to high-performance and low-power-consuming data processors!

Trevor Johnston, University of Toronto
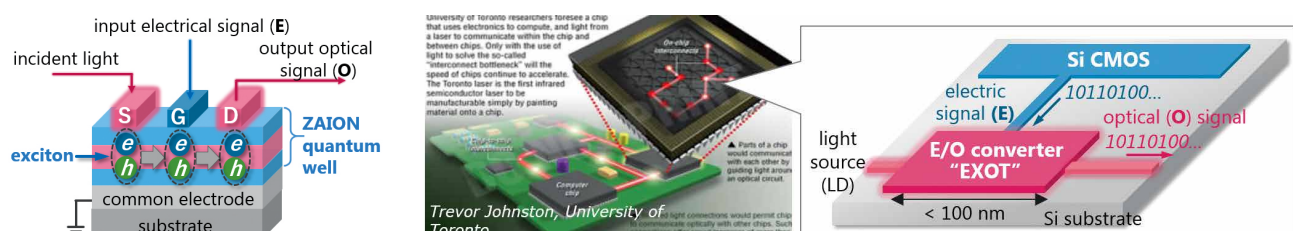
Courses and Subjects of ISEE

The Curriculum Outline of the Graduate School of Information Science and Electrical Engineering

The social and industrial communities point to the scarcity of information and hardware engineers supporting information systems. The primary objective of the present curriculum revision is to cope with this shortage. Social demands for the educational programs of ISEE can be summarized as follows:

1. Requirements for advanced informatics education to cope with the rapid advancement of science related to information technology due to worldwide networking.
   ○ Education of researchers and engineers who support technological schemes concerned with contents structuralizing from information.
   ○ Education of researchers and engineers who support the theoretical backbone of information technology.

2. Requirements for ICT specialists, particularly leading researchers and engineers, triggered by infiltration of the social information foundation.
   ○ Education of researchers and engineers who support the infrastructure basis of the advanced information system.
   ○ Education of researchers and engineers who support an advanced information foundation to enhance awareness of interference with the real world, including real-world information processing.

3. Requirements for education accommodating to technological revolution and extending interdisciplinary research in the field of electrical engineering.
   ○ Education of researchers and engineers who support the physical layer of information and energy.
   ○ Education of researchers and engineers who support the interdisciplinary area between the information system and the electrical system.

Education in the graduate school of ISEE is conducted by three departments corresponding to the above subjects. Additional courses, according to the field specialty and the educational method, are established in the department to clarify the details of educational contents. Establishment of the courses enables us to educate a wide variety of engineers to satisfy future industrial needs without reorganization of the department. Fundamental ideas of the curriculum for the Master's and Doctoral courses are as follows:

Characteristic Education Methods

(a) An advisory committee is organized to provide each student with close personalized guidance (Doctoral Program).

(b) Real PBL (Project-Based Learning) is introduced for practical education.

(c) Collaboration with industries is established for nurturing leading ICT engineers and introducing leading-edge technologies to the Master's Program.

(d) Practical English education is provided through lectures in English and international PBL.

(e) A long-term Internship program is introduced in collaboration with industries.

(f) Lectures and guidance in PBL are given by engineers who are active at the forefront of Industry.

(g) Subjects on intellectual property management, entrepreneurship, and engineering ethics are available as graduate school common subjects.
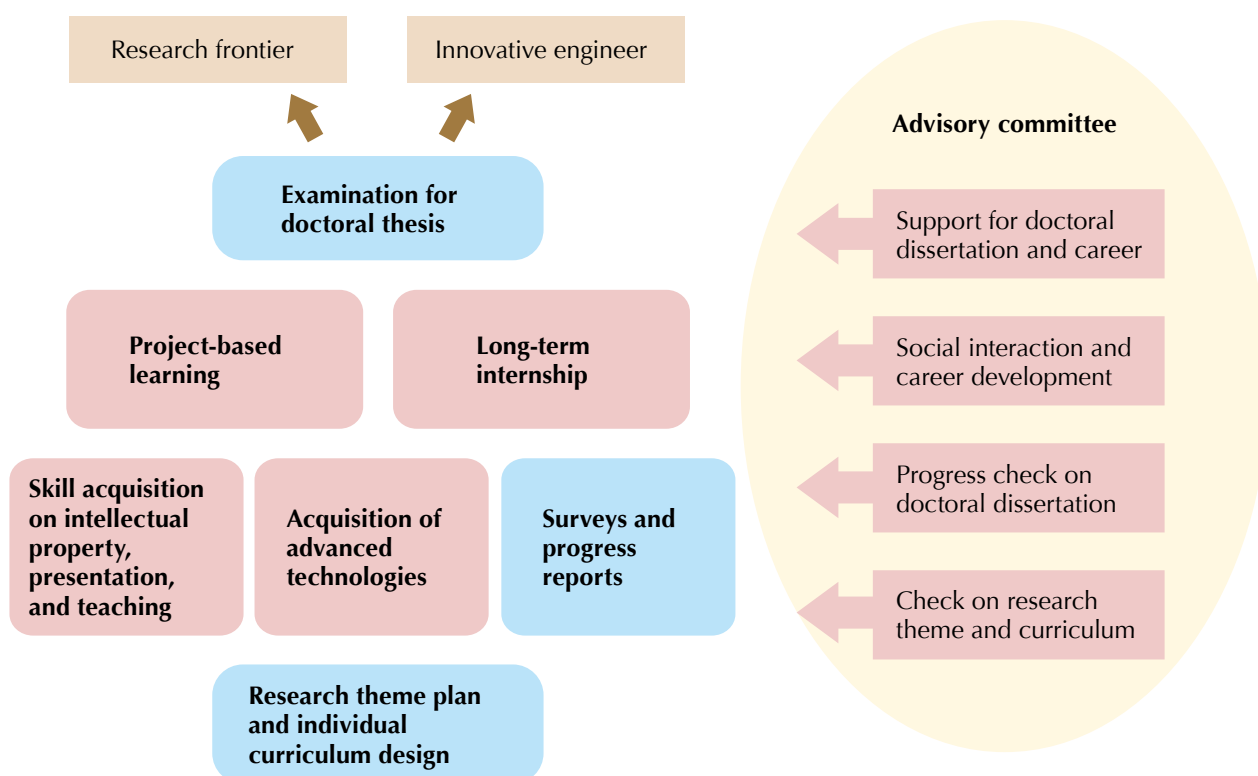
(h) Practical education on safety and ethics is

provided through exercises and experiments.

(i) Collaboration with the Graduate School of Systems Life Sciences is established.

(j) Collaboration with the Graduate School of Mathematics is established to enhance education in mathematics.

(k) Collaboration with the Graduate School of Integrated Frontier Sciences is established to explore new interdisciplinary fields.

Curriculum for Doctoral Course Students

ISEE will organize an advisory committee for each doctoral course student. The advisory committee is composed of several faculty members of ISEE and specialists from companies, universities, and other organizations. The committee first designs an individual curriculum according to the research theme of the student, then checks his/her progress periodically and suggests appropriate direction. The committee will also offer advice on possible career paths. The curriculum offers opportunities to learn intellectual property and teaching skills and to serve in authorized long-term internships.

Research frontier

Innovative engineer

Examination for doctoral thesis

Project-based learning

Long-term internship

Skill acquisition on intellectual property, presentation, and teaching

Acquisition of advanced technologies

Surveys and progress reports

Research theme plan and individual curriculum design

Advisory committee

Support for doctoral dissertation and career

Social interaction and career development

Progress check on doctoral dissertation

Check on research theme and curriculum

Curriculum for doctoral course students

Admissions for International Students

Graduate Programs:

Master's Program

The practical education system established for the Master's Program emphasizes experiments, exercises, discussion, and course work. To develop interdisciplinary intellectual power, each student should select one extended area and take classes from the designated extended subjects in addition to those for his/her major field. Minimum required credits are 45.
The completion of a thesis is also required. A two-year program is standard.

Ph. D. Program

Students enrolled in the doctoral course can concentrate on their own research. To support the progress of their research, ISEE will organize an advisory committee for each student composed of several faculty members and specialists from companies, universities, and other organizations. The curriculum offers opportunities to learn intellectual property and teaching skills and to serve in authorized long-term internships. It typically takes three years to complete the program though students can shorten the period depending on their research achievements.

The Global Course:

ISEE opens the Global Course to master's and doctoral students. Students who select this course at the time of entrance can complete their course in English.

Job Opportunities:

There are many job offers for the graduates of ISEE from companies across a wide range of industries in Japan. Ph. D. students can find research positions not only in companies but also in national institutes and universities. The following is a partial list of organizations where *foreign students* have found jobs over the last four years: Asahi Kasei, Buffalo, Daikin, Denso, DNP, Fujitsu, Hitachi, Ibiden, KDDI, Kubota, Kyocera, Mitsubishi, NEC, Nichicon, Nifty, Nikon, Nissan, NTT, Omron, Renesas, SEI, TMEIC, Toshiba Solutions, Ulvac, Yahoo, and others.

Admission:

Master's Program

The time of entrance is April and October. Entrance examinations for foreign students are scheduled for August of the previous year and late January. Those who wish to enter should pass either one.

Ph. D. Program

The program begins in April and October with selection scheduled for late February and late July, respectively. Visit website for details.

Students Enrollment (As of April 2018)

Departments	Department of Informatics	Department of Advanced Information Technology	Department of Electrical and Electronic Engineering	Total
Quota	40	45	55	140
General Selection	44(1)	50(5)	71(1)	165(7)
Special Selection (Grade-skipping)	1	0	0	1
Special Selection for International Students	10	9	13	32
Total	55(11)	59(14)	84(14)	198(39)

( ) Shows the number of international students included in the totals

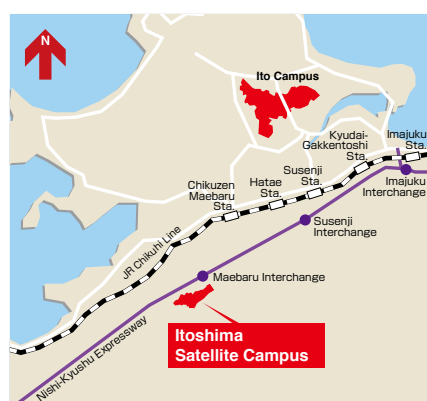## Doctoral Program (October 2017 Enrollment, April 2018 Enrollment)

Departments		Department of Informatics	Department of Advanced Information Technology	Department of Electrical and Electronic Engineering	Total
Quota		14	15	16	45
October Enrollment	General Selection	3(2)	3(3)	5(5)	11(10)
October Enrollment	Special Selection for Working Adults	1	1	0	2
April Enrollment	General Selection	4(3)	6(5)	2(2)	12(10)
April Enrollment	Special Selection for Working Adults	2	0	1	3
Total		10(5)	10(8)	8(7)	28(20)

( ) shows the number of international students included in the totals

International Student Enrollment (As of May 1, 2018)

Country	Department of Informatics	Department of Advanced Information Technology	Department of Electrical and Electronic Engineering	Total
India			1	1
Indonesia	2	2	2	6
Egypt		1	3	4
Australia		1		1
Korea	3	3	2	8
Kenya		1		1
Zimbabwe			1	1
Thailand			1	1
Taiwan	1		1	2
China	23	24	39	86
Germany	1			1
Tunisia		2		2
Nepal			2	2
Palestine		1		1
Bangladesh	1	4	1	6
Philippines			1	1
Brazil		1		1
Malaysia			1	1
Myanmar	2			2
Mongolia		1		1
Laos		1		1
Total	33	42	55	130

MAPS

Ito Campus

Ito Campus

Itoshima Satellite Campus

The Graduate School / Faculty of Information Science and Electrical Engineering moved to the new Ito Campus in 2006. The Graduate School / Faculty of Information Science and Electrical Engineering, the System LSI Research Center have a satellite campus in the Momochi area, where IT industries accumulate. The System LSI Research Center also opened a satellite campus in Itoshima area in May 2011 in accordance with the establishment of Experimental Center for Social System Technologies, which is managed by Fukuoka Prefecture.

Graduate School / Faculty of Information Science and Electrical Engineering Kyushu University

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- Office of the Department of Electrical and Electronic Engineering
  Tel: +81-92-802-3701
- Graduate School / Faculty of Information Science and Electrical Engineering
  Fax: +81-92-802-3600
- Educational office of the Department of Electrical Engineering and Computer Science
  Tel: +81-92-802-3711 Fax: +81-92-802-3710

Momochi Satellite Campus: Fukuoka Institute of System LSI Design Industry 3F, 3-8-33 Momochihama, Sawara-ku, Fukuoka 814-0001
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Itoshima Satellite Campus: Experimental Center for Social System Technologies, 1963-4 Higashi, Itoshima, Fukuoka 819-1122
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