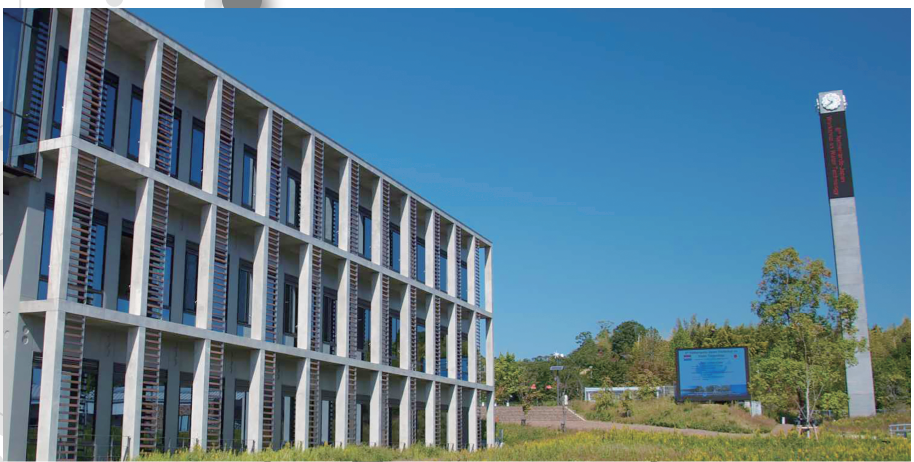
2020 KYOTO UNIVERSITY

Graduate School of Engineering
Faculty of Engineering Outline



1. Greetings from the Dean

Dean
Masahiro Ohshima

The recent pandemic of the Covid-19 virus has changed the world. It has changed our life style as well as our social system. We all have confronted a difficulty in balancing between society and individual, and we need to think outside of the box for a new way of life. Are we ready to step out of the norm and take on new challenges? What can we address as engineers or scientists for the new challenges? One thing clear is that we must not end up with mere critics.

"Engineering" has been playing great roles in the production of useful devices for society and the development of environmentally friendly technologies. The role will not change even in our new life. It is my conviction that the fundamental core of our graduate school of engineering is one example that keeps inspiring innovative minds under the spirit of academic freedom. I genuinely believe in the infinite possibilities among all faculty members, administrative staff, and students, at our school that will keep giving a positive impact on society in the future or even in the current situation. We will be carrying on the tradition of "academic freedom" and a noble spirit of building character through knowledge and appreciation of oneself expressed as "self-reliance and self-esteem".

Standing upon the tradition and the spirit, the Faculty of Engineering has an educational ideal of "placing emphasis on fundamentals and principles". This educational ideal has remained

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unchanged since our founding in 1897. In other words, we put the importance on the ability to capture the things from their fundamentals by starting with simple questions like “why does such a phenomenon occur and what basic principle is behind”. This is because we believe that real innovation, unique ideas, and advancements in technology come true only after capturing the fundamental and searching the truth or principle behind the matters. We think that this ability is necessary for our graduates to contribute to our society in the future. I hope you our educational ideal could be understood from the fact that three of Japanese Nobel laureates, Professors Fukui, Noyori, and Dr. Yoshino are graduates of our Faculty.

Currently, we have 6 schools in undergraduate, and 17 departments and 8 centers in the Graduate School. You will find the information about those schools, departments, and centers not only in this brochure but also on the website. The information outlines how these schools’ specialized courses are arranged, what kind of curriculum these schools offer, and what kinds of research projects are pursued in both undergraduate and graduate schools. I would like all of you to use the information for making your selection of course and major and planning your future.

Learning through the research is very much different from what you had learned at the classes in high school and undergraduate ordinary classes, where you have solved the problems that have a correct answer. At the initial stage of the research, no one knows the answer. There might be more than one solution. Your research may find the new research directions that your mentor did not even think about. During the research, you may suffer from various difficulties. However, the more difficulty you have for pursuing the research, the more you would learn through the research. Also, the more difficult your research is the more pleasure you would experience when finding a solution or making a new discovery. I believe this is the essence of learning at the university.

To complete Covid-19, I believe, we have to advance our discipline and knowledge wider and deeper. We do not hesitate to go for it! You have infinite potentials. I would like you to cherish the potential, dream about your career path, learn and spend a rich students'life so as to make your ideal and dreams come true. I really hope that you will contribute to the future of our society when the times come. With a belie of the proverb “blue dye comes from the indigo and is bluer than indigo”, all of our faculty members have a dream of the appearance of the next generation who leads the Kyoto University as well as our society in the future.

Please take a look at this guidebook and learning about the academic culture and contributions to the society that our Engineering schools have made and expand your dreams and ideals.

2. Admission Policy

Faculty of Engineering

Admission Principles

The Faculty of Engineering is committed to building foundations for learning by following the Kyoto University tradition of academic freedom. By longstanding tradition, the university encourages students to explore the world for themselves, free from the influences of preconceived notions which demands a critical attitude toward learning. Under such a guiding principle, the Faculty of Engineering provides its engineering students with top quality engineering education for applying their basic understanding of scientific knowledge to the advancement of technology. Although Engineering is generally considered to be a discipline focused on the application of technology, our Faculty of Engineering emphasizes on the principle of fundamentals for learning based on its belief that a thorough understanding of scientific principles is essential for promoting future applications and advancement of technology on a broad scale.

Admission Policies and Procedures

The Faculty of Engineering welcomes applications from candidates with the following attributes to enroll our programs

1. Successful candidates with a thorough understanding of the subject matter from their secondary-school education and a level of academic ability adequate to the pursuit of an education in scientific fundamentals through the Faculty of Engineering program
2. Successful candidates unfettered by preconceived notions and prepared to understand the essential attributes of natural phenomena by rigorously identifying them firsthand, organizing the information and knowledge they have obtained, and thinking in logical terms.
3. Successful candidates with the foundational language proficiency and communication skills in order to develop the capacity to convey their own opinions and arguments clearly, in either Japanese or other languages.
4. Successful candidates overflowing with the enthusiasm and vitality to creatively pursue new horizons of technology and science.

When selecting candidates for admission, in addition to the examination by the Common Test for University Admissions, the Faculty of Engineering evaluates the results of university-specific examinations to understand each applicant's basic academic abilities in mathematics, science, English, and Japanese.
When assessing an application with a unique examination (Tokusyoku-Nyushi), the admission teams will identify applicants with outstanding academic capabilities in science and engineering in addition to the abovementioned basic academic abilities. Each Undergraduate School evaluates applicants in accordance with its-Admission Statements-based on (1) applicants' academic transcripts, (2) letters of recommendation, (3) records of outstanding performance in activities, (4) letters of intention (i.e. a proposal letter with a set of future goals for learning) learning design, (5) records of the Common Test for University Admissions, and (6) interviews results.

Graduate School of Engineering

Philosophy and Objectives

The pursuit of the truth is the essence of learning. Engineering is an academic field that impacts the lives of people, and is greatly responsible for the sustainability of social development and the formation of culture. The Graduate School of Engineering at Kyoto University, based on the above premise, is committed to the development of science and technology with an emphasis on disciplinary fundamentals and basic principles while harmonizing with the natural environment. At the same time, we aim to assist students in their pursuit of a rich education with specialized knowledge, as well as the ability for its creative application, while nurturing high ethical standards and sense of responsibility.

Student Profile of the Master's Course Program

The master's course program of the Graduate School of Engineering welcomes the following students:

○Individuals who agrees the philosophy and objectives of the Graduate School of Engineering and those who achieve these things actively.
○Individuals who have the basic education to pursue the truth and also have the judgment with logical thinking and beyond established concepts in specialized fields and related fields.
○Individuals who have a strong desire and initiative to pioneer new fields of science technology while integrating knowledge and keeping on solving, regarding the science technology and the social issues.
○Individuals with basic communication ability who understands other opinions and also express own opinions and assertions in an easy to understand.

Entrance examination will be performed individual academic exam, evaluate and select the applicants including English ability, with emphasis on the basic knowledge of specialized field and those who have logical thinking abilities. For details of evaluation methods, it is mentioned in the guidelines for applicants to Master's course program.

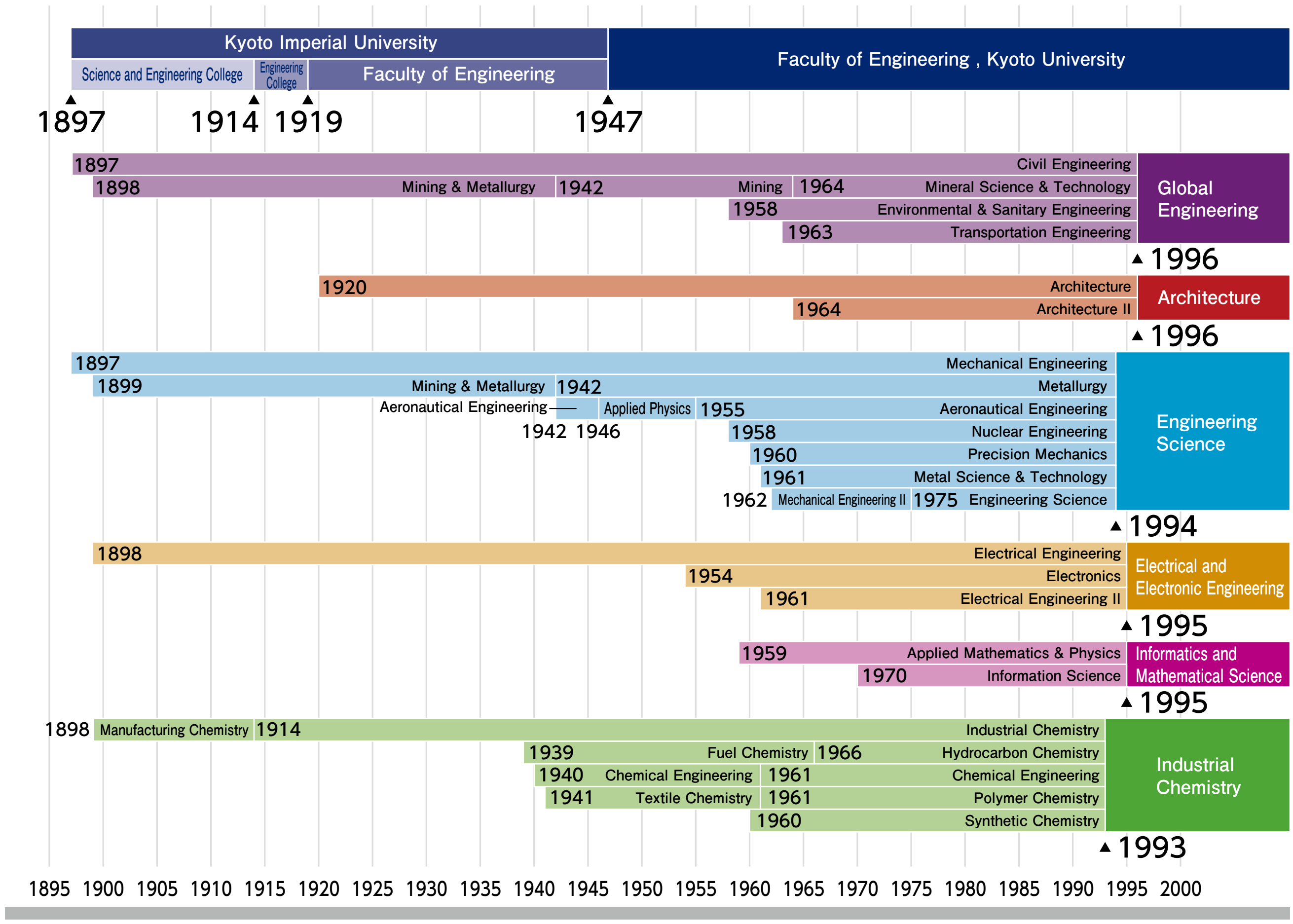
Student Profile of the Doctoral Course Program

The doctoral course program of the Graduate School of Engineering welcomes the following students:

○Individuals who agrees the philosophy and objectives of the Graduate School of Engineering and those who achieve these things actively.
○Individuals who have well-cultured education to pursue the truth and also have outstanding judgment with logical thinking and beyond established concepts in specialized fields and related fields .
○Individuals who have a strong desire and initiative to pioneer new fields of science technology while integrating well-cultured knowledge and keeping on solving, regarding the science technology and the social issues.
○Individuals with high communication ability who understands other opinions and also express own opinions and assertions in an easy to understand.

Entrance examination will be performed individual academic exam, evaluate and select the applicants including English ability, with emphasis on the basic knowledge of specialized field and those who have logical thinking abilities. In addition to the above mentioned points of view, by conducting oral exam, we will select applicants with advance on research and explanation ability logically. For details of evaluation methods, it is mentioned in the guidelines for applicants to Doctoral course program.

3. History



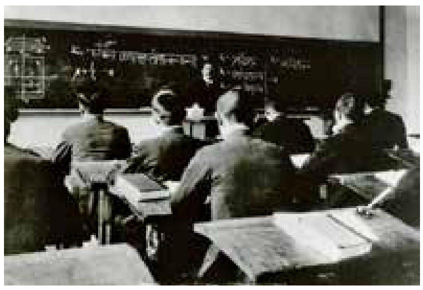
Kyoto Imperial University was founded in June 1897 and the College of Science and Engineering was established in September of the same year as the first of several colleges in a confederation of colleges comprising the university.

In July 1914, the College of Science and Engineering was split into the College of Science and the College of Engineering.

In February 1919, the system of a confederation of colleges evolved into a system of faculties, and the College of Engineering became the Faculty of Engineering.

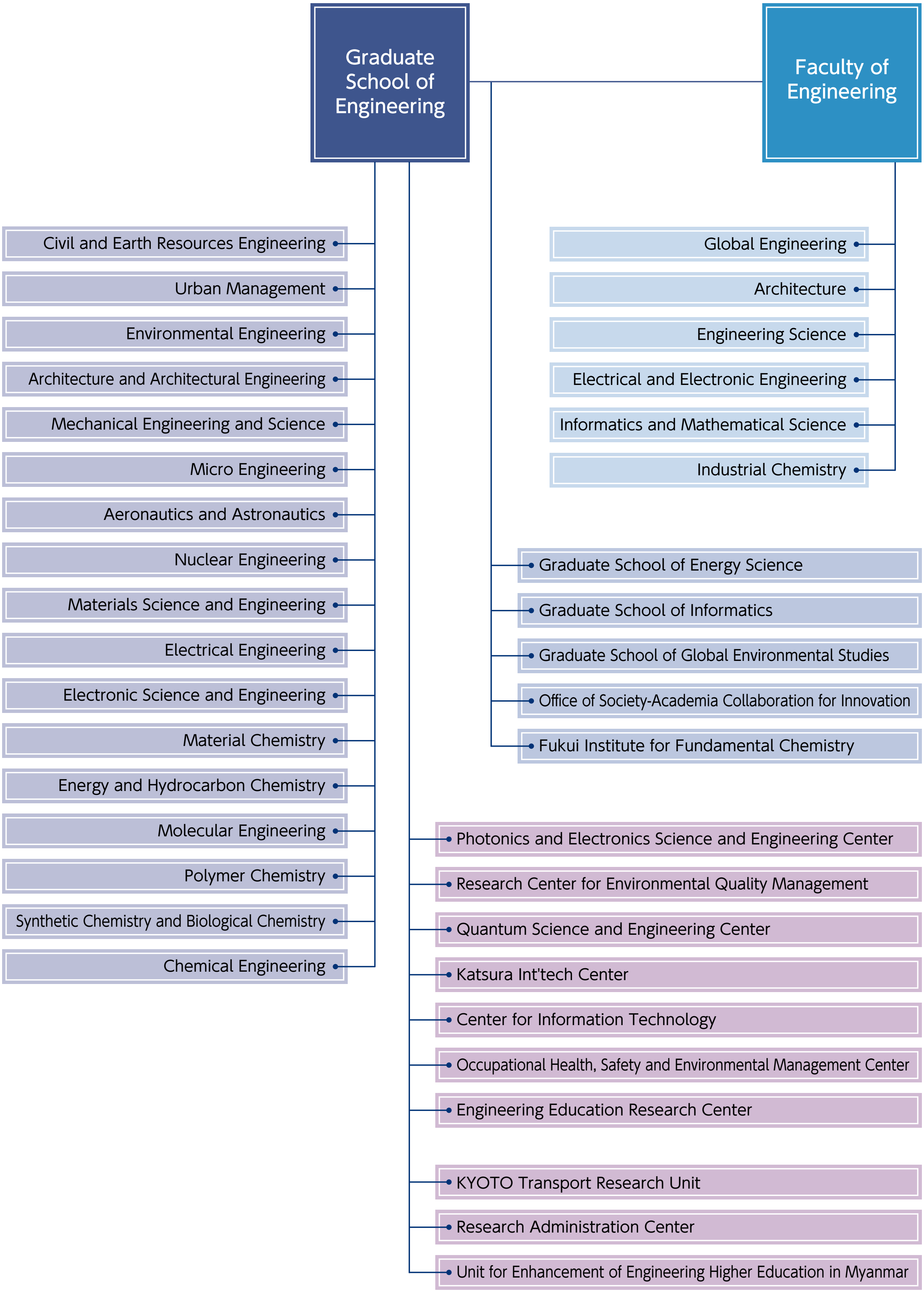
Since its establishment, the Faculty of Engineering has constantly sought to expand and develop in response to the academic and social demands of the times while sharing the same historical timeline as the university. It stands today as the university's largest faculty and is engaged in activities and initiatives that deal with almost all fields of engineering.

A program of restructuring undertaken by the Faculty of Engineering to reflect a greater focus on graduate schools resulted establishment of the School of Industrial Chemistry in 1993, the School of Engineering Sciences in 1994, the School of Electric Electronic Engineering and the School of Informatics and Mathematical Science in 1995, and the School of Global Engineering and School of Architecture in 1996, and heralded the launch of a new Faculty of Engineering for the twenty-first century.



Courtesy of Kyoto University Archives

4. Organization Chart



5. Faculty of Engineering

Undergraduate Schools

Global Engineering

Overview

The twentieth century can be characterized by a rapid increase in population, advances in industrial technologies, and mass consumption of natural resources, as well as emerging environmental problems. In the twenty-first century, we must develop solutions for our civilization by reconstructing and combining various fields of study based on new ideas on humanity and the environment – a new global image. We have proposed a "Global Engineering" as a practical science to establish a new discipline and to solve the emerging problems based on the new global image.

Curriculum

The first and second year students must enroll in Natural Sciences courses such as Math, Physics, Chemistry, Biology, and Earth Science from the shared curriculum as the basis for engineering. They must also choose Social Sciences subjects such as language study and humanities to gain a broad education. During the transition to the third year of undergraduate studies, the students, except the ones of international Course, will be separated into one of three groups: Civil Engineering Course, Environmental Engineering Course, and Earth Resources and Energy Engineering Course.

Courses

● Civil Engineering

Japanese Civil Engineers have successfully completed the many boastful projects to the world, such as the Kurobe Dam, Seikan Tunnel, Kansai Airport and Akashi Bridge, and realized the dream of people. Civil Engineering contributes to the maintenance and preservation of the infrastructure that is the basis of civilization as well as the creation of safe and pleasant communal spaces in the harmony with nature.

● Earth Resources and Energy Engineering

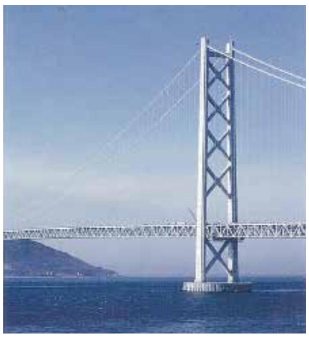
The Earth Resources and Energy Science bearing the investigation, development, production and purification of the natural resources must offer appropriate solutions to the problem of civilization crisis. We must contribute to the saving of mineral resources and energy resources, the recycling of them, and the other effective utilization, and also, it must contribute to the development of new resources as well as the development of innovative methods to utilize the Earth crust.

● Environmental Engineering

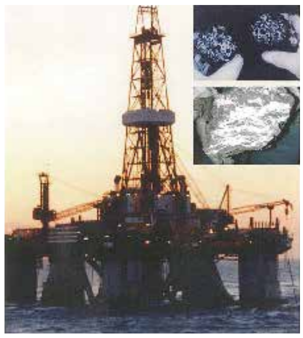
Our health and life are now being threatened by environmental problems in atmosphere, water and soil. Environmental problems are the serious problems that we must tackle for the existence of humankind in this century. Environmental Engineering also aims to produce a harmonious, symbiotic and sound material-cycle society from a long-term and broad-ranged perspective.

● International Course

The course will train the next generation of human resources who will design and manage civil infrastructure while considering global environmental issues and civil engineering problems on a global scale. We welcome students from all over the world whose interests are in global development issues as well as regional ones in their home countries, in particular, in Asia and Africa.



Akashi-Kaikyo Bridge



Research Consortium for Methane Hydrate Resources

Connection to the Graduate School

Undergraduate

School of Global Engineering

- **Graduate School of Engineering**
  - Dept. of Civil and Earth Resources Engineering
  - Dept. of Urban Management
  - Dept. of Environmental Engineering
- Graduate School of Energy Science
- Graduate School of Global Environmental Studies

Architecture

Overview

Architecture, which gives form to the human environment and nurtures safe, healthy and comfortable lives, emerges through the innovative synthesis of diverse technologies. The generation of architecture is conceived as a humane skill broadly and deeply rooted in every aspect in our life. For this distinctive feature of architecture, our curriculums have been arranged to help students simultaneously incorporate interdisciplinary knowledge from the natural, cultural and social sciences. Career prospects for our graduates are similarly diverse, and encompass various positions including architects, structural engineers, building services engineers, construction engineers, architectural administration officers, planners of various development projects, and other related professional executives.

Curriculum

The curriculum of the School of Architecture is divided into four fields: Planning and Design, Structural Engineering, Environmental Engineering, and Integrated Systems, each of which is structured according to its specific topics and methodologies.

Courses

● Planning and Design

Planning and Design comprise the field that clarifies spatial principles in the composition of housing, various other building types, and urban-regional spaces, as well as education and research on the theories and methodologies of architectural planning, urban planning, urban design, project management, and so on. Additionally, the planning and modeling skills necessary for spatial creation are nurtured through studying historical shifts in architecture.

● Structural Engineering

Structural Engineering is the study of the construction of enduring buildings that can also resist natural hazards such as earthquakes and typhoons. The progressive advancement of structural engineering technology makes it possible to realize superstructures such as super-tall skyscrapers, all-weather large-scale baseball stadiums, and so on. Additionally, this advancement implies the potential for further expansion of design theories, architectonic methods, and construction skills, as well as the opportunity to apply knowledge gained in the natural sciences.

● Environmental Engineering

Environmental Engineering is the study of how to implement comfortable environments and to reduce physiological and psychological impact on the human body in and around buildings, by improving physical environmental parameters such as heat, air, light, and sound. One recent concern is environmental safety, due to the increasing correlation between building and urban emissions and the global environmental crisis. We are now being challenged to solve various building and urban environmental issues and simultaneously to reduce environmental load by means of advanced simulation technologies. Our goal is to nurture solutions through the natural, cultural, and social sciences.

Connection to the Graduate School

Undergraduate

School of Architecture

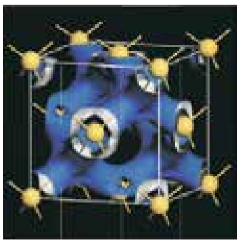
Graduate School of Engineering

• Dept. of Architecture and Architectural Engineering

Engineering Science

Overview

Engineering Science represents a creative, intellectual activity that aims at creating new technology conducive to making humanity's dreams come true, including developing new systems, materials and energy sources and expanding the sphere of human activities into outer space for the 21st century and beyond. Realizing such goals requires overcoming numerous technological challenges, while creating new technology is premised on a mastery of fundamental scholarship. The School of Engineering Science is a place of basic research and education dedicated to these ends.



Curriculum

The School of Engineering Science provides integrated education in its undergraduate course programs: Mechanical and Systems Engineering Course, Materials Science Course, Aeronautics and Astronautics Course, Applied Energy Engineering Course, and Nuclear Engineering Course.

Courses

Mechanical and Systems Engineering Course

Students in this course must acquire comprehensive knowledge concerning the analysis, design, control, and manufacturing of mechanical systems and their elements, based on fundamentals such as the mechanics of materials, fluid mechanics, thermodynamics, material science, mechanical dynamics, vibration theories, and control theories.

Materials Science Course

The students are expected to acquire fundamentals for understanding processing – structure - property relations in materials. The course works not only on converting natural substances into materials, but also on designing and learning to create the advanced materials that do not even exist in the natural world.

Aeronautics and Astronautics Course

Students are expected to acquire abilities that would allow them to work in a wide range of engineering fields, not limited to aerospace engineering, as well as the ability to further develop these fields acquired through undergraduate studies. Accordingly, this course places emphasis on basic scholarship centered on applied mathematics, dynamics and physics.

Applied Energy Engineering Course

The Applied Energy Engineering course offers educational and research opportunities to pursue a sustainable society and seek solution to energy problems by learning basic scientific theories and their engineering applications.

Nuclear Engineering Course

The Nuclear Engineering Course provides lectures and experiments concerning effective and safe use of nuclear energy and quantum beams, based on physics approach from a microscopic point of view. This Course aims to develop valuable human resources as researchers and engineers who acquire both microscopic and systematic approaches as a result of their studies and experience.

Connection to the Graduate School

Undergraduate
- School of Engineering Science

Graduate School of Engineering
- Group of Mechanical Engineering Departments
  - Dept. of Mechanical Engineering and Science
  - Dept. of Micro Engineering
  - Dept. of Aeronautics and Astronautics
- Dept. of Nuclear Engineering
- Dept. of Materials Science and Engineering

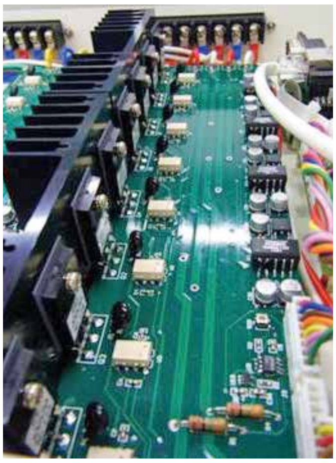
Graduate School of Energy Science

Graduate School of Informatics

Electrical and Electronic Engineering

Overview

Electrical and electronic engineering is a technology indispensable to the foundation of every industry and social life today. Examples are various electronic/information/communication systems that incorporate large-scale integrated circuits (LSI) and optical/semiconductor devices, and artificial intelligence and control systems that are programmed into home electronics, robots, automobiles, communications satellites, medical and welfare apparatus. In addition to technologies for securing efficient and stable electric power supply, technologies to improve the efficiency of electrical and electronic equipment and promote the harmonious coexistence between human and nature are of increasing importance.

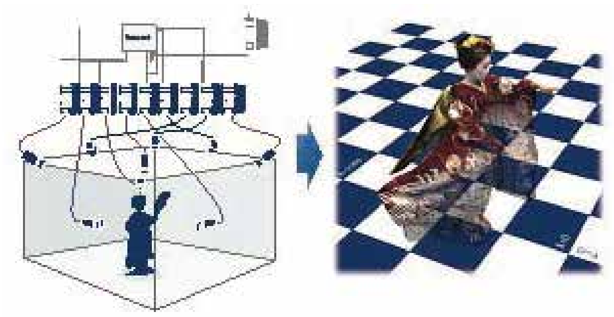


Antenna Array of Antarctic Syowa MST/IS Radar

Frequency Standard: “Optical-Frequency Comb”

Curriculum

As engineers and researchers, alumni and alumnae of our school have been playing prominent roles in the vast fields, such as energy, communications, informatics, electronic, system control, etc. This can be achieved by mastering a solid scientific foundation and by widening knowledge in the form that it can be applied to solve a broad range of issues. In our school, students learn basic subjects in their first and second undergraduate years and then select their areas of specialty to study in their third and fourth years. The core courses mandatory to all students include: mathematics, physics, electromagnetics, electric and electronic circuit, computer systems, and information processing. Laboratory experiments are systematically integrated into the curriculum from the second year in order to deepen the understanding of each subject. Through the four-year program, students also take liberal arts subjects, such as foreign languages and cultural/social science, to acquire profound and extensive knowledge and thinking.
After studying the above subjects, students in the fourth year engage in latest research topics that the faculty members and graduate students are deeply engaging in.



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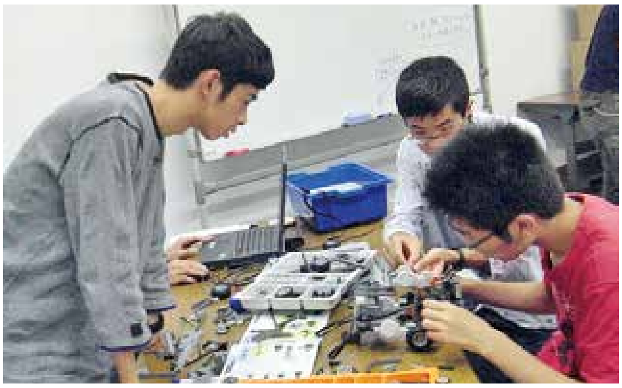


Students at Electronic Summer Camp:
Setting Up a Robot Controlled by a Micro-Computer

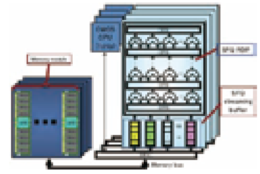
Connection to the Graduate School

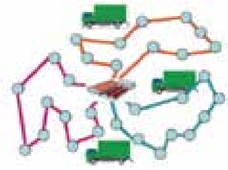
Undergraduate

School of Electrical and Electronic Engineering

- Graduate School of Engineering
- Graduate School of Energy Science
- Graduate School of Informatics

Informatics and Mathematical Science



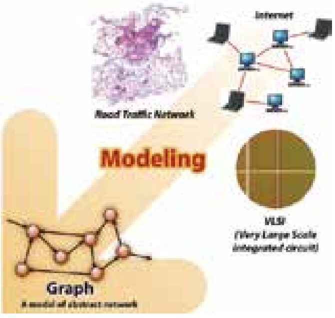


Overview

We provide comprehensive education and research, ranging from the basics to advanced fields, aiming at developing the people who pursue the essence of information, which is the foundation of advanced information society, and solve actual problems of sophisticated systems through the thinking of mathematical science.

Curriculum

Because information science is essentially related to many fields, the education policy of the School of Informatics and Mathematical Science places emphasis on providing students with a broad perspective. Students of this School are taught by the instructors of the Graduate School of Informatics and divided into the Computer Science Course and Applied Mathematics and Physics Course, usually at the end of the first academic year, for more specialized education.



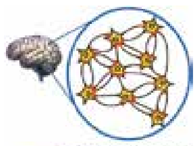
Courses

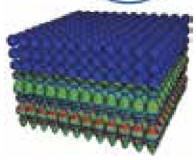
● Applied Mathematics and Physics Course

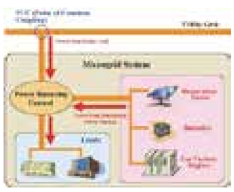
In the Applied Mathematics and Physics Course, students chiefly study mathematics and physics as the basis of mathematical science, control theory that is the basic field of systems engineering, and operations research that applies the methods of mathematical science, along with such fields as systems theory, optimization theory, and discrete mathematics. Of course the School curriculum includes classes to learn about computers, information and communications required to specifically apply the achievements of the study. Applied mathematics and physics is an academic discipline that plays the role of comprehensive engineering while placing emphasis on both the basics and advanced subjects for the development of engineering. This Course aims at developing the academic ability required to achieve this objective.

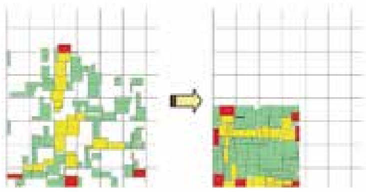
● Computer Science Course

The Computer Science Course offers educational and research opportunities concerning the processing, transmission and accumulation of information, pursuing the question: What is information? Students learn a wide variety of cutting-edge technologies, such as the theories of information and communications; theories of computation; design of logic circuits; design and analysis of algorithms; architectural principles of computer hardware and software and various techniques concerning them; processing of language, audio and image data by computers; artificial intelligence and knowledge engineering; computer networks; information systems and how to build them; and media processing and their various applications. Thus the Course intends to develop engineers and researchers who will play major roles in the information society.









Connection to the Graduate School

Undergraduate

School of Informatics and Mathematical Science

Graduate School of Engineering

- Dept. of Applied Mathematics and Physics
- Dept. of Systems Science
- Dept. of Advanced Mathematical Sciences
- Dept. of Intelligence Science and Technology
- Dept. of Social Informatics
- Dept. of Communications and Computer Engineering

Industrial Chemistry

Overview

The Department of Industrial Chemistry was founded in 1898, and the department branched out to form an additional four departments related to applied chemistry. In 1993, the five departments and one division were integrated into a single undergraduate school to provide a systematic, comprehensive four-year education. Thus, the undergraduate educational curriculum provides students with a broad range of chemistry-related subjects. Fourth-year student is assigned to one of the research laboratories of six departments and participates in the latest research, such as the synthesis of functional materials, application of biotechnology, and the design of environmentally benign production systems.

Curriculum

First-year students will learn the fundamentals of chemistry, physics and mathematics, in addition to the general subject requirements of Kyoto University. Second-year students will take specialized programs and will receive advanced education from the Department's faculty in the areas including physical chemistry, organic and inorganic chemistry, analytical chemistry, polymer chemistry and chemical process engineering. In continuation of the curriculum of the first year and a half, students will take courses related to their future specialization in the following three programs from the second semester of the second year. The student ratio of the three programs is 2:3:1. In the fourth year, students will become a member of a research laboratory and conduct specialized research for the completion of their thesis.

Programs

● Frontier Chemistry

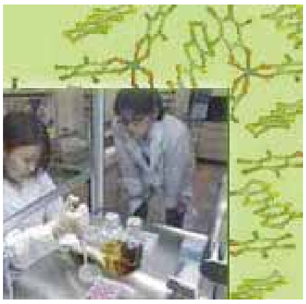
The Frontier Chemistry Undergraduate Program teaches young people the knowledge and spirit of creation, and aims to nurture the talent that will support chemistry and industry of the next generation. The Program will systematically educate students in the basic chemistry, knowledge of substances/materials, and in the newest trends of chemistry.

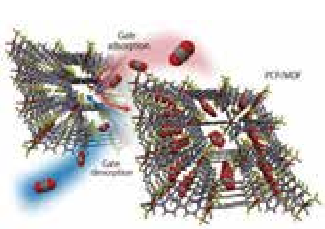
● Fundamental Chemistry

Students in this program learn the basic principles that govern chemical properties and reactivity, together with the necessary experimental techniques. Through this, students will gain an understanding of reactivity and properties on a molecular level, which in turn will let them solve challenging problems in diverse fields of chemistry.

● Chemical Process Engineering

This course program is designed to teach students the following three principle axes of investigation: 1) identify and extract the principal phenomena and variables from a targeted chemical process, 2) construct generalized models for their essential properties and dynamical characteristics, 3) design and implement a system that enhances the functional properties of the materials and the processes.





Molecular simulation for gas adsorption on PCP/MOF

Relationship with the Graduate School

Undergraduate
- School of Industrial Chemistry

Graduate School of Engineering
- Dept. of Material Chemistry
- Dept. of Energy and Hydrocarbon Chemistry
- Dept. of Molecular Engineering
- Dept. of Polymer Chemistry
- Dept. of Synthetic Chemistry and Biological Chemistry
- Dept. of Chemical Engineering

- Graduate School of Energy Science
- Graduate School of Global Environmental Studies

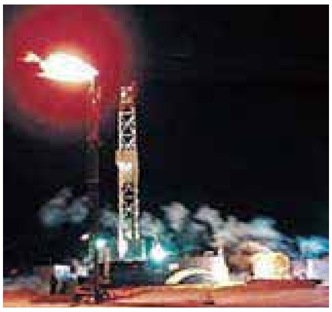
6. Graduate School of Engineering

Departments

- Civil and Earth Resources Engineering
- Urban Management
- Environmental Engineering
- Architecture and Architectural Engineering
- Mechanical Engineering and Science
- Micro Engineering
- Aeronautics and Astronautics
- Nuclear Engineering
- Materials Science and Engineering
- Electrical Engineering
- Electronic Science and Engineering
- Molecular Engineering
- Energy and Hydrocarbon Chemistry
- Molecular Engineering
- Polymer Chemistry
- Synthetic Chemistry and Biological Chemistry
- Chemical Engineering

Civil and Earth Resources Engineering

Overview



The Department of Civil and Earth Resources Engineering aims for technological innovations based on the inheritance, integration, and evolution of the fundamental technology for the development and maintenance of infrastructures, disaster prevention, and the exploration, development, and use of natural resources and energy. We endeavor to contribute from the standpoint of engineering science to establish sustainable development of society and the stable supply of natural resources in harmony with the environment.

Research

● Applied Mechanics

The main focus is on development of mechanical models that can elucidate laboratory tests or field observations, as well as development of numerical methods to predict behaviors of solids, fluids and their interactions. The research fields comprises of stability analysis of mechanical systems, computational fluid/structure dynamics and coastal wave dynamics.

● Structural Engineering

The research area covers a wide range of fields about civil structures, using various kinds of materials, such as concrete, steel, composite, FRP and so on. The safety of structures against environmental and natural actions is investigated in conjunction with structural deterioration, maintenance and health monitoring.

● Hydraulic Engineering

(Environmental Hydrodynamics): Air-water interaction, vegetation flows, CFD, floodplain hydraulics, urban flooding and measures, river basin management (Hydrology and Water Resources Research): The hydrologic cycle, hydrologic prediction, rainfall-runoff modeling, real-time hydrologic forecasting, hydrologic design, flood disaster mitigation, water resources management.

● Geomechanics

Geomaterials support all of the civil structures and environments as a ground. Our research activities focus deals on one hands with constitutive models for geomateials and on the other hand with the interaction between soil and structures through experiments and numerical analyses.

● Geoinformatics

Research and education are conducted on methodology for acquisition, processing, and utilization of spatial information for disaster prevention and environmental protection. In particular, we focus on satellite remote sensing, 3-D digital photogrammetry, laser surveying, and geographic information systems.

● Urban Infrastructure Design

Urban and landscape Design: This laboratory aims to study on the structure of the landscape based on landscape engineering, cultural climate analysis, and regional planning. Urban Coast Design: We aim for establishment of the methodology of computational science and engineering, to describe various phenomena in civil engineering by Lagrangian Particle Method.

● Earth Resources Engineering

The chair formed with three laboratories, “Geophysics”, “Earth Crust Engineering” and “Measurement and Evaluation Technology”, conducts researches to explore and develop natural resources, to evaluate the stability of underground artificial structures and to improve nondestructive testing methods.

● Disaster Prevention Engineering (Disaster Prevention Research Institute, DPRI)

The interdisciplinary research covers development of methodologies and engineering techniques for various disaster related aspects such as sediment control, coastal disaster, water front and marine geohazards, geotechnics, hydrosciences such as hydraulics and hydrometeorology, and innovative disaster prevention technology and policy.

● Computational Engineering (Academic Center for Computing and Media Studies, ACCMS)

Our research activities cover the following items: 1) modeling for multi-physics problems related to fluid mechanics, 2) development of computational methods based on FDM, FVM etc., 3) high-performance computing with parallelization methods and 4) application of the computational methods to actual engineering problems.

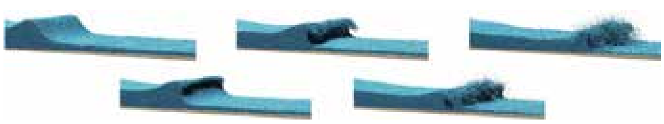
● Disaster Risk Management Engineering (West JR)

The goal of our research is to enhance the safety of large scale infrastructures such as road and railway systems by providing proper methodologies in risk management to prevent recent disasters occurring in larger, wider and longer scale than before.

● Innovative Techniques for Infrastructures (ITIL)

(NEXCO West, NEXCO West Engineering Kansai, Saginomiya Seisakusho, Tokai Technical Center, Core Institute of Technology, IPH Method Association)

To manage expressway infrastructures to be sustainable continuously while ageing of social capitals, the ITIL has been established in 2014 in collaboration with road companies. From 2020, several new organizations have joined in to introduce the developed innovative technologies to real maintenance scheme of infrastructures. The consortium of innovative technologies of infrastructures, organized in 2020, is also managed by ITIL.



Urban Management

Overview

Urban management is a comprehensive engineering discipline that aims at creating sustainable, safe, and internationally competitive urban systems that can serve as a base for creative human activities. The Department of Urban Management aims to promote knowledge for realizing safe, comfortable, and sustainable cities in which people can lead healthy and fulfilling lives. The department is ambitiously striving to construct state-of-the-art urban systems for advanced information societies, and to cultivate the human resources needed to support them.

Research

● Structures Management Engineering

It is important to maintain our infrastructures, keeping their performance and extending their service life, in order to enhance our social activities and to reduce negative impact on environmental. We are developing technologies for rational design, extending service life, strategic maintenance and management of infrastructures.

● Earthquake and Lifeline Engineering

A broad range of researches related to earthquake engineering is studied, from the estimation of strong ground motion, to the investigation of the mechanisms of structural damages and casualties. Our goal is effective earthquake risk reduction and development of effective mitigation measures.

● River System Engineering and Management

To resolve problems on water in river basins, we have been developing various kinds of computational models which predict river flows, sediment transport, water environmental issues and mechanical and hydromechanical behavior on subsurface.

● Geo-Management

The most important thing for the development of infrastructure is to ensure their safety quantitatively from the standpoint of mechanics at all steps, such as planning, design, construction and management. The focus of the research is put in the geological and geotechnical problems caused by construction as well as natural disasters.

● Urban Systems Planning

Chair of Urban Systems Planning consists of two laboratories. Planning and Management Systems focuses upon the economic and management issues related to infrastructure. Urban and Regional Planning focuses upon researches related to transport policy and urban policy, to improve cities's attractiveness and vitality.

● Urban Management Systems

In overcrowded urban areas, the developments of new infrastructures, such as railways, rapid transport systems, and energy facilities, is being adjusted in order to employ underground space. Underground space is useful as a solution for the geosequestration of by-products after energy generation. In order to develop new geofronts, the mechanical and hydro-mechanical properties of soils and rock are being studied and their application to tunnel and underground excavations, dam foundations, and slope stability is being researched based on the geotechnical engineering, rock mechanics, and fluid mechanics.

● Transportation Engineering and Management

These laboratories study various approaches to design transport networks that maximize benefit for society. Operational issues as well as the various impacts transport systems have on the well-being of a population are considered. This includes aspects such as resilience, safety, reliability, efficiency and wider community aspects.

● Earth Resource Sciences

This chair covers interdisciplinary researches about science and technology for Earth resources focusing on: distribution analyses of mineral, water and energy resources using remote sensing, and mathematical geology, and geochemistry; evaluation and recovery techniques for hydrocarbon and geothermal energy resources; and characterization of rocks and formations including physical properties and in-situ stress over various depths.

● Urban Regional Disaster Control (Disaster Prevention Research Institute, DPRI)

The interdisciplinary research covers development of methodologies and engineering techniques for natural, social and environmental disaster mitigation, hazard assessment and risk management to establish safe and sustainable urban systems, river and infrastructure.

● Environmental Infrastructure Engineering

The laboratory has developed special expertise to address geo-environmental issues, including soil and groundwater contamination, waste disposal and containment, and use of by-products in geotechnical applications.

Environmental Engineering

Overview

Science progress has brought in substantial prosperity to human beings. Meanwhile, under such circumstance, it is true that many environmental problems have occurred to become the menace to human health and life, and natural ecosystem. In addition, as is typified in global environmental issues like climate change, we are now facing global limits in terms of development. While our society is aging with various values, there still exists another society suffering from such problems as population explosion and unsatisfactory human safety assurance. Now is the time to endeavor overcoming such environmental issues unique to region, to integrally seek for a new sustainable development society.

To respond to the above demands, the Department of Environmental Engineering is promoting education and researches on various environments ranging from individual life space to regional and global environments, closely cooperating with related departments. Our specific missions are as follows: to provide solutions for overt/covert regional environmental issues, to secure the environment supporting health, to create sustainable global and regional environments, and to establish the new environmental science.

Research

● Water Supply, Wastewater Treatment, and Management of Aquatic Environment

Technologies on water include: development of advanced drinking water treatment systems, wastewater treatment technology including stormy events and recovery of nutrients and energy, water reuse technology and establishment of an urban water recycling system, water distribution networks, bioremediation of contaminated soil and groundwater. Risk issues on water include: evaluation of the safety of drinking water, risk assessment of toxic chemicals, management and control of contaminants in the environment, physico-chemical method to remove micropollutants in wastewaters, microbial water quality and control. Researches on water environment include: integrated watershed management, fate and source tracking of micro-pollutants and pathogens in the environment, water quality monitoring technology, assessment method of physiological activity due to emerging micropollutants.

● Environmental Modeling and Environmental Health

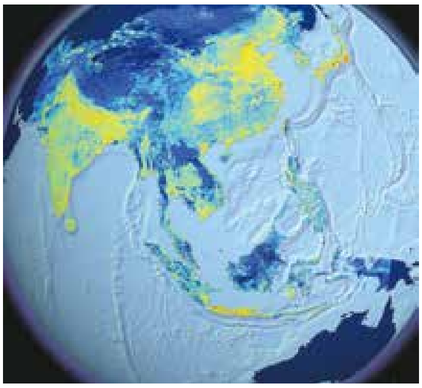
Human activities discharge a huge amount of pollutants and greenhouse gases into the environment, causing climate change, and adverse effects on human health and eco-system. This field includes: the development of integrated assessment models of environment and mainly to support policy making, analysis of long-range transport of air pollutants in the Asian region, the investigation of the detail mechanism of toxicity of environmental pollutants, epidemiology of environmental health effects.

● Solid Waste Management

Generation of solid waste is inevitable in our lives. Inappropriate treatment or disposal of solid waste will invite many problems such as bad odors, air pollution, water pollution, etc. Developing procedures to analyze, manage, design and control treatment and disposal systems for solid wastes, including 3R (reduce, reuse, recycle) is necessary in order to establish the sound material-cycle society. Our research topics are as follows, development of the technology about waste proper treatment, recycling and energy recovery, control of trace hazardous substances, and evaluation and optimization of waste treatment and management systems.

● Risk Analysis and Radiological Health Engineering

Health risks of various environmental pollutants, such as heavy metal, pesticides, and radioactivity accidentally released to the environment, are analyzed. Their movements in the environment are evaluated by monitoring and numerical simulation and their exposure levels to the people are estimated. Their toxicities are surveyed using epidemiological approach or state-of-the-art microbiological, genome and proteome analysis. Their management methods and final disposal methods are investigated and developed to establish safe and healthy environment. Radioactive waste management methods are also investigated.



CO_2 emission map in Asia

Development of new water treatment system

Field survey in oversea research site

Architecture & Architectural Engineering

Overview

Contemporary society demands highly complex functions from architectural design and urban planning. As well as the development of basic and advanced studies, this entails the connection and synthesis of specialized research fields reconsidered from the viewpoint of the relationships between natural and artificial environments. This department provides a higher education program that promotes both basic and advanced research in order to construct creative methodologies and operational systems, as well as training students to enhance their humanistic skills.

Research

● Regenerative Preservation of Built Environment
Design methods and regenerative preservation technologies for a sustainable built environment

● Architecture and Human Environmental Engineering
Design and science for architecture and living environments based on human cognition and behavior

● History of Architecture / History of Architecture
Aiming at the preservation, conservation, and revitalization of historical architecture and urban landscapes

● History of Architecture / Architectural Theory and Criticism
Analysis of theory and criticism in historical and contemporary architecture, and related fields such as art and technology

● Construction Technology of Building Structures
Toward high-performance and sophisticated concrete buildings

● Architectural Environmental Planning / Architectural Environmental Planning
Design methodology for reading and creating the built environment as a human-environment system

● Architectural Environmental Planning / Building Environment Control
Towards eco-friendly and human-oriented architecture that incorporates culture

● Architectural Design and Theory / Architectural Design and Theory
Exploring design theory based on architectural practice

● Architectural Design and Theory / Architectural and Environmental Design
Expanding the possibilities of architectural thinking

● Structural Engineering of Buildings / Mechanics of Building Structures
Study of response characteristics and development of design methods for building structures based on mechanics and numerical analysis

● Architectural Construction Engineering / Architecture System and Management
Development of mathematical methods for architecture design and restructuring of equitable systems for design, construction and management

● Architectural Construction Engineering / Space Development and Structural Systems
Development of design and construction techniques for the implementation of architectural spaces using steel structures

● Built Environment Materials and Structural Systems
Research on the application of new materials to architecture and building structural systems for the next generation

● Housing and Environmental Design
Research and design on the optimal relationships between people and the urban and rural residential environment

● Sustainable Built Environment Engineering
Control of environment and safety in buildings, built environment and urban spaces

● Architectural Environment Systems / Environmental Acoustics
Development of theory and technology for control of the acoustic environment

● Architectural Environment Systems / Building Geoenvironment Engineering
Toward design of safer and more robust building structures through innovative seismic-control technologies

● Disaster Mitigation Engineering / Earthquake Resistant Engineering
Development of disaster mitigation technologies through studies of earthquake response in ductile building structures

● Disaster Mitigation Engineering / Structural Safety Control
Research and development for the seismic safety control of buildings and subsequent construction of safe and secure urban spaces

● Disaster Mitigation Engineering / Architectural Wind Engineering
Development and innovation of architectural wind engineering for disaster reduction and comfort

● Space Safety Engineering / Earthquake Engineering for Seismic Safe Design of Structures
Understanding the nature of seismic action on structures to achieve a seismically safe environment

● Space Safety Engineering / Urban Disaster Reduction Planning
Cultivating a disaster-resilient society

● Global Environmental Architecture (Graduate School of Global Environmental Studies)
Environmental design and planning that may integrate local contexts

Group of Mechanical Engineering Departments

Mechanical Engineering and Science

Micro Engineering

Aeronautics and Astronautics

Overview

Mechanical engineering is a comprehensive discipline concerned with monozukuri (literally, "making things"), which serves as the foundation to support the development of a wide range of industrial fields.
The history of mechanical engineering studies at Kyoto University spans more than a century, dating back to a school of mechanical engineering established when the university was founded in 1897 as the Kyoto Imperial University. Through research and education that has constantly anticipated the evolution of society, the Department of Mechanical Engineering at Kyoto University has been at the center of engineering in Japan. In 2003, the department was designated a "Center of Excellence for Research and Education on Complex Functional Mechanical Systems," under the 21st Century COE Program of the Ministry of Education, Culture, Sports, Science and Technology, and we are promoting world-leading research through this project. In 2005, to respond comprehensively to the new demands of the era, the Departments of Mechanical Engineering, Engineering Physics and Mechanics, Precision Mechanics and Aeronautics and Astronautics were integrated to form the Group of Mechanical Engineering Departments. This initiative was aimed at establishing an enhanced system of research and education. The Department of Mechanical Engineering, which serves as the core of the Group of Mechanical Engineering Departments, implements research and education to provide a foundation for mechanical engineering, grounded in the physical sciences, with the aim of promoting future advances in engineering and technology. As a center for the promotion of new project-based research and education initiatives adapted to the demands of a changing world, the Group of Mechanical Engineering Departments includes the Departments of Micro Engineering and Aeronautics and Astronautics as part of an innovative system for meeting today's challenges in a flexible and focused way.

Mechanical Engineering and Science

Overview

Long ago, when humans began to walk upright, they carried tools in their hands. Tools served as extensions (instruments) of the human hand. Over time, tools evolved, and even functioned separately from the human hand. At this stage, they came to be known as machines. Machines thus act as extensions of the human body, created to realize the functions that humans require. However, the functions required by humans today are very different from those required 10 years ago, and the machines that deliver these functions have also changed. While the powerful turbines of power plants that produce electric power on a massive scale or the linear motor cars that travel at 500 km/h are still clearly recognizable as machines, new technologies such as fuel cell systems and functional nanostructures, which do not exhibit any visible motion, as well as new concepts like intelligent soft systems, can also be regarded as extensions of the human body—despite the fact that they do not appear as machines in the traditional sense. "Mechanical engineering" is activity that is continually broadening the horizons of "machines".


Analysis and design of human-machine interaction for advanced manufacturing systems

Research

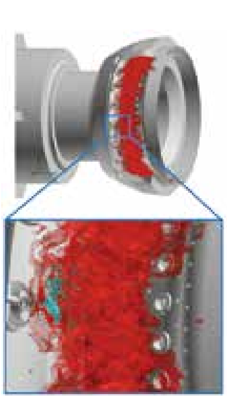
● Mechanical Systems Design

Human-machine systems, Systems engineering, Human-centered automation

● Manufacturing Systems Engineering

Manufacturing Systems, Optimum Design, Topology Optimization, Design Engineering

Kyoto Academic Racing Team (KART): Automobiles and other transportation systems are developed based on the state-of-the-art mechanical engineering research



Computer simulation of turbulent spray combustion in an aircraft gas turbine engine

In situ observation and simulation to investigate the mechanical and multi-physics properties of nano-scale materials

● Mechanics of Adaptive Materials and Structures

Advanced composite materials, Deformation and fracture, Fracture mechanics, Processing, Elastic wave propagation

● Solid Mechanics

Nano/micro-mechanical behavior, Fatigue and creep mechanisms, Thin films and nanostructured materials

● Mechanics of Thermal Fluid and Material

Experimental and Numerical Thermo-Fluids Engineering, Viscoelastic Fluids, Biocells, Microchannel flows

● Fluid Physics

Turbulent heat and mass transfer, Waves in fluids, Stratified fluids, Rotating fluids

● Molecular Fluid Dynamics

Dynamics of low-pressure gas flows, Microscale gasdynamics

● Optical Engineering

Development of spectroscopic methods and instruments, Spectroscopy for fusion and other plasmas

● Materials Science

Fracture, Nanomechanics, Nano-multiphysics, Metamaterials, In situ experiment, Ab initio simulation

● Thermal Science and Engineering

Nano ～ Macroscale transport phenomena, Combustion, Radiation heat transfer, Turbulence

● Vibration Engineering

Mechanism, Robot, Vehicle, Personal mobility, Actuator, Transmission

● Mechatronics

Modeling, Design and control of robot system, Bio-inspired robotics, Interface, Swarm intelligence, Rescue robot systems

● Machine Element and Functional Device Engineering

Machine Elements, Tribology, Lubrication engineering, Functional design, Surface modification

● Medical Engineering

Medical engineering, Tissue engineering, Bio-environment designing, Biomaterial

● Advanced Imaging Technology

Visualization and analysis, Thermal engineering, Transport phenomena with reactions

● Particle Beam Material Science

Irradiation effects in materials, Defect interaction with hydrogen or helium, Lattice defects, Characterization of irradiated materials

● Physics of Neutron Scattering

Atomic structure, Physical property, Functional material

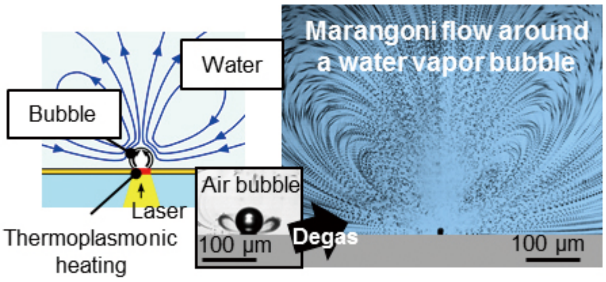
Pipe Climbing of Snake Robot

Micro Engineering

Overview

The Department of Micro Engineering offers an education and research program to elucidate physical phenomena specific to the micro range (i.e., from nanometer to micrometer order) based on a fundamental knowledge of mechanical engineering. Students develop expertise in scientific fields such as quantum engineering, which is required to utilize quantum effects that are expressed at the nanometer level, material and micromechanical engineering at the microscopic scale for creating and processing materials, and system engineering and control engineering to build and freely manipulate nano- and micro-systems. In addition, students will study living organisms, which are assemblies of extremely precise microelectromechanical systems, and learn about biomechanical engineering, which integrates microelectromechanical systems with the fields of living organisms and biotechnology.

Measuring tool for machine tool accuracy



High-speed water flow around a microbubble induced by laser-heating of nano-gold

Research

- **Nanometrix Engineering**

On-chip vascular network, Organ-on-a-Chip, Motor proteins, iPSCs (Induced pluripotent stem cells)

- **Nano/Micro System Engineering**

Nano/micro system, Materials, fabrication process, assembly, devices and measurement at nano/micro scale

- **Nanomaterials Engineering**

Quantum beam science, Ion surface interaction, Ion beam analysis, Molecular imaging

- **Quantum Condensed Matter Physics**

Complex adaptive systems, Living matter, Stochastic process, Relativistic quantum theory

- **Micro Process Engineering**

Control of nanomorphology, Physical self-assembly, Nanowires, Shape-related useful properties

- **Precision Measurement and Manufacturing**

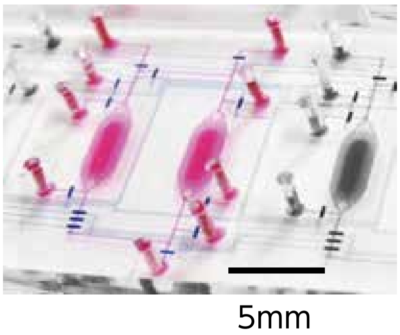
Manufacturing, Machine tools, Machining process control, Metrology, High-precision positioning technology

- **Biomechanics**

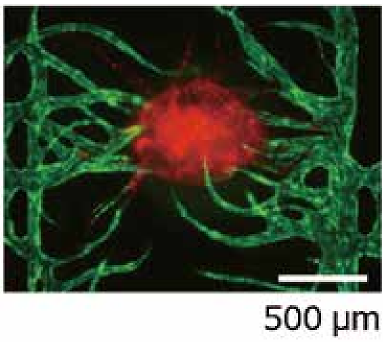
Molecular, cellular and tissue biomechanics, Mechanobiology, Adaptation, Mechano-chemical coupling

- **Digital Design and Manufacturing**

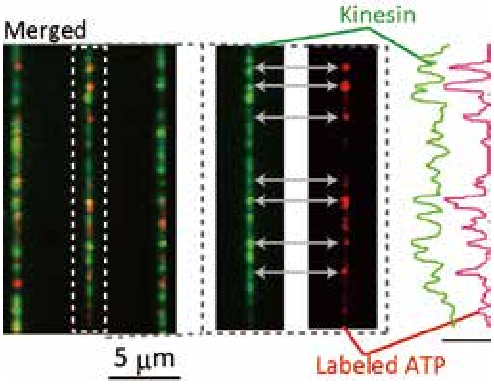
Digital twin in manufacture, Machining process modelling, Machining process data mining and machine learning



"Body on a Chip" for mimicking the physiological and pathological body conditions in vitro



On-chip vascular network for three-dimensional tissue culture

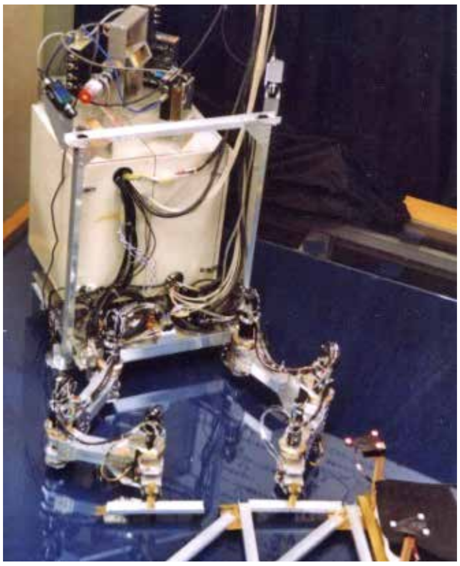


A nano-track for the single molecule detection of a motor protein and adenosine-triphosphate

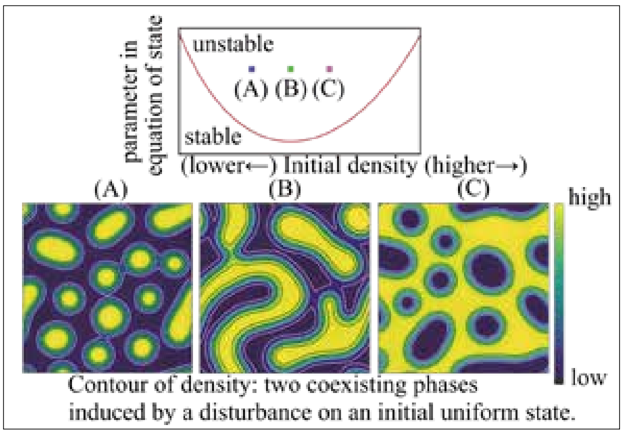
Aeronautics and Astronautics

Overview

The extreme physical conditions under which aeronautical and astronautical engineering systems must operate pose a wide range of difficult and important challenges. We conduct fundamental research leading to the development of innovative technology to address such challenges. We actively pursue cutting-edge science that will contribute to an understanding of many of the most important problems in urgent need of solutions for a wide range of general engineering purposes. In addition, we are proud of our proven record of providing high-quality education with an emphasis on a strong theoretical background that fosters professionals with a wide range of abilities in developing and applying new technologies.



A robot model of an astronaut-type free-flying space robot that assembles truss structure autonomously



Construction of a simple kinetic model for the phase transition of the van der Waals fluid and its application

Research

● Dynamics in Aeronautics and Astronautics

Aerospace systems, Dynamics, Control, System design, Autonomy, Motion intelligence, Locomotion

● Fluid Dynamics

Complex flows, Two-phase flows, Flapping wing, Kinetic theory, Molecular gas dynamics

● Mathematical Fluid Mechanics

Kinetic theory and fluid mechanics for nonequilibrium systems

● Propulsion Engineering

Engineering science for space propulsion, Plasma and ion thrusters, Plasma- and gas-surface interactions

● Systems and Control

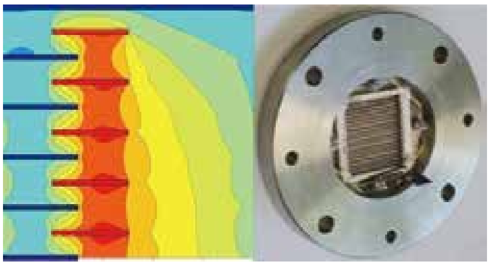
Control theory, Nonlinear control, System identification, Statistical learning, Aerospace systems

● Mechanics of Functional Solids and Structures

Elastic wave propagation, Nondestructive evaluation and structural health monitoring, Origami engineering

● Thermal Engineering

Heat, Mass and Charge Transfer, Energy conversion, Reactions, SOFC, Reformer, Catalytic combustion



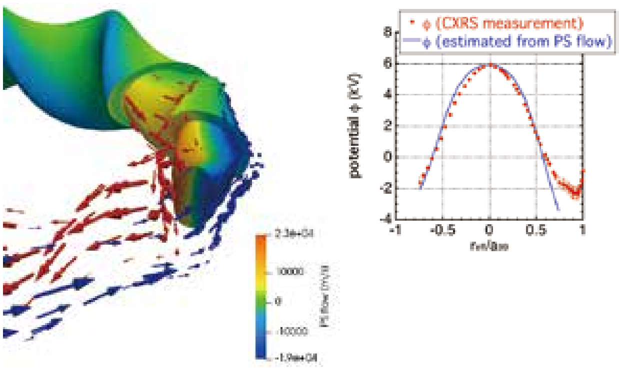
Model pump unit with no moving parts driven by the thermally driven flow in the rarefied gas

Experimental apparatuses for plasma propulsion and plasma-surface interactions (Super-gasdynamics laboratory in Uji campus)

Nuclear Engineering

Overview

The Department of Nuclear Engineering is exploring quantum technologies leading to the state-of-the-art science, such as quantum beams, nanotechnology and atomic technology, from a microscopic point of view based on the science of quantum phenomena, such as elementary particles, atomic nuclei, atoms and molecules. The department also strives to establish recycling systems by developing engineering applications to the relevant areas, such as materials, energy, life sciences and the environment.



Numerical simulation of plasma flows in the magnetic confinement fusion device


An electrostatic accelerator for MeV-energy ion beams (Radiation Laboratory in Uji campus)

Research

● Nuclear Energy Conversion

In order to develop economic, environmentally-sound and safe energy systems in the future, we are studying on science and technology of utilizing nuclear energies based on the fundamental understandings of physics of energy production and conversion.

● Quantum Engineering System

Aiming at utilization of nuclear fusion energy with magnetically confined plasmas, we are studying transport, global instabilities, energetic particles, and control schemes with electromagnetic waves in fusion plasmas.

● Nuclear Materials

Our research topics are mainly focused on safety of nuclear reactors and more reliable disposal of radioactive wastes in terms of nuclear materials and physical chemistry.

● Condensed-Matter Chemistry in Actinides

Condensed-matter chemistry in actinides reveals hidden nature of 5f-electrons which encompass application of actinides such as nuclear medicine, MA separation and/or storage etc.

● Quantum and Beam Science

Accelerators can provide high-performance and multifunctional particle beams of ions, electrons and photon. Using these particles, we are searching novel mechanisms and atomic processes in particle-induced natural phenomena and applying them to the creation of nature-friendly new systems including analytical and diagnostic tools for materials and human body.

● Quantum Science and Engineering

We study quantum phenomena systematically in order to achieve precise understanding, find new principles of physics and explore new interdisciplinary research fields leading to the establishment of safe and recycling-based human society.

● Particle Radiation Medical Physics

Medical physics is the general term for the physics and technology which are supporting medicine, especially radiation therapy and particle therapy. Focusing on boron neutron capture therapy (BNCT), we are studying about the irradiation system, dose estimation system, quality assurance and quality control, etc..

● Quantum Physics

Quantum theory has successfully explained the behavior and properties of matter to a large extent. However, its peculiar structure is a matter of concern for researchers who have an interest in the foundations of quantum physics. We explore the universal features of quantum theory and search for its logical foundations and applications.

● Neutron physics and Engineering

Photons such as x-rays and gamma-rays, and neutrons have no electric charge and can penetrate through materials. With measuring photons or neutrons, we can extract various information inside materials. On the other hand, their high penetrating power tends to be a drawback in detection. Thus, we are also studying on the better ways of measuring them.

● Neutron Sources and Applications

We are conducting the following research works: Studies of advanced nuclear reactor and accelerator physics for accelerator-driven neutron source. Investigations of neutron behavior in nuclear fuels and other materials, nuclear reactions, and nuclear transmutation, Development of diagnostic technique for structural integrity of nuclear facilities, and their safety.

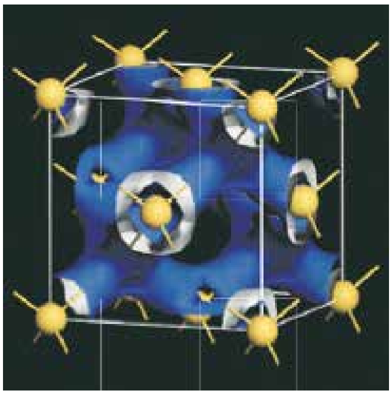
● Neutron Optics and Applications

Our site is one of the best in the world as the neutron reflective optical device research & development center. New type neutron scattering spectrometers (VIN-ROSE) for material and life science have been developed in J-PARC using neutron spin interferometry. Neutron imaging in Kyoto Univ. Research Reactor (KUR) is also progressing for wide variety of research fields.

Materials Science and Engineering

Overview

Materials Science and Engineering (MSE) is an interdisciplinary field of metallurgy, solid state physics, glass and ceramic technology, polymer chemistry, and inorganic chemistry. Our mission is to create advanced materials based on various innovative concepts. We are working on developing novel methods to transform “natural substances” into “materials that are useful for human life” through investigating fundamental properties of various materials both experimentally and theoretically at multiple length and time scales. The production of novel materials will cause paradigm shifts in development of innovative technologies that can benefit the future of humanity and the planet.



Visualization of electron density distribution in a semiconductor material

Research

● Metallic Materials Design

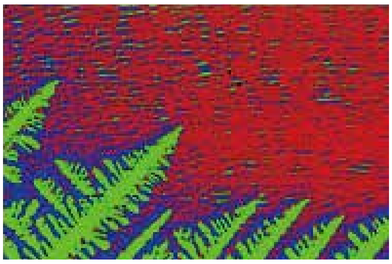
In-situ X-ray scattering/diffraction, phase transformation kinetics, soft X-ray scattering, visualization of nanostructure distribution

● Materials Processing

Design of Sustainable Materials and Processing Laboratory
Chemical thermodynamics, Titanium smelting, Fuel cells, Solid State Ionics, Diffusion Theory

Materials Informatics Laboratory
Development of low-power small instruments, Data analysis for physical science and chemical analysis, X-ray physics, Spectrochemistry

Nanotructural Design of Advanced Materials Laboratory
Photovoltaics based on compound semiconductor, processing of bulk crystals and thin films, statistical mechanics based on geometry



In-situ observation of dendrite crystal growth

● Basic Studies of Advanced Materials

Atomic level characterization and elucidation of material’s structures and electronic properties

● Basic Science of Materials

Materials Design Through Quantum Theory Laboratory
Design and exploration of advanced materials through quantum theory

Property Control of Crystalline Materials Laboratory
Intermetallic compounds, High-temperature structural materials,Dislocation theory, Defect engineering

Structure and Property of Materials Laboratory
Structural Metallic Materials, Deformation and Fracture, Microstructure,Phase Transformation, Bulk Nanostructured Metals

High temperature structural Materials: Turbo charger rotors and an engine valve of TiAl-based alloy

● Properties of Advanced Materials

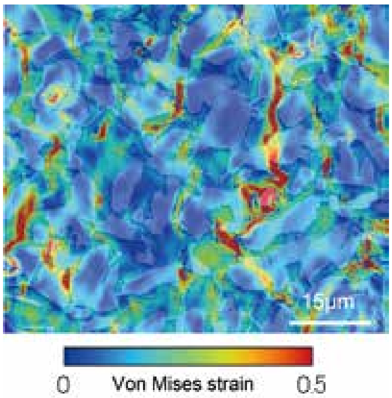
Solidification Dynamics, Microalloying Science, Electro-Magnetic Processing, 2D and 3D X-ray Imaging for Materials Science

● Materials Properties

Magnetism and Magnetic Materials Laboratory
Physics and chemistry of electron correlation and novel quantum phenomena, development of magnetic materials.

Electrochemistry and Hydrometallurgy Laboratory
Electrochemical materials processing, Aqueous and non-aqueous chemistry, Porous electrodes and their application

Nanoscopic Surface Architecture Laboratory
Organic/inorganic interface, Self-assembled monolayer,Scanning probe microscopy for materials science



Local strain distribution in ferrite + martensite dual phase steel during deformation analyzed by digital image correlation technique

● Non-ferrous Extractive Metallurgy

Pyroprocessing, Hydroprocessing, Extractive Metallurgy, Recycling

Electrical Engineering

Overview

The **Department of Electrical Engineering** is formed by four chairs; “**Advanced Electrical Systems Theory**”, “**Fundamentals of Systems**”, “**Biomedical Engineering**” and “**Electromagnetics Engineering**”. The department also has two Cooperating Chairs; “**Radio Engineering**” and“**Information Media Engineering**”. The education and research focuses are from the fundamental concepts and advanced theories of electromagnetics, electric and electronic circuits and system theories, to advanced applications in the fields of signal and electric energy generation, transmission and transformation, superconductive phenomena, large-scale simulations, automatic control and measurement, biological systems, information and multimedia, and space science.

Fig. 1

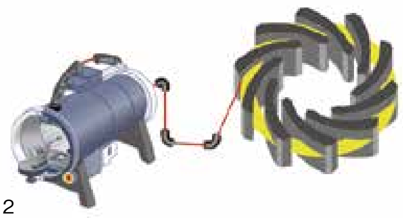


Fig. 2

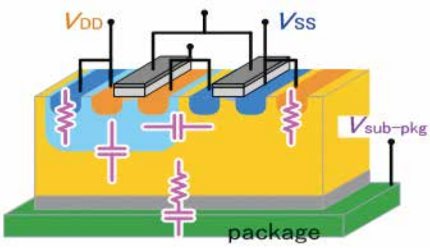


Fig. 3

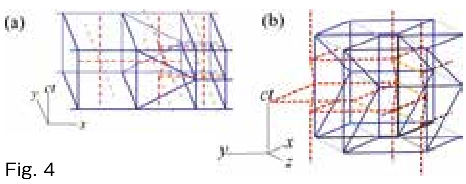
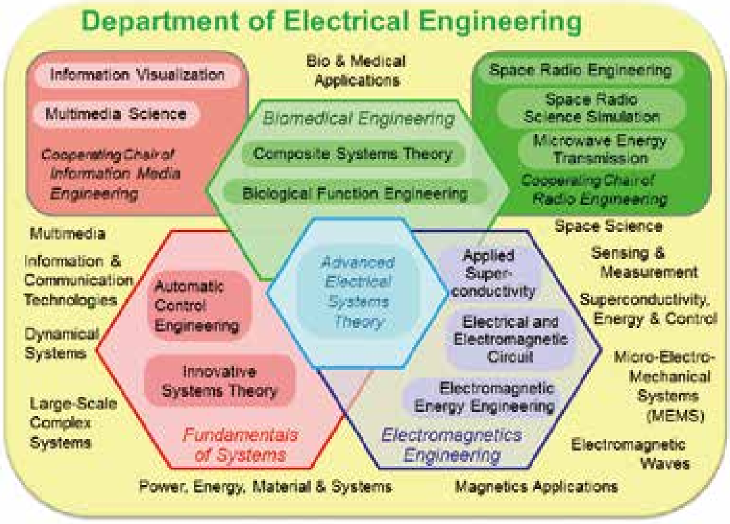


Fig. 4



Research

● Chair of Advanced Electrical Systems Theory:

The ***Advanced Electrical Systems Laboratory*** pursues advanced research related to electric power conversion and system control engineering. The fields are expanded to power conversion circuits using wide-bandgap semiconductors (SiC), the operation of electric power networks featuring power conversion and system control technology, control technology for micro-electro-mechanical systems (MEMS), and mathematical research on nonlinear dynamics including fluid flow dynamics.

● Chair of Fundamentals of Systems:

Automatic Control Engineering Laboratory pursues studies primarily on theoretical aspects of feedback control systems, with time-to-time laboratory scale experiments aiming at practical application of its theoretical developments. The keywords in the research topics include robust control, sampled-data systems, positive systems, time-delay systems, stochastic systems and so on. ***Innovative Systems Theory Laboratory*** aims to develop advanced wireless sensing technologies for imaging and monitoring human activities by combining system theory, applied mathematics, electromagnetic theory, and medical engineering.

● Chair of Biomedical Engineering:

Composite Systems Theory Laboratory covers a broad range of research such as computational biology, nonlinear dynamical systems, and system optimization. ***Biological Function Engineering Laboratory*** is engaged in research to advance functional biomedical imaging and neuro-engineering through innovation in engineering methodologies which will contribute to basic science and biomedical applications. (Fig.1: Development of an ultra-sensitive optically pumped atomic magnetometer for noninvasive imaging of the human higher brain functions.)

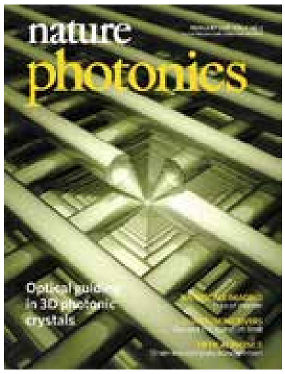
● Chair of Electromagnetics Engineering:

In ***Applied Superconductivity Laboratory***, electromagnetic phenomena in superconductors and fundamental technologies for various applications of superconductivity are being studied extensively. An example of applications is the carbon ion accelerator for cancer therapy shown in the figure (Fig. 2). Recent topics in ***Electrical and Electromagnetic Circuit Laboratory*** are extension of the conventional circuit theory and modeling methods to include electromagnetic phenomena, such as parasitic coupling in electronic devices (Fig.3), and control of electric energy flow. In ***Electromagnetic Energy Engineering Laboratory***, the key theories and techniques for computational electromagnetics are studied such as space-time electromagnetic field analysis (Fig. 4) and magnetic material modeling.

Electronic Science and Engineering

Overview

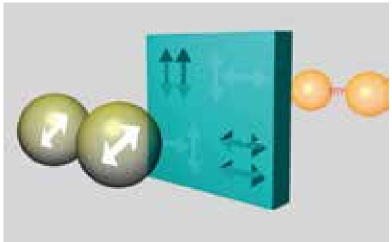
This Department engages in education and research on advanced science and engineering for creating new materials and devices that serve as the basis of future electronics and photonics in order to establish “more than Moore” and/or “beyond CMOS” technologies. Examples of future prospects of research topics are: (i) novel high-power semiconductor devices, (ii) novel optical devices using compound semiconductors (iii) advanced photonic materials and devices by using quantum effects of electrons and photons, (iv) investigations of various molecular materials and their electronic device applications, (v) quantum computation and communication, (vi) high-temperature superconductivity devices, and (vii) fundamental study on spintronics and its device applications using dissipationless pure spin current.



(1) Ishizaki et al., Nature Photonics. 2013.
(Cover picture of Vol.7, No. 2, 2013)

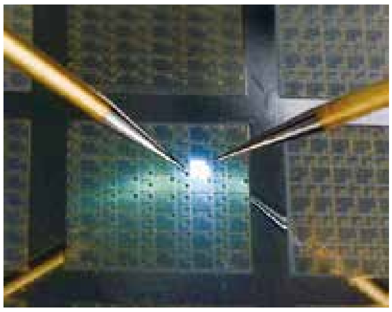
Recent Research Highlights:

(1) Photonic crystals : In this century, photons take on an increasingly important role in our society, for example: environment-friendly solar energy, next-generation information technology based on high speed optical communication, ultra-high efficient lighting devices, material processing by photons, and quantum information processing using photons. An objective is to control and manipulate “photons” at will, using photonic crystals or photonic nano-structures, to realize the innovative technologies which make the above mentioned applications reality. We believe that our research will open up the next generation information and communication technology and also greatly contribute to the solution in global energy or environmental issues.



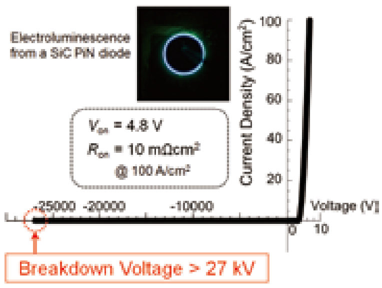
(2) Okamoto et al., Science 2009.

(2) Quantum information : Quantum information science tries to harness the fundamental features of quantum mechanics for information processing, communication, and more. We are trying to manipulate the quantum states of photons, or entanglements, using photonic quantum circuits and nanophotonic devices.



(3) Funato et al., APEX 2008.

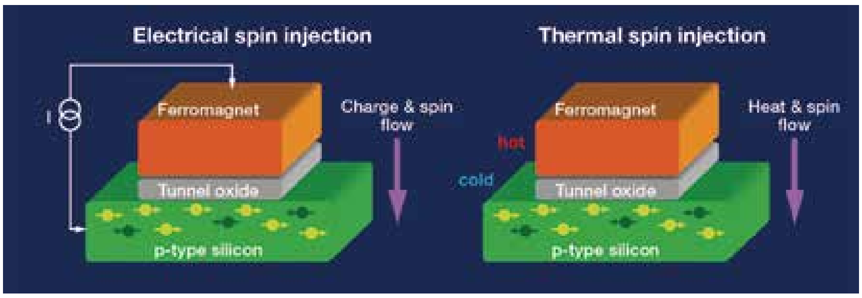
(3) White LEDs : Environmental-friendly devices with novel functions are strongly awaited. Phosphor-free white light-emitting diodes (LEDs) have been demonstrated in the structure based on micro-structured InGaN/GaN quantum wells for solid state lightings in the next generation.



(4) Kimoto et al., Compound Semiconductor 2014.

(4) High-power semiconductor devices : High-efficiency electric power conversion is an essential technology for energy saving. Silicon carbide (SiC) is an emerging wide bandgap semiconductor, by which high-voltage, low-loss power devices can be developed. Major subjects of study include material science and device physics of SiC.

(5) Spintronics : Pure spin current, which is a flow of spin angular momentum without charge flow, enables ultra-low energy dissipation information propagation and calculation and plays one of the most pivotal roles in spintronics. The pure spin current can be generated in Si, graphene and Ge at room temperature, and that in topological insulators can be experimentally detected.



(5) Shikoh et al., Phys. Rev. Lett. 2013.

Material Chemistry

Overview

With the rapid development of society, there is greater demand for the development of new substances and materials and the creation of novel functions. The advance of material science and technology supports our contemporary way of life and industrial infrastructure, and so expectations for the roles that chemistry will play in the future are increasingly growing.

For the purpose of satisfying a host of different demands for materials, the Department of Material Chemistry covers an extremely broad spectrum of research fields, with each providing education and research opportunities ranging from the fundamentals of chemistry to the latest applied research.

Our Department consists of five research units: Design of Functional Materials, Inorganic Material Chemistry (Inorganic Structural Chemistry, Industrial Solid-State Chemistry), Organic Material Chemistry (Organic Reaction Chemistry, Organic Chemistry of Natural Products, Analytical Chemistry of Materials), Polymer Material Chemistry (Polymer Physics and Function, Biomaterial Chemistry), and Nanomaterials (Nanomaterials).

Research

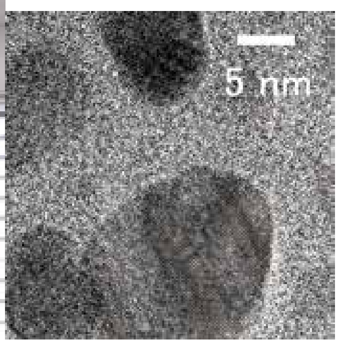
The Department of Material Chemistry covers all the basic chemistry fields ranging from physical chemistry, inorganic chemistry, organic chemistry, analytical chemistry, polymer chemistry, bio-related chemistry, and to nano-chemistry, which are rich in variety but in depth in science. The primary missions are to develop foundational sciences and technologies for the 21st century through invention of new materials/reactions, mechanism elucidation and theory construction for various phenomena, and establishment of innovative analysis techniques.

Educational Policy

Nowadays, chemistry is not merely a tool for creating new substances and materials, but it is rapidly developing into an academic discipline that studies the characteristics of atoms and molecules composing substances/materials and that investigates the properties or functions specific to the substances/materials. Our department offers multidisciplinary educational programs concerning inorganic, organic, and polymer materials, which enable students to learn the different genres. Through these programs, our department cultivates knowledge professionals who possess not only the sophisticated expertise that is fundamental to chemistry, but also the wide-ranging perspective. Our department also aims to foster the next-generation researchers and engineers who have the ability to open up new areas of material chemistry as well as to perform high-level, original research.

History

The Department of Material Chemistry was inaugurated in 1993 in a reorganization that focused its activities on the graduate school. The Department's predecessor was the Department of Industrial Chemistry, Faculty of Engineering. The Department of Industrial Chemistry was established within the Kyoto Imperial University College of Science and Engineering as a department with four chemistry chairs, and in September of the following year two courses were inaugurated: Pure Chemistry and Manufacturing Chemistry. Subsequently, in September 1914 the College of Science and Engineering was split into the College of Science (the predecessor of the Faculty of Science) and the College of Engineering (the predecessor of the Faculty of Engineering) and became the Department of Industrial Chemistry, College of Engineering. The Department of Industrial Chemistry has at all times embraced and supported promising young professors, fulfilling its role as a mother organization that has given birth to the Department of Fuel Chemistry (later renamed the Department of Hydrocarbon Chemistry), the Department of Textile Chemistry (renamed the Department of Polymer Chemistry), and the Department of Synthetic Chemistry (renamed the Department of Synthetic Chemistry and Biological Chemistry). We take great pride in the fact that, over the years, the Department of Industrial Chemistry has produced many leaders who have contributed to corporations, universities, and research institutions in Japan and around the world in the fields of basic and applied chemistry.



Energy and Hydrocarbon Chemistry

Overview

The ultimate purpose of chemistry is to clarify the essential nature of unknown chemical phenomena, to find out new knowledge, including materials and chemical reactions, and to transfer the results of these activities so as to improve human life and society. To acheive these goals, the Department of Energy and Hydrocarbon Chemistry in the Graduate School of Engineering has designed an educational program for the students who will go on to lead the scientific challenges of the 21st century. This program furnishes students with a sound understanding of the basic principles and knowledge of chemistry, as well as cultivating a scientific way of thinking.

Research

Civilization has advanced greatly in the 20th century; however, rapid technological developments simultaneously brought about shortage of natural resources and great stress on the global environment. To encourage an environment-conscious civilization, it is essential to develop a new paradigm of science and technology. In other words, it is of vital importance to develop new technologies that will achieve the production of high value-added products with minimum use of raw materials and minimum energy consumption, as well as the production and storage of high-quality energy and recycling of chemical resources. To achieve these objectives, it is our mission to develop cutting-edge science and technology associated with substances and energy. As a science that deals with material transformation and energy conversion, chemistry plays a central role in realizing a sustainable human society. To meet the demands of society, scientists at the Department of Energy and Hydrocarbon Chemistry engage in synergistic advancement of basic and applied chemistry, thereby promoting original and innovative chemical research.

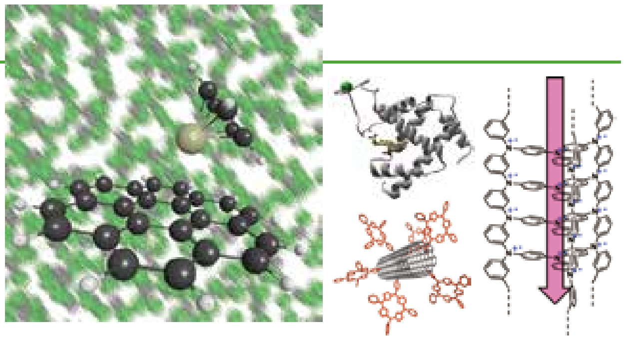
The following research is under way in this department:

- Chemical reactions related with energy problems
- Research on environmental catalysis and energy-conversion photocatalysis
- Development of new catalysts and photocatalysts
- Development of electrochemical reactions and materials for energy conversion and storage
- Clarification and control of liquid-liquid, solid-gas, and solid-liquid interfacial reaction mechanisms
- Creation of new materials by controlling active species
- Development of disease-specific imaging probes for diagnosis and therapy
- Creation of functional π-conjugated systems
- Development of molecular transformations exploiting under-utilized resources
- Effective use of radioactive tracers
- Development of advanced batteries and their materials

Curriculum

Thirty-nine students are admitted to the Master's program after passing the entrance examination. Students who wish to be admitted to the Doctoral program must pass the qualifying examination in the Department. The Department offers advanced courses in energy chemistry, hydrocarbon chemistry, catalysis, electrochemistry, radiation chemistry, physical chemistry, organic chemistry, and other related areas.

Molecular Engineering



Overview

The discipline of chemistry is steadily expanding, so that in addition to the conversion of substances, it is increasingly concerned with investigating the physical properties of substances in relation to their electronic structure, molecular arrangements and interactions, and the design of molecules and materials with novel functions. Molecular engineering is an academic field serving to underpin the fundamental science of microscopic phenomena involving atoms, molecules, and polymers by theoretically and empirically elucidating the interactions between atoms, molecules, and polymers and applying the results directly to engineering at a molecular level. The importance of molecular engineering to the frontiers of chemistry is clearly recognized. High expectations are held for the potential contribution of molecular engineering to cutting-edge technology, particularly in Japan. One of the most important areas of research in molecular engineering at present is the development of new materials: for example, new electronic materials; high-performance materials in molecular biotechnology; high-performance organic, inorganic, and polymeric materials; highly selective catalysts; and energy and information-related materials. The aim of the Department of Molecular Engineering is to train researchers and engineers who can use new concepts in molecular theory to develop useful applications from fundamental science.

Research

● Biomolecular Function Chemistry

Our Lab is devoted to investigate the structures and functions of biomacromolecules, such as proteins and DNAs and to develop physicochemical methodologies for the investigations. Our current interests focus on the methylation of genomic DNA and ubiquitination of intracellular proteins.

● Theoretical Chemistry

In our laboratory we are concentrating on developing molecular theory to describe chemical phenomena based on quantum chemistry and statistical mechanics. Current research activities cover the understanding of chemical reactions, chemical dynamics and molecular properties of various chemical processes, especially in the condensed phase.

● Quantum Function Chemistry

Our research group is engaged in a wide range of research projects designed to establish (1) the cooperative coupling between the molecular design and theoretical analysis, (2) the organic synthesis, and (3) the elucidation of physicochemical properties of advanced functional organic materials.

● Catalysis Chemistry

Our Lab is devoted to clarification of entire mechanism of catalysis and to a design of a new green catalytic system thereby. Our current researches are in situ spectroscopic characterization of catalysts, design of highly active photocatalysts for artificial photosynthesis, development of catalyst materials based on elements strategy.

● Photoorganic Chemistry

Our group is devoted to basic and application researches based on organic chemistry and photochemistry. Current interests involve development of photofunctional molecules and nanocarbon materials for artificial photosynthesis, photovoltaic devices, and cellular function control.

● Condensed Matter Physical Chemistry

Main objectives of our research group are (1) developing new techniques and methodology for discerning physical properties of molecular materials, (2) design and optimization of molecular systems with concerted electronic, optical, and magnetic properties, (3) developing low-dimensional functional nanomaterials for the future application in optoelectronic and biomedical fields.

● Quantum Materials Science

We investigate Quantum Materials for quantum sensing and/or quantum information science. These fields are expected to provide new opportunities - especially with regard to higher sensitivity and precision, faster calculation, and safer communication compared with those operated by classical physics.

● Molecular Rheology

This laboratory focuses on molecular origins of rheological properties of various softmatters that include polymers and suspensions. For basic understanding of the materials, rheological, dielectric, optical, and scattering measurements as well as molecular simulations are conducted, and the results are analyzed from a comprehensive point of view.

● Organic Materials Science

Our research target is the realization of highly efficient organic LEDs and organic solar cells. The establishment of fundamental science on these devices is another target of our group. For the purpose, we have carried out molecular designs, syntheses, device fabrications, NMR and DNP-NMR analysis, and quantum chemical calculations.

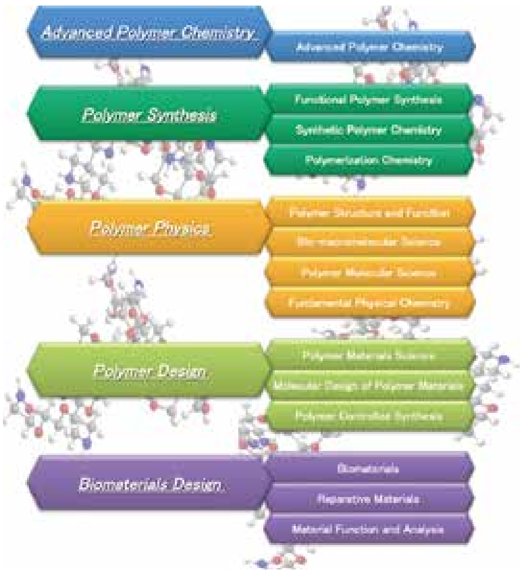
● Theoretical Solid State Chemistry

In our Lab, we develop novel concepts in order to design functional molecules such as light-emitting molecules and carrier-transporting molecules from the view of vibronic (electron-molecular vibration) couplings. They are also applied for chemical reactivities of large molecules such as fullerenes, nanotubes, and solid surfaces.

● Porous Physical Chemistry

Our group develops porous microstructures using an assortment of organic, inorganic and physical chemistry tools. These materials target the global targets of reduced carbon emissions and water scarcity. Our unique approach serves as a remarkable screen from the various potential chemistries available to those that are realistic for impact.

Polymer Chemistry



Overview

The Department of Polymer Chemistry, recognizing the importance and potential of polymers and macromolecules, aims at fundamental research and integrated education to cover every facet of polymer chemistry and science: synthesis, reactions, structures, physical properties, and functions. Via its close partnership with neighboring disciplines in chemistry, physics, and biology, the research contributes to discoveries and innovations in science and technology that better the world for all of us. With its first-rate curricula, facilities, and faculty, the education cultivates creative and competent researchers and engineers of polymer science and relevant advanced studies.

Research

● Advanced Polymer Chemistry

Education and research aiming at the design of next-generation polymers having novel unique functions. Synthesis and evaluation of functional heteroatom-containing conjugated polymers by novel transition metal catalysts. Nanostructure-control and functionalization of various block copolymers and development of techniques for nanostructure analysis.

● Polymer Synthesis

Aims and Activities of the Polymer Synthesis Group: Exploration of novel reactions and designed catalysts for polymer synthesis; clarification of polymerization mechanisms; physico-chemical analysis of the structure and functions of newly synthesized polymers; development of polymer materials precisely designed in a molecular scale; and research and education in general principles and fundamental chemistry in polymer synthesis.

● Polymer Physics

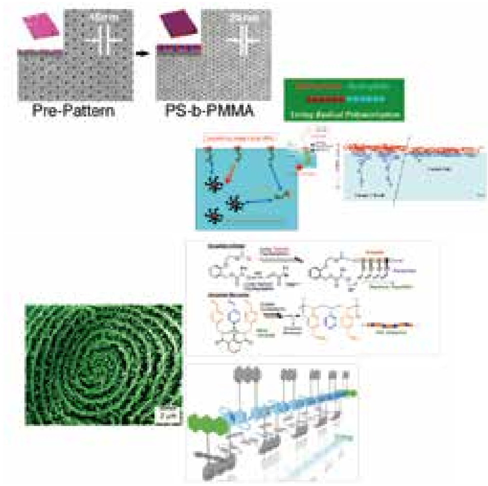
Research and Education in Polymer Physics Group: studies on structures and properties in a wide variety of polymeric systems such as solution, blends, gels, rubbers, amorphous, crystals, and liquid crystals, aiming for deep understanding of the polymeric systems through the molecular-level investigation of the relationships between their forming processes and transition mechanisms, and between their assembled structures and functions.

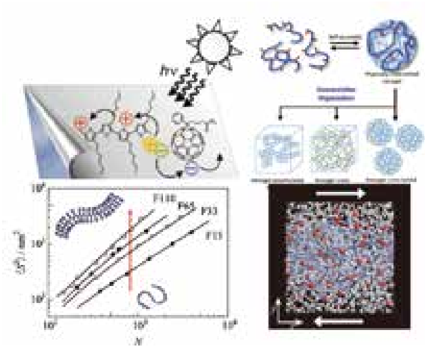
● Polymer Design

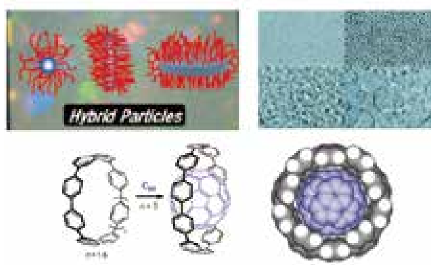
Education and research related to molecular design of functional polymers: in particular, functionalization of polymers by chemical reactions and analysis of static/dynamic structure in a micro to macro scale by e.g., electron microscopy and X-ray/neutron/light scattering techniques.

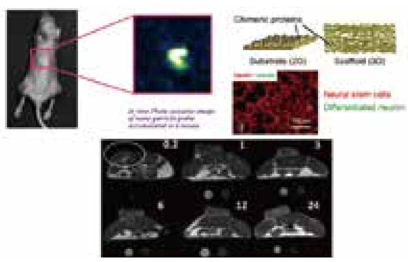
● Biomedical Polymers

Education and research regarding basic biology and medicine as well as clinical medicine on the basis of polymer material sciences. The projects of interest are biomedical materials for surgeries (general surgery, ophthalmology, orthopedic surgery, neurosurgery or dentistry, etc.) and internal medicines as well as polymeric materials for regenerative medicine and for DDS of drug and gene therapy, prophylaxis, and diagnosis.





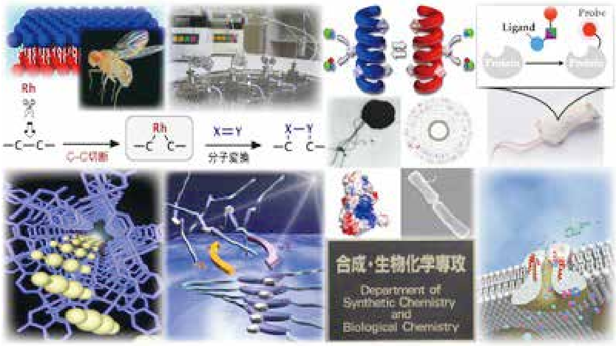




Synthetic Chemistry and Biological Chemistry

Overview

The mission of the Department of Synthetic Chemistry and Biological Chemistry is to drive advances in synthetic and biological chemistry through the promotion and application of fundamental science, as well as to establish this interdisciplinary field. Our department is also striving to promote sound and balanced views of nature and life, and to help establish new industrial platform technologies for the development of a sustainable society.



Research

● Chair of Organic System Design

Laboratory of Organic System Design tackles the design and production of new chemical reactions and materials that can serve as a basis for the creation of useful materials for 21st century society, and the development of efficient material transformation techniques.

● Chair of Synthetic Chemistry

Laboratory of Synthetic Organic Chemistry is focused on time integration and space integration of reactions (one-pot and flow synthesis) using unstable reactive intermediates generated by various methods including electron transfer reactions and organometallic reactions to enhance the power and speed of organic synthesis.
Laboratory of Functional Chemistry is focused on design of new functional molecules with simple and elegant structures, and self-assembling molecular systems toward new porous materials, polymer-based phosphorescence materials and carbon rich materials with three-dimensional ordering.
Laboratory of Physical Organic Chemistry aims at understanding the correlation between structure and properties in organic molecules and tries to develop new organic functional materials for application in electronics and optics.
Laboratory of Organometallic Chemistry tries to develop new synthetic methodology using transition metal catalysts, and particularly, is focused on the selective activation of carbon–carbon bonds, carbon–hydrogen bonds, and carbon–nitrogen bonds of readily available starting materials.

● Chair of Biological Chemistry

Laboratory of Bioorganic Chemistry is focused on creating novel chemistry useful for live cell and in vivo research in molecular level, with the following aims--the development of chemo- and bio-sensors, imaging probes, and methodology for selective protein labeling and regulation of protein, innovative semi-wet supramolecular biomaterials for control of biomolecules and live cells.
Laboratory of Molecular Biology focuses on the elucidation of cellular response mechanisms in various types of living tissue, such as the cerebral nervous system, under native conditions, and also studies the molecular motion of bio-signals, using molecular biology and cellular engineering techniques, for the purpose of exploring the chemical basis of the causes of disease.
Laboratory of Biorecognition Chemistry is focused on the molecular motion of components in biological membranes, and also aims at elucidating the molecular basis of various physiological/pathophysiological events such as cellular morphogenesis, energy metabolism, and muscular dystrophy.
Laboratory of Biochemical Engineering is focused on the physiology and metabolism of microorganisms. Genome sequence data and genetic technology are utilized in elucidating the function of unknown genes and in engineering microbes with improved or novel metabolic capacity.

● Technical Service Office

State of the art instrument infrastructure supported by technical staff offers researchers and students access to a wide range of analytical technologies (such as NMR and MS) and the necessary technical expertise. The office also provides the assistance in information technology.

Chemical Engineering

Overview

The department is actively pursuing educational and research activities to develop chemical products and processes that address society's growing technological needs in a sustainable manner. Chemical engineering is particularly suited for such a demanding task. One of the main features of chemical engineering is that it can extract the relevant phenomena of a given process, evaluate its dynamical characteristics, and proceed to develop methodologies that enable advanced functionality, as well as optimize the production efficiency of the materials involved.

Research

● Transport Phenomena

Our research targets include soft materials (colloids, polymers, membranes) as well as active matter systems (soft tissues and swimming microorganisms). We aim to develop theoretical models that can be used to simulate these systems based on physical principles.

● Surface Control Engineering

We focus on the engineering for nanoscale confined space to exploit interfacial phenomena. Current research topics include simulation and modeling of phase behavior in nanopores, self-assembly of colloid particles, synthesis of functional particles with micro- and nanoreactors.

● Chemical Reaction Engineering

CRE Laboratory focuses on modeling of functional materials production processes, electro chemical processes, coal conversion processes, etc. New reaction processes and materials are being developed based on understandings of the chemical structure, reactions, and processes.

● Separation Engineering

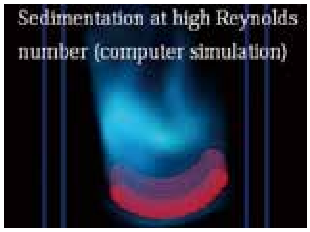
We are developing methodologies and materials for separation and purification operations. The current research activities cover adsorption, drying, nanocarbons, dielectrophoresis and molecular dynamic simulation.

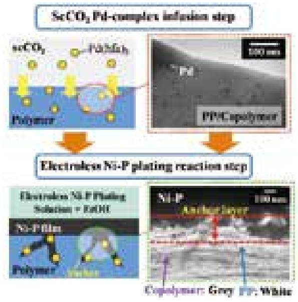
● Energy Process Engineering

We focus on the development of the technology for renewable energy production and high-efficiency energy conversion/utilization. Specifically, we design and fabricate next-generation photovoltaic devices and hydrogen-energy systems, etc.

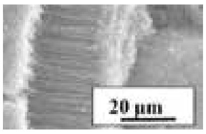
● Materials Process Engineering

We are developing new material processing technologies for creating new functional materials such as polymer foams or metal-plated plastics. Our research mainly focuses on controlling the material structures as well as developing the optimal processing devices and techniques.







● Process Control and Process Systems Engineering

Process Systems Engineering (PSE) is a research area where the systematic methodology for realizing an innovative production system is investigated. PSE covers all aspects of design, operation, control, planning, and logistics for the process industries.

● Environmental Process Engineering

We are developing several environmentally benign technologies based on new conversion methods.
The current research activities cover micro reaction technology, biomass conversion and catalytic reaction toward a new industrial paradigm in sustainable society.

● Particle Technology

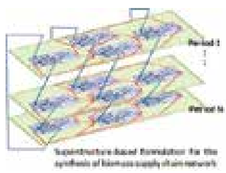
Analysis of the dynamic behavior of particles and evaluation of powder properties such as particle adhesion and electrification are important for fine-particle handling. Our research is focused on analyzing the phenomena and on developing new handling methods.

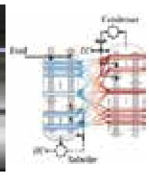
● Environment and Safety Engineering

The focus of our research is the development of the technology for environmental preservation and safety life: Oxidative decomposition of organic pollutants utilizing active radicals generated by chemical reagent or plasma; Removal of heavy metal ions by magnetic nano-particles.

● Soft Matter Engineering

Our research group focuses on the combination of separation and reaction technologies with energy conservation principles to enhance the energy performance of current processes by means of process intensification (PI).





7. Research and Educational Facilities and Centers

Photonics and Electronics Science and Engineering Center

Support for advanced ion beam technology deployment in interdisciplinary and multidisciplinary areas

Through the use of ions, kinetic energy and chemical activity can be freely controlled and materials in a vacuum can be manipulated, making it possible to control the micro-properties of matter. Taking advantage of this characteristic of matter, the Photonics and Electronics Science and Engineering Center engages in cutting-edge ion beam technology research based on the synthesis of new materials used in a variety of fields ranging from electronics, electricity, machinery, and medicine to the production of high-performance thin-film devices such as very-large-scale integrated circuits. Noteworthy among these pursuits, the cluster ion beam technology developed at the Center is attracting attention in Japan and abroad as a novel process that promises to open up new applications for ion beams.

Research Center for Environmental Quality Management

Management, prediction, and monitoring of environmental quality

The Research Center for Environmental Quality Management (RCEQM) was inaugurated in 2005 with three research and educational divisions: Environmental Quality Management, Environmental Quality Prediction, and Environmental Quality Monitoring. The main objectives of the Center are to integrate the relevant fields of engineering and to become an advanced educational and research institution by investigating the direct and indirect adverse effects of environmental pollutants on human health and the ecosystem by holistic approach.

Quantum Science and Engineering Center

Supporting nanoscale science research using particle beam accelerators

The Quantum Science and Engineering Center (QSEC) was established in April 1999 with the aim of promoting the use of quantum beams, seeking new phenomena induced by quantum beam irradiation and investigating nuclear engineering for establishing the safe energy system. For this purpose, the center provides four accelerators to researchers, and studies nanoscale material science under extreme conditions and nuclear fuel cycle technology including actinide science.

Katsura Int'tech Center

Creating new world-leading technologies that transcend the framework of conventional technical specialization

The center is composed of multiple research divisions, consisting of groups of researchers from different departments and graduate schools. It pursues cutting-edge strategic research and implements research exchanges with external organizations from a global perspective. Furthermore, the center features five laboratories (“open labs”) that are expected to develop substantially over the coming years. These labs are being used by a variety of project groups.

Center for Information Technology

The construction and operation of IT systems for educational activities, research, and administrative affairs

The Center for Information Technology was established in 2002 with the aim of efficiently managing the information system of the Graduate School of Engineering, Kyoto University. The Center is responsible for the construction and management of IT systems for all educational, research, and administrative affairs, as well as for information security and literacy instruction. The Center also contributes to university-wide information systems by developing novel IT systems.

Occupational Health, Safety and Environmental Management Center

Ensuring a comfortable environment for the people studying and working in the Graduate School of Engineering

The aim of the center is to fashion an ideal environment for education and research, with careful consideration to environmental protection, safety, and public health. In this effort, the center complies strictly with the Industrial Safety and Health Law and other applicable health and safety-related laws, and is working systematically towards sustainable environmental protection. The center supports the education and research activities of the Graduate School of Engineering through the allocation of specialist academic and technical staff in the areas of work management, work environment management, and health and safety management, and the implementation of work environment monitoring and systems for handling of chemical substances.

Engineering Education Research Center

Inspiring engineering leaders for tomorrow

The center fosters the next generations of engineers by supporting their learning which reinforces the development of international leadership skills. The center offers a wide range of multi-disciplinary courses that are tailored to the needs of engineering students at both undergraduate and graduate levels. These courses empower the engineering students who desire to acquire the knowledge and skills for stepping up to the leadership roles. The center also provides the opportunities for faculty members and post-graduate students to participate in faculty development programs which promote active learning in engineering.

Research Administration Center

Supporting and promoting research activities in Graduate School of Engineering

The Center with URAs(*) was established in December 2012.
The URAs support to apply for government and industry research funding, promote research projects, and arrange joint research opportunities for matching research seeds with industry needs.
* University Research Administrator

8. Statistics Data

1. Statistics of Academic & Administrative Staff

Academic Staff

As of May. 1, 2020

Departments & Institutes	Professors	Associate Professors	Junior Associate Professor	Assistant Professors	Total
Civil and Earth Resources Engineering	12 (4)	11 (2)	2	13 (1)	38 (7)
Urban Management	7 (1)	12 (1)		7	26 (2)
Environmental Engineering	3 (1)	4 (1)	1	5 (1)	13 (3)
Architecture & Architectural Engineering	15	11		7	33
Mechanical Engineering and Science	14	9	2	10	35
Micro Engineering	5	3	1	6	15
Aeronautics and Astronautics	6	3 (1)	1	5	15 (1)
Nuclear Engineering	5	4	2	3	14
Materials Science and Engineering	10	11	1	11	33
Electrical Engineering	8	2 (1)	3	4	17 (1)
Electronic Science and Engineering	6	9	1	7	23
Material Chemistry	7 (1)	5	1	7	20 (1)
Energy and Hydrocarbon Chemistry	8 (1)	10 (1)	1	6	25 (2)
Molecular Engineering	5	6		5	16
Polymer Chemistry	6	5	1	10	22
Synthetic Chemistry and Biological Chemistry	7	6	4	14	31
Chemical Engineering	8	7	2	8	25
Photonics and Electronics Science and Engineering Center	1		1	1	3
Research Center for Environmental Quality Management	2	2	1	3	8
Quantum Science and Engineering Center	1	2			3
Katsura Int'tech Center					0
Center for Information Technology			[2]		[2]
Occupational Health, Safety and Environmental Management Center		[1]	[1]		[2]
Engineering Education Research Center			5		5
Total	136 (8)	122 (7) [1]	30 [3]	132 (2)	420 (17) [4]

Note1: ( ) The numbers in parentheses indicate number of Teaching Staff belonging to Hall of Global Environmental Research, Graduate School of Management and Institute for Liberal Arts and Sciences, in addition to the regular figures

Note2: [ ] The numbers in parentheses indicate the personnel who are officially classified to belong to other sections, in addition to the regular figures

Administrative Staff

As of May. 1, 2020

Departments & Institutes		Admin. Staff	staff·Technical staff	Total
Civil and Earth Resources Engineering	C Cluster Office	8	3	25
Urban Management			2	
Environmental Engineering			2	
Architecture and Architectural Engineering			2	
Mechanical Engineering and Science			5	
Micro Engineering			1	
Aeronautics and Astronautics				
Nuclear Engineering			2	
Global Engineering	Global Engineering Office	3		3
Architecture	Architecture Office	2		2
Materials Science and Engineering			4	4
Engineering Science	Engineering Science Office	4		4
Electrical Engineering	A Cluster Office	7		15
Electronic Science and Engineering				
Material Chemistry				
Energy and Hydrocarbon Chemistry			2	
Molecular Engineering			1	
Polymer Chemistry			1	
Synthetic Chemistry and Biological Chemistry			3	
Chemical Engineering			1	
Electrical and Electronic Engineering	Electrical and Electronic Engineering Office	3		3
Industrial Chemistry	Industrial Chemistry Office	4		4
Informatics and Mathematical Science			1	1
Katsura Int'tech Center			2	2
Katsura Int'tech Center			3	3
Occupational Health, Safety and Environmental Management Center			3	3
	Katsura Campus Office	82	4	86
	Yoshida Campus Office	9	1	10
Total		122	43	165

2. Statistics of Current Undergraduate & Graduate Students

Graduate School

As of May. 1, 2020

Departments \ Academic Year	Master's Course		Doctoral Course						Total	
	Year 1	Year 2	Year 1		Year 2		Year 3			
			April	Octorber	April	Octorber	April	Octorber	April	Octorber
Civil and Earth Resources Engineering	77	83	9	10	17	10	9	5	195	25
Urban Management	60	65(1)	10	5	6	6	26	10	166	22
Environmental Engineering	37	42(1)	5	3	4	8	15	9	102	21
Architecture and Architectural Engineering	68	87	13	6	11	6	16	2	195	14
Mechanical Engineering and Science	65	62	9	5	14	4	15	7	165	16
Micro Engineering	26	29	4	1	4	3	5	1	68	5
Aeronautics and Astronautics	20	22	3		4	2	5		54	2
Nuclear Engineering	25	29	4	1	7	1	9		74	2
Materials Science and Engineering	47	38	8	2	8	7	10	3	111	12
Electrical Engineering	41	47	6	2	6	1	12	2	112	5
Electronic Science and Engineering	31	31	5	1	5	1	8		80	2
Material Chemistry	30	32	4	1	3		4	1	73	2
Energy and Hydrocarbon Chemistry	32	39	7	3	12	1	7	2	97	6
Molecular Engineering	30	36	5	2	8		11		90	2
Polymer Chemistry	46	50	7	1	2		12		117	1
Synthetic Chemistry and Biological Chemistry	32	36	10		7	1	5		90	1
Chemical Engineering	42	42	8	2	2	2	5	1	99	5
Total	709	770(2)	117	45	120	53	174	43	1,888	143

Note: The numbers in parentheses indicate number of students enrolled in October

Undergraduate

As of May. 1, 2020

Undergraduate Schools \ Academic Year	Year 1	Year 2	Year 3	Year 4	Total
Global Engineering	189	192	191	244	816
Architecture	85	82	81	104	352
Engineering Science	240	244	243	318	1,045
Electrical and Electronic Engineering	134	136	133	171	574
Informatics and Mathematical Science	94	94	94	142	424
Industrial Chemistry	245	243	240	305	1,033
Total	987	991	982	1,284	4,244

3 Statistics of Research Students, International Students and Guest Scholars

Statistics of Research Students and others

As of May. 1, 2020

Depts. \ Status	Research Students	Research Fellows	Special Auditors	Special Research Students	Short-term International Students	Total
Civil and Earth Resources Engineering	3(3)		1(1)			4(4)
Urban Management	2(2)			1(1)		3(3)
Environmental Engineering		1		1		2(0)
Architecture and Architectural Engineering	8(5)	2	2(2)	2(2)		14(9)
Mechanical Engineering and Science	1(1)	2				3(1)
Micro Engineering	1(1)					1(1)
Aeronautics and Astronautics						0(0)
Nuclear Engineering						0(0)
Materials Science and Engineering				2(2)		2(2)
Electrical Engineering	2(2)	1				3(2)
Electronic Science and Engineering				1(1)		1(1)
Material Chemistry	1					1(0)
Energy and Hydrocarbon Chemistry	2(2)			3(1)		5(3)
Molecular Engineering				2		2(0)
Polymer Chemistry	1(1)	2		1		4(1)
Synthetic Chemistry and Biological Chemistry		1		2(1)		3(1)
Chemical Engineering	1(1)			2		3(1)
Global Engineering						0(0)
Architecture			2(2)			2(2)
Engineering Science						0(0)
Electrical and Electronic Engineering			1(1)			1(1)
Informatics and Mathematical Science			4(4)			4(4)
Industrial Chemistry						0(0)
Total	22(18)	9	10(10)	17(8)	0	58(36)

Note1: The numbers in parentheses indicate number of foreign nationals
Note2: Research Fellows figures include Research fellow from a private-sector institution etc.

International Students

As of May. 1, 2020

Country/Region \ status	Faculty	Graduate school		Total
		Master's Course	Doctoral Course	
Asia (20)				
India	3		9	12
Indonesia	5	3	11	19
Korea	25	18	27	70
Cambodia		1	2	3
Singapore	1			1
Sri Lanka	2			2
Thailand	6	2	13	21
Taiwan	2	5	7	14
China	87	121	118	326
Hong Kong	1		1	2
Nepal		1	2	3
Pakistan		1	1	2
Bangladesh		1	2	3
Philippines		2	2	4
Bhutan		2		2
Viet Nam	2	3	5	10
Macau		1		1
Malaysia	2		4	6
Myanmar	3		5	8
Mongolia	1			1
Middle East (4)				
Iran	1	3	4	8
Oman		2		2
Turkey			1	1
Bahrain			1	1
Africa (4)				
Uganda			1	1
Egypt	1	2	2	5
Tunisia		1		1
Liberia			1	1
Oceania (2)				
Kiribati		1		1
Solomon Islands			1	1
North America (2)				
U.S.A.	1		1	2
Canada	1	1		2
Latin America (4)				
Argentina			1	1
Costa Rica			1	1
Brazil	2	1	1	4
Peru	1		1	2
Europe (Including NIS countries)(6)				
U.K.			1	1
Kazakhstan			1	1
Greece			1	1
Kyrgyz		1		1
France			2	2
Lithuania			1	1
Total (42 countries / regions)	147	173	231	551

International Research Students

As of May. 1, 2020

status / Country/Region	Research Students	Special Auditors	Special Research Students	Short-term International Students	Total
Asia (5)					
Indonesia			1		1
Korea		1			1
Taiwan			1		1
China	9	3	4		16
Malaysia	1				1
Middle East (1)					
Syrian	1				1
Africa (4)					
Uganda	1				1
Egypt	1				1
Congo	1				1
Senegal	1				1
Oceania (1)					
Australia		1			1
North America (1)					
U.S.A.	1				1
Latin America (1)					
Venezuela	1				1
Europe (Including NIS countries)(5)					
Italy		1			1
Austria		1			1
Swiss			1		1
Germany			1		1
France	1	3			4
Total (18 countries / regions)	18	10	8	0	36

Guest Scholars

Academic year 2019(Apr.1-Mar.31)

status / Country/Region	Guest Scholars	Guest Research Associates	Visiting Research Scholars	Total
Asia (9)				
India	4	4		8
Indonesia	2			2
Thailand		1		1
Viet Nam	1	1		2
Korea	2	3		5
Taiwan	3	1		4
China	6	22		28
Malaysia		2		2
Myanmar	2		1	3
Middle East (1)				
Iran	2			2
Africa (1)				
Egypt	1	4		5
Oceania (1)				
Australia		1		1
North America (2)				
U.S.A.	1		1	2
Canada		1		1
Latin America (1)				
Ecuador		1		1
Europe (Including NIS countries)(9)				
Italy	1	3		4
U.K.	2	2		4
Austria	1	1		2
Swiss	1			1
Slovenia		1		1
Germany	1	6		7
France	2	4		6
Poland			1	1
Lithuania		1		1
Total (24 countries / regions)	32	59	3	94

Collection statistics

As of May. 1, 2020

	Library name, etc.	Books (Number of books)			Miscellaneous magazines (Number of titles)		
		Japanese book	Western books	Total	Japanese book	Western books	Total
1	Katsura Library	60,787	105,480	166,267	2,883	3,343	6,226
2	Library of School of Global Engineering	3,636	453	4,089			
3	Library of School of Architecture	55,485	24,539	80,024			
4	Library of School of Engineering Science	13,352	33,602	46,954			
5	Electrical and Electronic Engineering Library	15,092	15,338	30,430			
6	Library of Industrial Chemistry	3,839	3,472	7,311			
	Total	152,191	182,884	335,075	2,883	3,343	6,226




Budgets

Category	F/Y2017 (¥1000)	F/Y2018 (¥1000)	F/Y2019 (¥1000)	Note
Personnel expenses	5,460,001	5,440,481	5,385,964	
General expenses	1,836,314	1,851,025	1,871,129	
Revenues from Sponsored Research (Income)	2,346,682	3,026,575	2,410,316	
Revenues from Collaborative Research (Income)	640,392	663,277	713,249	
Revenues from Collaborative Projects (Income)			53,100	
Revenues from Donations for scholarships (Income)	355,432	382,144	589,515	
Academic Consulting (Income)	33,485	45,646	37,836	
Subsidies for Scientific Research (Income)	2,432,064	2,196,136	1,990,785	
Other subsidies (Income)	72,401	164,010	168,782	
Other large-scale projects (Income)	765,351	792,000	719,400	Cooperative projects with other departments in large-scale project etc.

9. Award Winning Researchers in Kyoto University

Kyoto University is acknowledged as one of the most accomplished research-oriented universities in Asia. The validity of that reputation is testified by the accolades conferred on our alumni and researchers, most notably 9 Nobel Prize laureates who undertook vital research during their time at the university. In addition to those awards, several other Kyoto University faculty members have received respected accolades, including two Fields Medalists and one recipient of the Gauss Prize.

Nobel Prize

Kenichi Fukui

Ryoji Noyori

Isamu Akasaki

2019	Chemistry	Yoshino Akira
2018	Physiology or Medicine	Honjyo Tasuku
2014	Physics	Isamu Akasaki
2012	Physiology or Medicine	Shinya Yamanaka
2008	Physics	Makoto Kobayashi
2008	Physics	Toshihide Maskawa
2001	Chemistry	Ryoji Noyori
1987	Physiology or Medicine	Susumu Tonegawa
1981	Chemistry	Kenichi Fukui
1995	Physics	Shinichiro Tomonaga
1949	Physics	Hideki Yukawa

Fields Medal

1990	Mathematics	Shigefumi Mori
1970	Mathematics	Heisuke Hironaka

Gauss Prize

2006	Mathematics	Kiyoshi Ito

Lasker Award

2014	Basic Medical Research	Kazutoshi Mori
2009	Basic Medical Research	Shinya Yamanaka
1998	Basic Medical Research	Yoshio Masui
1989	Basic Medical Research	Yasutomi Nishizuka
1987	Basic Medical Research	Susumu Tonegawa

Japan Prize

2005	Information and Media Technology	Makoto Nagao
2005	Cell Biology	Masatoshi Takeichi
2004	Chemical echnology fou tho Environment	Kenichi Honda

Kyoto Prize

2018	Basic Sciences	Masaki Kashiwara
2016	Advanced Technology	Takeo Kanade
2016	Basic Sciences	Tasuku Honjyo
2013	Basic Sciences	Masatoshi Nei
2010	Advanced Technology	Shinya Yamanaka
2009	Advanced Technology	Isamu Akasaki
2004	Advanced Technology	Alan Curtis Kay
1998	Basic Sciences	Kiyoshi Ito
1995	Basic Sciences	Chushiro Hayashi

10. Campus Map

Access from International Airports

JR Kyoto Station

Osaka International Airport (Itami) → JR Kyoto Station
- About 50 min. Airport Limousine Bus

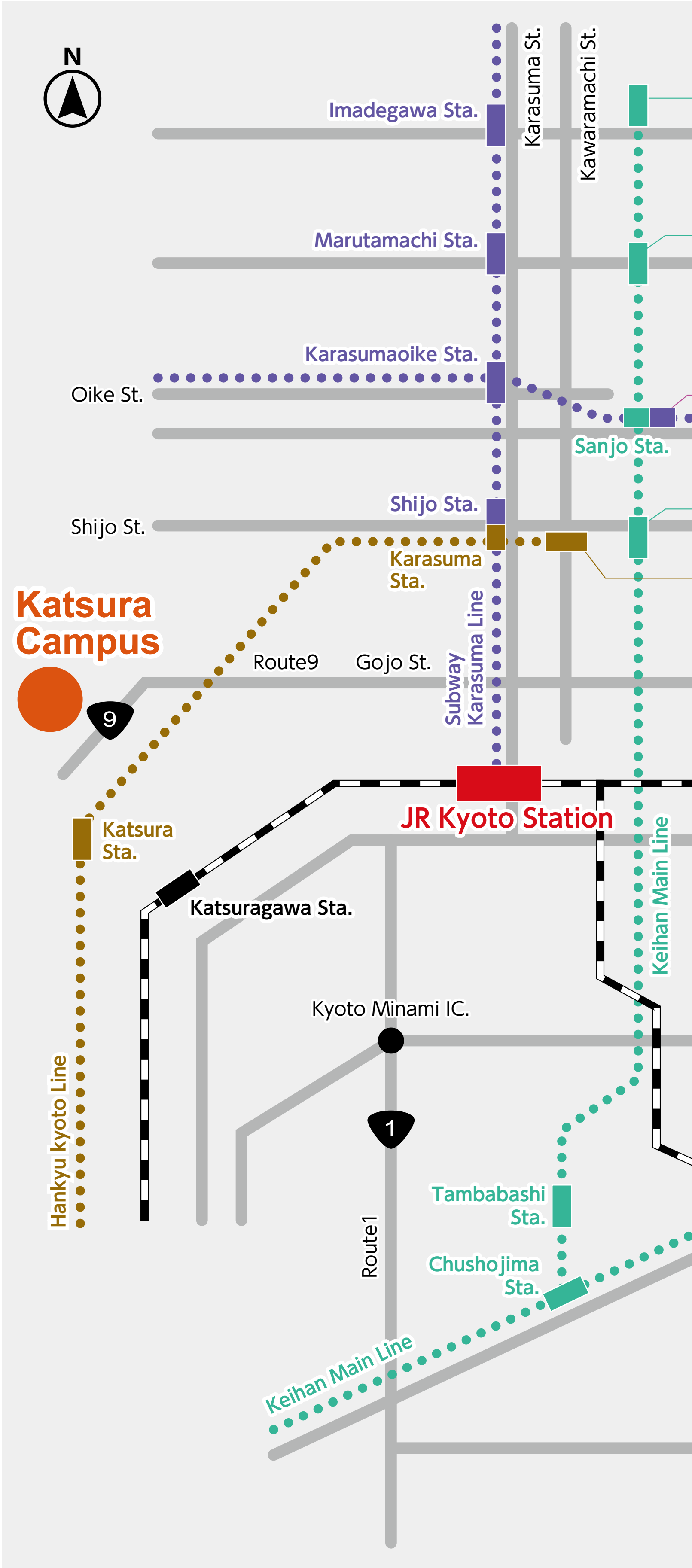
Kansai International Airport → JR Kyoto Station
- About 75 min. JR Airport Express "Haruka"
- About 105 min. Airport Limousine Bus

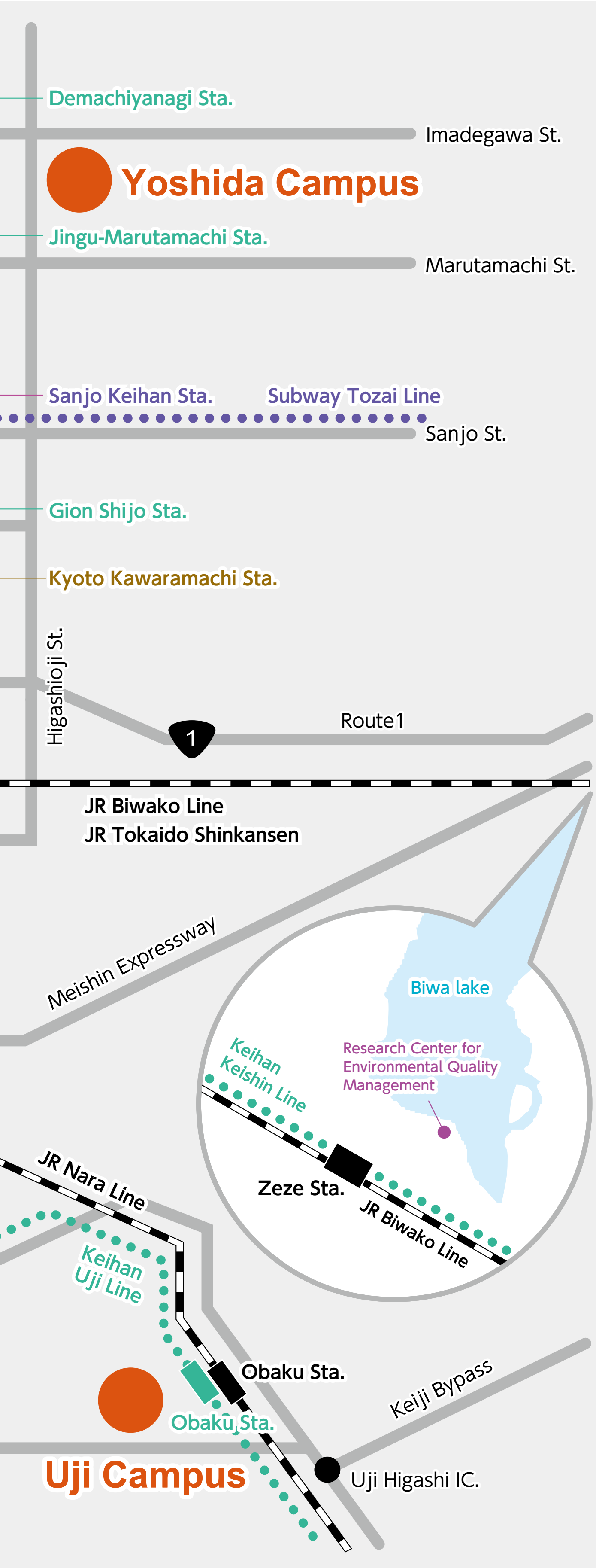
JR Kyoto Station → **Katsura Campus**
- Keihan Kyoto Kotsu Bus: (No. 21 or 21A) Get off at "Kyodai Katsura Campus-mae" About 45min.
- Taxi: About 35 min.

Hankyu Railway Katsura Sta. → **Katsura Campus**
- Keihan Kyoto Kotsu Bus: (No. 20 or 20B) City Bus: (West No. 6) Get off at "Kyodai Katsura Campus-mae" About 12 min.
- Taxi: About 10 min.

JR Kyoto Station → **Yoshida Campus**
- City Bus: About 30 min. (No. 206) Get off at "Kyodai Seimon-mae" About 30 min.
- Taxi: About 30 min.

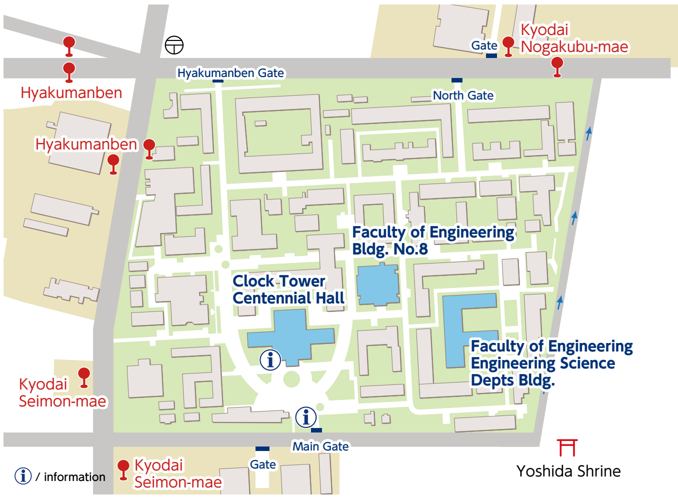
JR Kyoto Station → **Uji Campus**
- Local Train: About 20-25 min.
- JR Nara Line "Obaku"





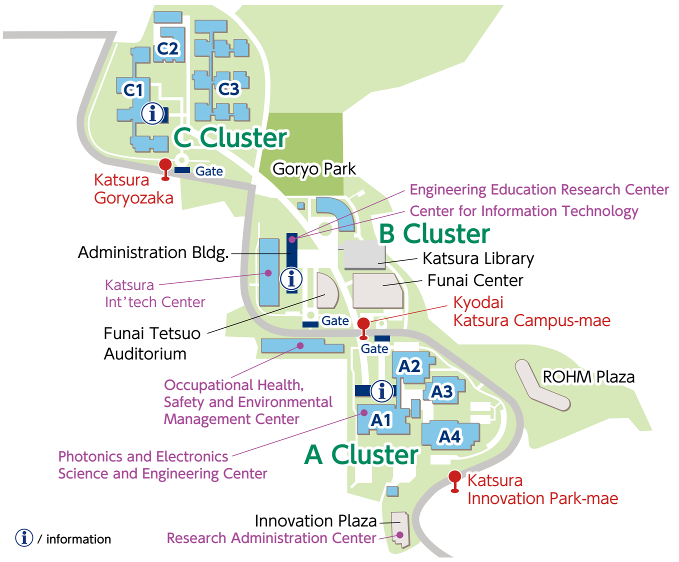
Kyoto University Yoshida Campus

Yoshida-Honmachi, Sakyo-ku, Kyoto 606-8501



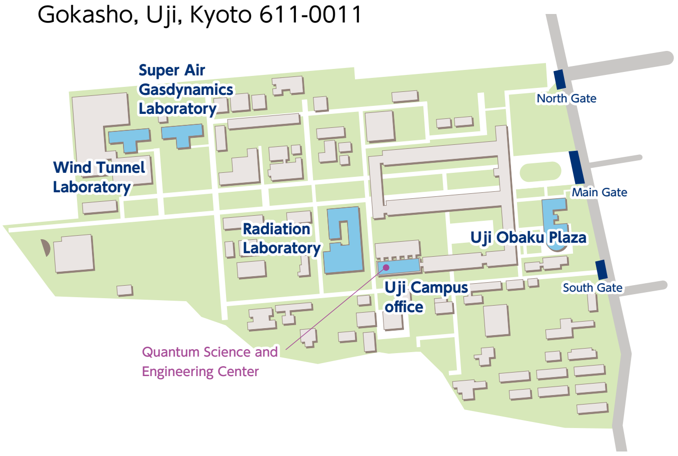
Kyoto University Katsura Campus

Kyoto daigaku-Katsura, Nishikyo-ku, Kyoto 615-8530



Kyoto University Uji Campus

Gokasho, Uji, Kyoto 611-0011



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