2015

Kyoto University

Graduate School of Engineering/
Faculty of Engineering Outline

KYOTO UNIVERSITY
KYOTO JAPAN
FOUNDED 1897

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2015 Kyoto University Graduate School of Engineering/Faculty of Engineering Outline

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1. Greeting from the Dean of the Faculty

Shinzaburo Ito

Prospective students have choices of six engineering schools in Kyoto University; the schools of Global Engineering, Architecture, Engineering Science, Electrical and Electronic Engineering, Information and Mathematical Science, and the school of Industrial Chemistry. The research field collectively dubbed “Engineering” in academia seeks to utilize natural principles clarified by studies in the natural sciences, mathematics, physics, chemistry and biology to develop technologies that brings more convenience and richness to our lives and allows us to create an affluent earth-friendly society. Taking into account that Japan has limited energy resources, development of those science and technologies is essential to achieve a more prosperous future for the country.
To become researchers and engineers who can achieve these goals, first and second-year students learn fundamental subjects in the natural sciences as part of the general education component of their programs (though the weight varies among the departments), together with subjects in the liberal arts, social sciences, and foreign languages. It is crucial to master these fundamental courses in order to become an engineer or researcher who has a broad outlook and can play an active role in international society.
From the second half or the third year, the focus of study shifts to students’ major subjects and most of the courses are provided from their school. In addition to courses strongly related to their major, there are some courses that are transdisciplinary and take place outsides of school. These may be on basic but more specialized subjects in the natural sciences which is shared among the entire field of engineering, or on new subjects which have arisen among multiple engineering disciplines. The courses consist of not only lecture classes but laboratory training to learn fundamental experimental knowledge and skills. In the fourth year, a student usually belongs to one of research groups in his/her school and tackle his/her own research for their graduation thesis. Students are expected to spend a majority of their time in their laboratories to immerse themselves in research and carry out cutting-edge and pioneering research.
Although some students find a job in industry after graduation, a majority of graduates (85% by recent data) from the Faculty of Engineering, Kyoto University, proceed to graduate school. Most of them go on to either the Graduate School of Engineering, the Graduate School of Energy Science, the Graduate School of Informatics, or the Graduate School of Global and Environmental Studies at Kyoto University, which have a strong connection with the six undergraduate schools. Th ough a two-year master’s course, they study more specialized and technical knowledge and also continue to conduct research in their laboratories. Some of these master’s students proceed to a doctoral (PhD) course to become researchers. The Graduate School of Management was established as a professional graduate school relevant to engineering in 2006. Each graduate school distributes their own guidance brochure which introduces their school in detail. It is important to look through the six graduate schools when he or she applies the Faculty of Engineering at Kyoto University to assess his or her future career options.
The guidance brochure “Faculty of Engineering, Kyoto University” explains the detail of curriculum and courses of each school throughout the four years. It also introduces recent research themes for graduation theses, which might be helpful in deciding which school a prospective student is best suited for.

In conclusion, I have given an outline of the Faculty of Engineering, Kyoto University. We are providing a high-quality education through cutting-edge, fundamental, and applied research. I welcome students to the Faculty of Engineering, Kyoto University who are highly motivated, inquisitive and ready to tackle challenging research and open hitherto untouched fields

2. Philosophy and Objectives

Faculty of Engineering

Admission Policy

The following persons are welcome to enroll in our program:

1. Individuals who possess a thorough command of the knowledge from their secondary school education, and who have the competence to undertake a post-secondary education in fundamental scientific principles in the Faculty of Engineering.
2. Individuals who are free of preconceptions, who strive to verify and understand the mechanisms behind matters firsthand.
3. Individuals who have the enthusiasm and vitality to creatively explore new fields of technology.

Curriculum Policy

The Kyoto University Faculty of Engineering emphasizes the building of a solid foundation for learning, under the tradition of a liberal academic environment. A liberal academic environment is one where students are encouraged to view the world free of preconceptions by garnering a scientific eye. This entails the development of a critical attitude toward academia, and becomes a solid foundation for learning. It is widely perceived that the focus of the faculty of Engineering is largely on applied technologies.

However, the Kyoto University approach differs from the general perception and is somewhat unique. In short, the Kyoto University Faculty of Engineering adheres to its principle academic approach based on its belief that a deep understanding of the basics is essential for applying technologies to a wide variety of situations in the future.

Here is a more detailed description of our undergraduate program. During the first and second years after enrolling as undergraduate of the Kyoto University Faculty of Engineering, students take general education courses common to all science course students. They are also required to take liberal arts, as well as English and/or other foreign languages. At the same time, department/program specialization begins from the first year, gradually increasing in weight. In their fourth year, individuals take up a special research project on a specific theme. Students are assigned to their chosen laboratory for their project, where they are able to conduct their studies in a cutting-edge environment together with graduate students and supervising academics. Students who continue on to graduate school can enjoy a more advanced level of specialized education and research guidance.

Through this approach to education, the Kyoto University Faculty of Engineering has continually turned out alumni who are capable of applying their expertise to a broad range of activities, independently and creatively tackling entirely new challenges, and who possess a deep knowledge base and strict sense of integrity.

Graduate School of Engineering

Admission Policy

The Graduate School of Engineering welcomes the following:

1. Individuals who identify with the principles and objectives of the Graduate School of Engineering and possess the basic expertise and enthusiasm to pursue them.
2. Individuals who have the basic education required to pursue the truth on their own and have the understanding and judgment to think beyond established norms.
3. Individuals who have a strong desire and initiative to pioneer new fields of knowledge.

Curriculum Policy

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 the fundamentals and in harmony 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.

The graduate school aims to educate technicians and researchers at the Master's course level to acquire a broad range of knowledge and international sensibilities and to instill highly tuned abilities for seeking out and solving problems. At the Doctorate course, research skills are nurtured through basic and applied research and practical teachings to become leaders at the international level, able to organize research teams in innovative research fields. To this end, the Graduate School of Engineering offers a joint Master's and Doctorate education program, in addition to the conventional Master's program.

3. Organization Chart

Graduate School of Engineering

- 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 ∗1
- Electrical Engineering
- Electronic Science and Engineering
- Material Chemistry
- Energy and Hydrocarbon Chemistry
- Molecular Engineering
- Polymer Chemistry
- Synthetic Chemistry and Biological Chemistry
- Chemical Engineering

- Photonics and Electronics Science and Engineering Center
- Research Center for Environmental Quality Management ∗2
- Quantum Science and Engineering Center ∗3
- Katsura Int'tech Center
- Center for Information Technology
- Occupational Health, Safety and Environmental Management Center
- Center for Global Leadership Engineering Education

- Kyoto Transport Policy Research Unit
- Research Administration Center
- ´e Unit for Enhancement of Engineering Higher Education in Myanmar

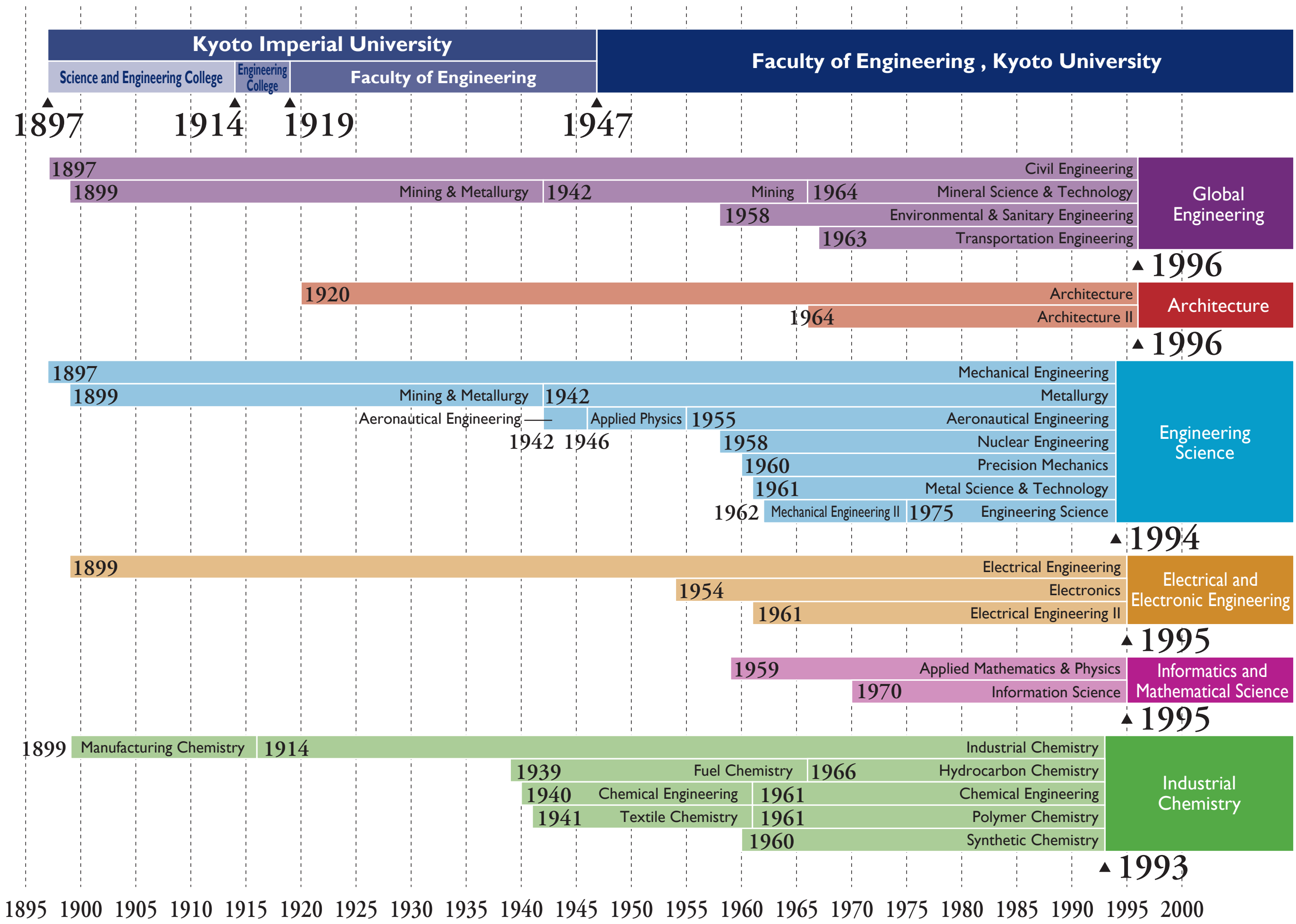
Faculty of Engineering

- Global Engineering
- Architecture
- Engineering Science
- Electrical and Electronic Engineering
- Informatics and Mathematical Science
- Industrial Chemistry

- Graduate School of Energy Science ∗1
- Graduate School of Informatics ∗1
- Graduate School of Global Environmental Studies ∗1

∗1 : Yoshida campus
∗2 : Yumihama, Otsu
∗3 : Uji campus

4.History



Courtesy of Kyoto University Archives

- 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 in the establishment of the School of Industrial Chemistry in 1993, the School of Engineering Sciences in 1994, the School of Electrical and Electronic Engineering and the School of Informatics and Mathematical Science in 1995, and the School of Global Engineering and the School of Architecture in 1996, and heralded the launch of a new Faculty of Engineering for the twenty-first century.

5. Faculty of Engineering

Undergraduate Schools

- Global Engineering
- Architecture
- Engineering Science
- Electrical and Electronic Engineering
- Informatics and Mathematical Science
- Industrial Chemistry

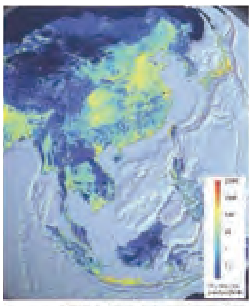
Global Engineering

Overviews

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. Now that the door has been opened to 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 Biology, Chemistry, Earth Science, Physics and Math 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 will be separated into one of three groups: Civil Engineering course, Environmental Engineering Course, and Earth Resources and Energy Engineering Course.



Carbon Dioxide Emission in Asia

Courses

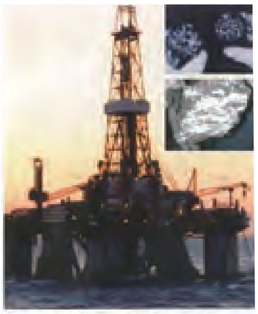
Civil Engineering

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 some 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.

Akashi-Kaikyo Bridge



Research Consortium for Methane Hydrate Resources

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.

Connection to 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

Overviews

Architecture, which forms the human environment and nurtures a safe, healthy and comfortable life, is emerged 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 normal life. For this distinctive feature of architecture, we arranged our curriculums to help students simultaneously reaching out these interdisciplinary knowledge in natural, cultural and social sciences.
Career prospects of our graduates have been similarly diverse, and involving in various positions ranging from architects, structural engineers, architectural environmental engineers, construction engineers, architectural administration officers, planners of various development projects and other related executives.

Curriculum

The curriculum of the School of Architecture is divided into 3 fields, which are namely the Planning and Design, the Structural Engineering, and the Environmental Engineering domains, according to the objects and methodologies of each of these study areas.

Courses

Planning and Design

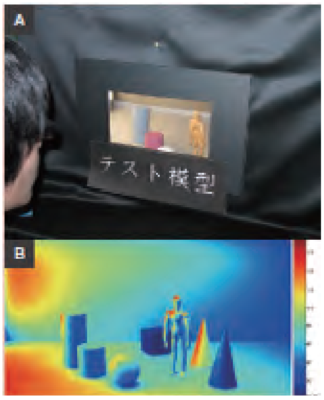
Planning and Design is the field aiming for clarifying the spatial compositional principles in housings, various building complexes and urban-regional spaces, and also for the education and research on the theories and methodologies in architectural planning, urban planning, urban design, project management, and etc. In addition, by the process of studying the historical development of architecture revolutions, it is to help nurturing students' insight in space planning and modeling skills for space creation.

Structural Engineering

Structural Engineering is the study of the construction of enduring buildings which can also stand against natural hazards such as earthquakes and typhoons. The progressive advancement of structural engineering technology makes it possible to realize superstructures such as super skyscrapers, all-weather big scale baseball stadiums, and etc. In addition, this advancement implies the potential of further expansion of design theories, architectonic methods and construction skills, as well as the opportunity to exercise the potential application of knowledge gained in natural science.

Environmental Engineering

Environmental Engineering is the study of building system planning, which can realize relatively more comfortable habitual space by the analysis of physical phenomena of environmental factors such as heat, air, light, sound and etc., and the related physiologic and psychological impact on human body. In recent years, the concern towards environmental safety is getting more important, due to the increasing correlation of global environmental crisis with architectural and urban problems, and remarkable technological progression of computerization which together cause the higher and various demands on architectural advancement. We are aimed to nurture the problem solving capability in regards to issues based upon natural, cultural and social sciences.



Connection to Graduate School

Undergraduate
School of Architecture → Graduate School of Engineering: Dept. of Architecture and Architectural Engineering

Engineering Science

Overviews

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.

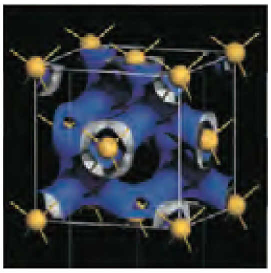
Curriculum

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, Energy Science 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.

Energy Science 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 Graduate School

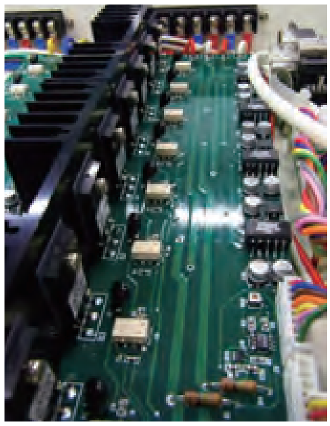
Undergraduate
School of Engineering Science

- 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

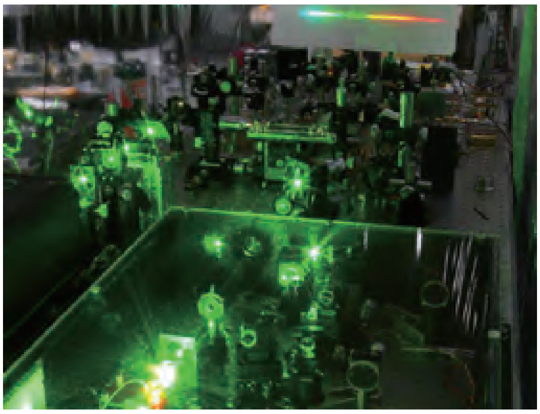
Overviews

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.



Power integrated circuits (power router) based on SiC

Antenna Array of Antarctic Syowa MST/IS Radar

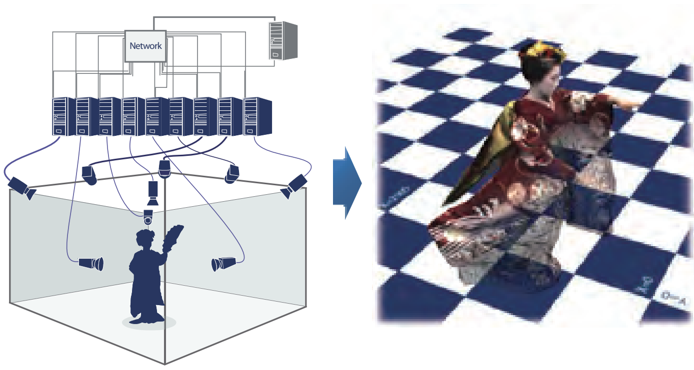


Frequency Standard: "Optical-Frequency Comb"

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.



3D image Generation from Multi-View Images

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

Connection to Graduate School

Undergraduate

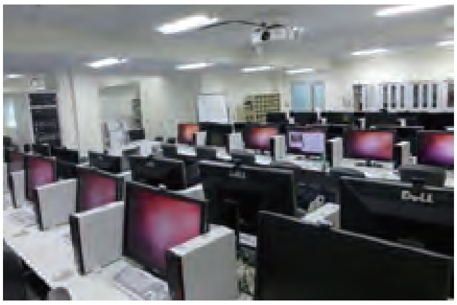
School of Electrical and Electronic Engineering →

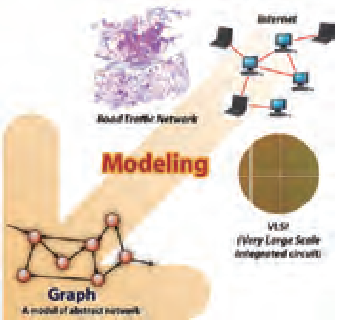
- Graduate School of Engineering
- Graduate School of Energy Science
- Graduate School of Informatics

Informatics and Mathematical Science

Overviews

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 the actual problems of sophisticated systems through the thinking of mathematic science.





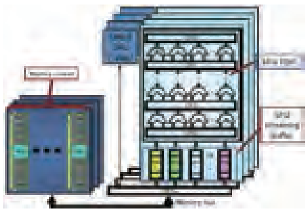
Curriculum

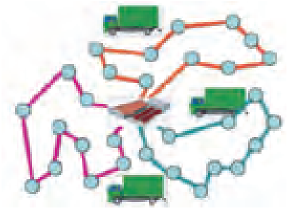
Because information science is essentially related to many fields, the education policy of the School of Informatics and Mathematical Science places emphasis on providing students with a broad perspective. Students of this School are taught by the instructors of the Graduate School of Informatics and 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.

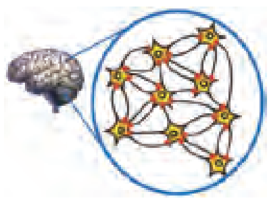
Courses

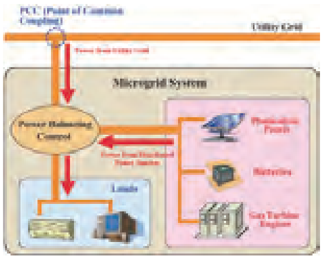
Applied Mathematics and Physics Course

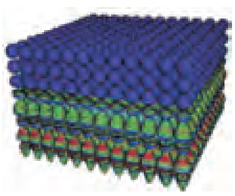
In the Applied Mathematics and Physics Course, students chiefly study mathematics and physics as the basis of mathematical science, control theory that is the basic field of systems engineering, and operations research that applies the methods of mathematical science, along with such fields as systems 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 study. Applied mathematics and physics is an academic discipline that plays the role of comprehensive engineering while placing emphasis on both the basics and flexible idea development in engineering. This Course aims at developing the academic ability required to achieve this objective.

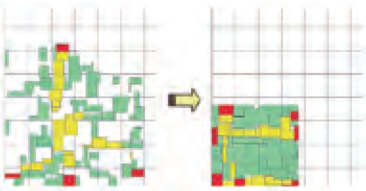












Computer Science Course

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 Graduate School

Undergraduate
School of Informatics and Mathematical Science

Graduate School of Informatics

- Dept. of Applied Mathematics and Physics
- Dept. of Systems Science
- Dept. of Applied Analysis and Complex Dynamical Systems
- Dept. of Intelligence Science and Technology
- Dept. of Social Informatics
- Dept. of Communications and Computer Engineering

Industrial Chemistry

Overviews

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. Each senior 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 courses and will receive advanced education from the Department's faculty in the areas including physical chemistry, organic and inorganic chemistry, analytic chemistry, polymer chemistry and chemical process engineering. In continuation of the curriculum of the first year and half, students will take courses related to their future specialization in the following three courses from the second semester of the second year. The student ratio of the three courses 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.

Courses

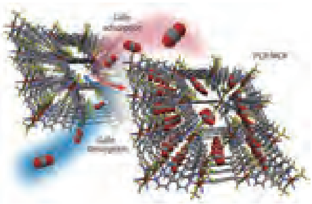
Frontier Chemistry

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

Fundamental Chemistry

Students in this course 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.

Our goal: To mentor students to become well-rounded, creative, highly-trained researchers with high ethical standards, who appreciate basic research and can lead science in a sustainable manner.



Molecular simulation for gas adsorption on PCP/MOF

Chemical Process Engineering

This course program is designed to teach students the following three principle axes of investigation: 1) Identify and extract the principle 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.

Connection to 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 & Architectural Engineering
- Mechanical Engineering and Science
- Micro Engineering
- Aeronautics and Astronautics
- Nuclear Engineering
- Materials Science and Engineering
- Electrical Engineering
- Electronic Science and Engineering
- Material Chemistry
- Energy and Hydrocarbon Chemistry
- Molecular Engineering
- Polymer Chemistry
- Synthetic Chemistry and Biological Chemistry
- Chemical Engineering

Civil and Earth Resources Engineering

Overviews

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.

Researches

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.

Urban Management

Overviews

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.

Researches

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.

Logistics Management Systems

The chair investigates efficient, environmentally friendly, and safe urban freight transport systems as well as management for sustainable and livable cities. We address logistics and supply chain systems using mathematical models to evaluate the social, environmental, and economic impacts of policy measures.

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.

Environmental Geosphere Engineering

Distribution analyses of mineral, water, and energy resources using remote sensing, and mathematical geology, and geochemistry; reservoir evaluation for storage properties of crustal gases and fluids; and assessment and spatio-temporal modeling of crustal environments from shallow to deep depths.

Urban Regional Disaster Control

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

Overviews

Science progress has brought in substantial prosperity to human beings. However, under such circumstance, it is true that many environmental problems have occurred to become the menace to human health and life. In addition, as is typified in global environmental issues like climate change, we are now facing global limit 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 overcome such environmental issues unique to region, to integrally seek for a new society for the 21st century.

To respond to the above demands, the Department of Environmental Engineering is promoting education and research on various environments ranging from individual life space to regional and global environments, with close cooperation 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 environment, and to establish new environmental science.

Researches

Water Supply, Wastewater Treatment, and Management of Aquatic Environment

Technologies on water include: development of advanced drinking water treatment systems, wastewater treatment technology 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 of micro-pollutants in the environment, water quality monitoring technology, assessment method of bioconcentration of organic micropollutants.

Environmental Modeling and Environmental Health

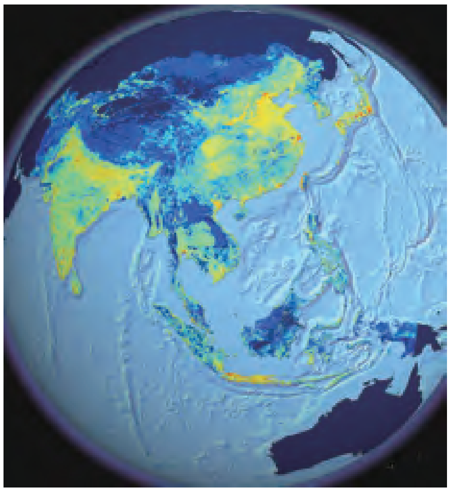
Human activities discharge a huge amount of pollutants and greenhouse gas into the environment, causing climate change and adverse effects on human health and eco-system. This field includes: the development of integrated assessment models of environment and their application to policy, analysis of long-range 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.



(Top) CO_2 emission map in Asia, (Center) development of new water treatment system, (Bottom) field survey in oversea research site

Architecture and Architectural Engineering

Overviews

Contemporary society requires highly complex functions from architectural design and urban planning. As well 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 aims at a higher education program that promotes both basic and advanced research in order to construct creative methodologies and operational systems, as well as training excellent people to acquire humanist skills.

Researches

■ Regenerative Preservation of Built Environment
Design method and regenerative preservation technology of sustainable built environment

■ Architecture and Human Environmental Engineering
Design and science for architecture and living environment based on the human cognition and behavior

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

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

■ Architectural Environmental Planning / Architectural and Environmental Planning
Design methodology to read and to create the built environment as human-environment system

■ Architectural Environmental Planning / Building Environment Control
Towards eco-friendly and human-oriented architecture inheriting culture

■ Architectural Design and Theory / Architectural Design and Theory
Expansion of the possibilities of architectural thinking

■ Architectural Design and Theory / Architecture and Environmental Design
Thinking a new architectural design theory

■ 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 method for architecture design & restructuring of fair system for design, construction and management

■ Architectural Construction Engineering / Space Development and Structural Systems
Development of design and construction technology to build architectural space by steel structure

■ Built Environment Materials and Structural Systems
Research on application of new materials to architecture and building structural systems in next generation

■ Housing and Environmental Design
Research and design concerning the optimal relationship between people and the urban 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 acoustic environment and its control

■ Architectural Environment Systems / Building Geoenvironment Engineering
Toward design of safer and robuster building structures via innovative seismic-control technologies

■ Disaster Mitigation Engineering / Earthquake Resistant Engineering
Development of disaster mitigation technologies through studies on earthquake responses of ductile building structures

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

■ Disaster Mitigation Engineering / Environmental Wind Engineering
Aiming at the creation of wind environmental engineering for disaster reduction and comfort

■ Space Safety Engineering / Earthquake and Tsunami Resistant Design for Structures
Earthquake and tsunami resistant design for urban structures based on serviceability, reparability and safety limit states

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

■ Global Environment Architecture (Graduate School of Global Environmental Studies)
Design for safe and harmonious human environment rooted in local culture and contexts

Group of Mechanical Engineering Departments

Overviews

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.

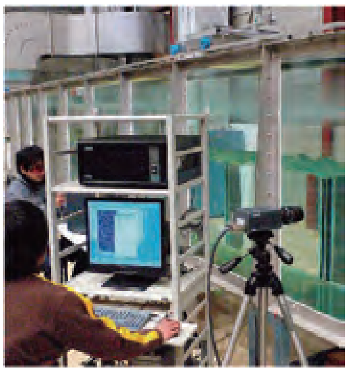
Mechanical Engineering and Science

Overviews

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".

Motion understanding

Magnetically levitated train is developed based on the state-of-the-art mechanical engineering research



Laboratory experiments to investigate the thermal and particle transports through the wind-driven air-water interface

Researches

Mechanical Systems Design

Design of human-machine systems, System engineering, Human-centered automation

Manufacturing Systems Engineering

Manufacturing system, Optimum Design, Topology optimization, Design engineering

Mechanics of Adaptive Materials and Structures

Advanced composite materials, Deformation and fracture, Micromechanics, Processing, Smart materials and structures

Solid Mechanics

Material modeling, Atomistic simulations, Statistical mechanics, Lattice defects, Hydrogen effects on metals

Mechanics of Thermal Fluid and Material

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

Environmental Fluids and Thermal Engineering

Fluid dynamics, Turbulence, Environmental flow, Multiphase flow, Combustion, Chemical reaction

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
Nanoscale transport phenomena, Particle-based simulation, Radiation heat transfer

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

■ Vibration Engineering

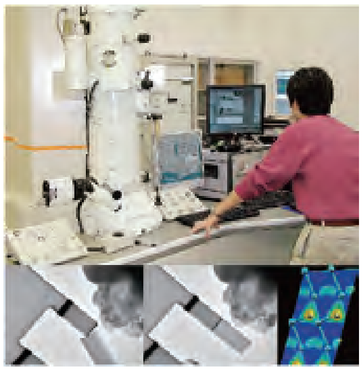
■ Machine Element and Functional Device Engineering
Mechanism, Robot, Transmission, Actuator, Design, Measurement, Accuracy

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

■ Advanced Imaging Technology
Analytical imaging, Multispectral imaging, Ultra high resolution system design and development

■ Materials and Radiation
Nuclear materials, Radiation effects in materials, Interaction with defects and hydrogen or helium in materials, Lattice defect

■ Physics of Neutron Scattering
Atomic structure, Physical property, Functional material

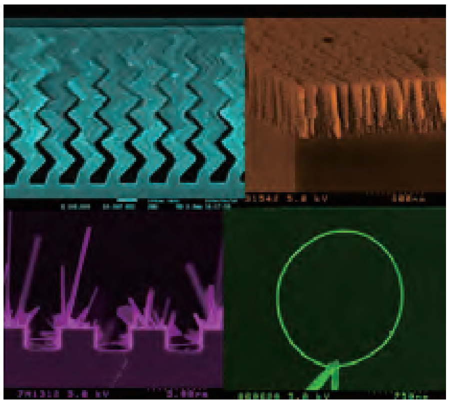


In situ observation and atomic scale simulation to investigate the deformation and fracture mechanics of the nano-scale materials.

Rescue robot

Micro Engineering

▷▷ Overviews
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.



Examples of nanomorphology tailored by oblique angle deposition technique

▷▷ Researches

■ Nanometrix Engineering
Microfluids engineering, Electrokinetics, Single cell analysis, Nano-biomolecular-system, Motor proteins

■ Nano/Micro System Engineering
3D Fabrication and material property characterization for Nano/Microsystem, DNA nanotechnology

■ Nanomaterials Engineering
Quantum beam science, Ion surface interaction, Ion beam analysis, Molecular imaging

■ Quantum Condensed Matter Physics
Quantum electrodynamics, Rigged QED, Quantum energy density, Stress tensor, Spin torque, Zeta force, Quantum gravity

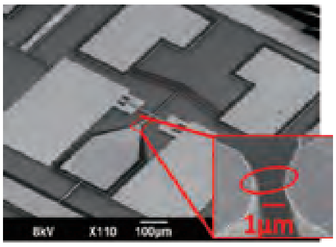
■ Micro Process Engineering
Control of nanomorphology, Physical self-assembly, Nanowires, Shape-related useful properties

A prototype high-precision machine tool designed and developed to test various positioning-related technologies

■ Precision Measurement and Manufacturing
Manufacturing, Machine tools, Machining process control, Metrology, High-precision positioning technology

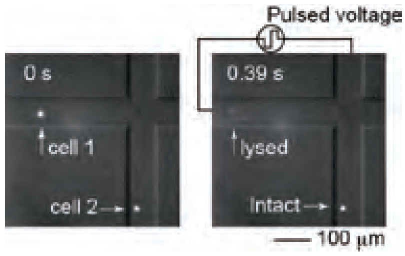
■ Biomechanics
Molecular, Cellular and tissue biomechanics, Mechanobiology, Adaptation, Mechano-chemical coupling

■ Nano Bioprocess
Single-molecule biophysics of the cellular plasma membrane and its signal transduction function



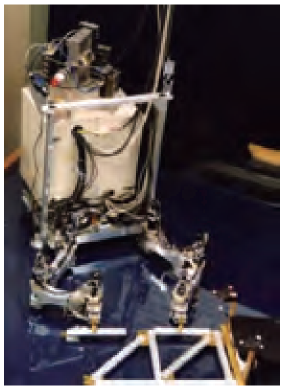
Micro Electro Mechanical Systems to reveal mechanisms of strength and fatigue properties of SWCNT

Fast and selective electrical lysis for single cell analysis; our technique enables simultaneous analysis of RNA and DNA at single cell level



Aeronautics and Astronautics

Overviews
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

Researches

■ 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

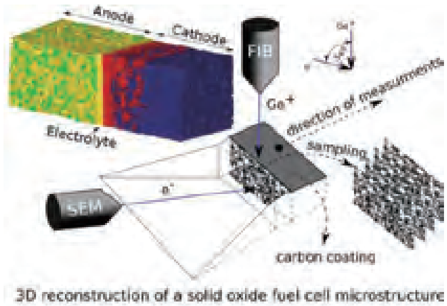
■ Mathematical Fluid Mechanics
Kinetic theory and fluid mechanics for nonequilibrium systems

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

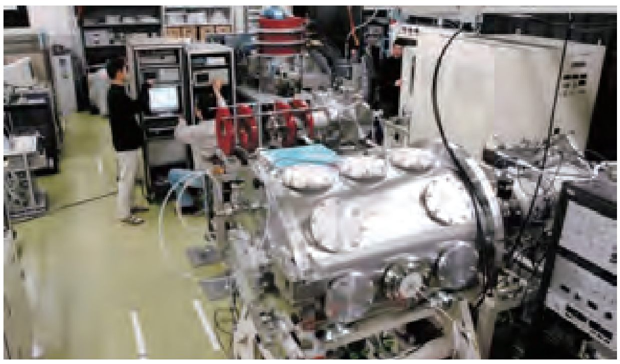
■ Systems and Control
Control theory, Nonlinear control, Statistical learning, Aerospace systems, Reliability engineering

■ Mechanics of Functional Solids and Structures
Elastic wave propagation, Nondestructive evaluation and structural health monitoring, Origami engineering

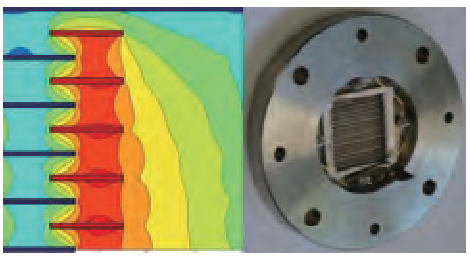
■ Thermal Engineering
Heat, Mass and Charge Transfer, Energy conversion, Reactions, SOFC, Reformer, Catalytic combustion



Microstructure quantification of porous electrodes for fuel cells



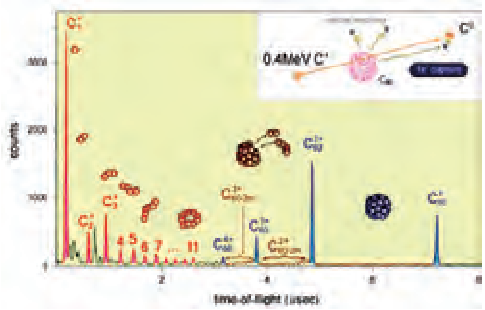
Experimental apparatuses for plasma propulsion and plasma-surface interactions (Super-gasdynamics laboratory in Uji campus)



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

Nuclear Engineering

Overviews



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.

Researches

■ 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 safe uses of nuclear energy and more reliable disposal of radioactive wastes in terms of nuclear materials and nuclear chemistry.

■ Nuclear Recycle Chemistry

By clarifying the chemical phenomena and their mechanisms, we try to expand them to the development of new chemical separation and purification technique for “recycling technology”.

■ 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.

■ 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.

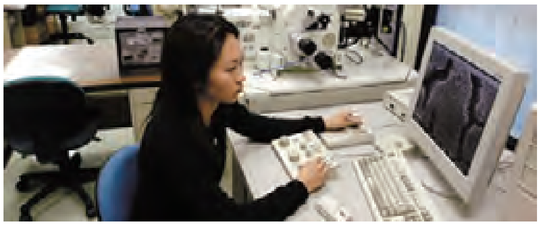
■ Neutron Sources and Applications

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. A new type neutron scattering system(VIN-ROSE) for material science is developed in J-PARC using neutron pin interferometry. Neutron imaging in Kyoto Univ. Research Reactor(KUR) is also progressing for wide variety of research fields.

Materials Science and Engineering



Overviews

Culture and civilization, both now and in the future, are shaped to a large extent by the production of materials. From stoneware, bronzeware, ironware, semiconductors, and, … what materials will be next? This department works not only on converting natural substances into materials that are useful to humanity, but also on designing and learning to create materials that do not even exist in the natural world—by working on the electronic, atomic, and molecular levels of substances. We are scientifically investigating the technology and theory for transforming substances that occur abundantly in the natural world into materials that can benefit humanity and the future of the planet.

Researches

Chair of Metallic Materials Design

Chair of Materials Processing

Aqueous Processing of Materials Laboratory
Materials Informatics Laboratory
Nanostructural Design of Advanced Materials Laboratory

Chair of Basic Study of Advanced Materials

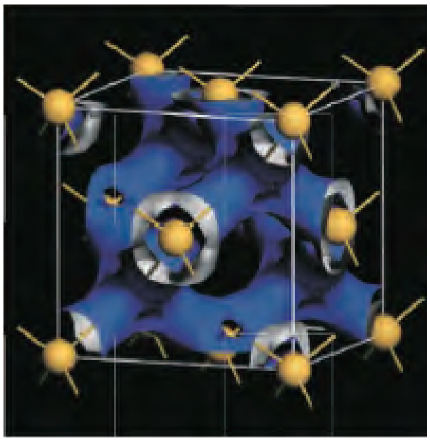
Chair of Basic Science of Materials

Materials Design Through Quantum Theory Laboratory
Property Control of Crystalline Materials Laboratory
Structure and Property of Materials Laboratory

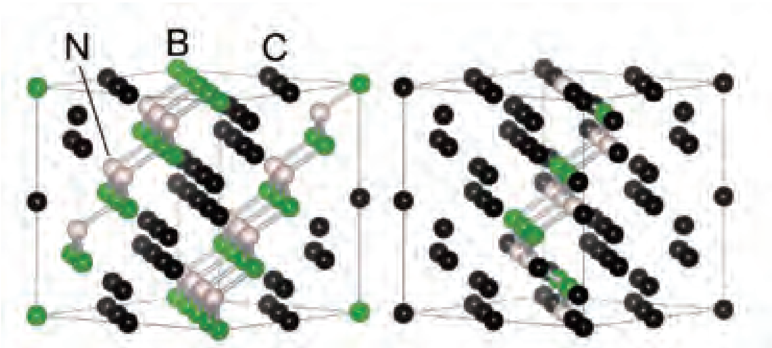
Chair of Properties of Advanced Materials

Chair of Materials Properties

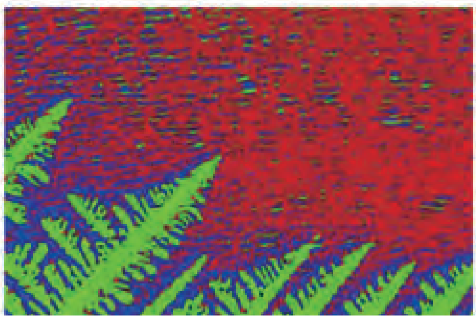
Magnetism and Magnetic Materials Laboratory
Electrochemistry and Hydrometallurgy Laboratory
Nanoscopic Surface Architecture Laboratory



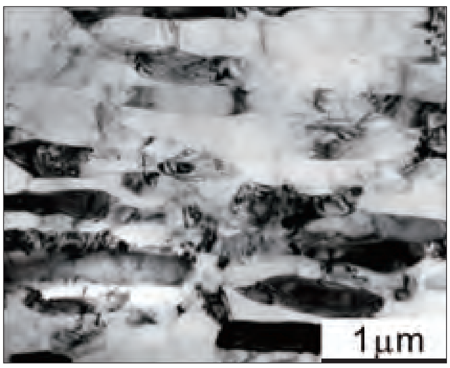
Visualization of electron density distribution in a semiconductor material



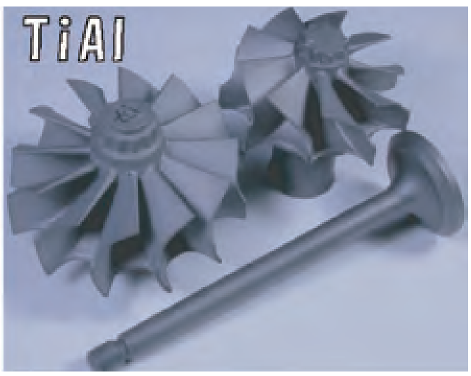
Crystal structures of theoretically-designed superhard materials



In-situ observation of dendrite crystal growth



Ultra-fine grained bulk aluminum produced by accumulative roll-bonding process



High temperature structural materials
- Turbo charger rotor of TiAl-based alloy

Electrical Engineering

Overviews

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.

Researches

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*** deals with theoretical bases commonly required by various fields in electrical engineering.

Chair of Biomedical Engineering: ***Composite Systems Theory Laboratory*** covers a broad range of research such as computational biology, nonlinear dynamical systems, medical control 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.)

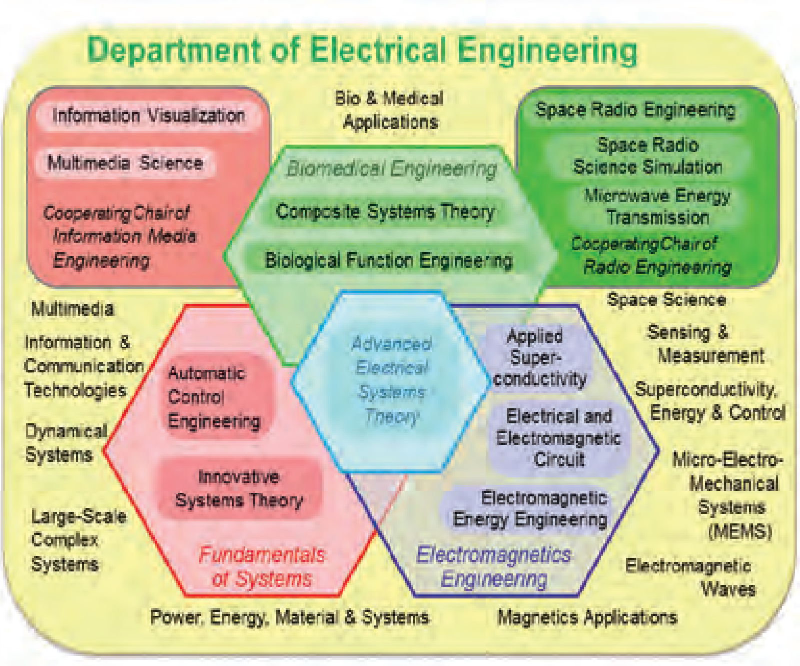



Fig. 1

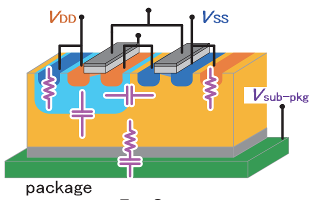


Fig. 3

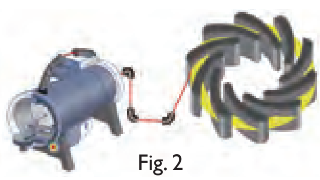


Fig. 2

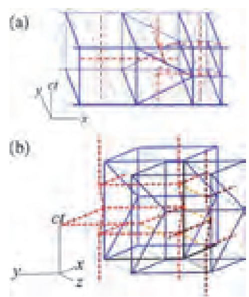


Fig. 4

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

Overviews

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.

Recent Research Highlights:

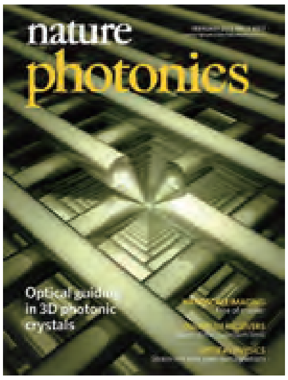
(1) Photonic crystals : In this century, photons take on an increasingly important role in our society, for example: environment-friendly solar energy, next-generation information technology based on high speed optical communication, ultra-high efficient lighting devices, material processing by photons, 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) 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.

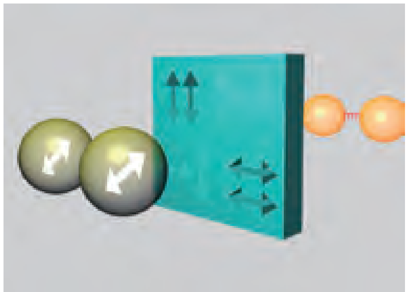
(3) White LEDs : Environmental-friendly devices with novel functions are strongly awaited. Phosphor-free white light-emitting diodes (LEDs) have been demonstrated in the structure based on micro-structured InGaN/GaN quantum wells for solid state lightings in the next generation.

(4) 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.

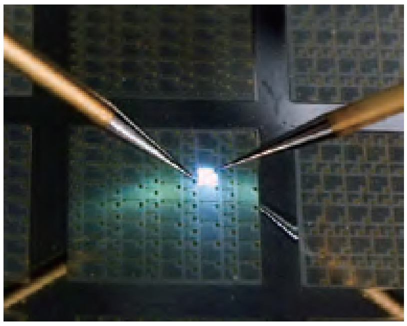
(5) Spintronics : Pure spin current, which is a flow of spin angular momentum without charge flow, enables ultra-low energy dissipation information propagation and calculation and plays one of the most pivotal roles in spintronics. The pure spin current can be generated in Si, graphene and Ge at room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



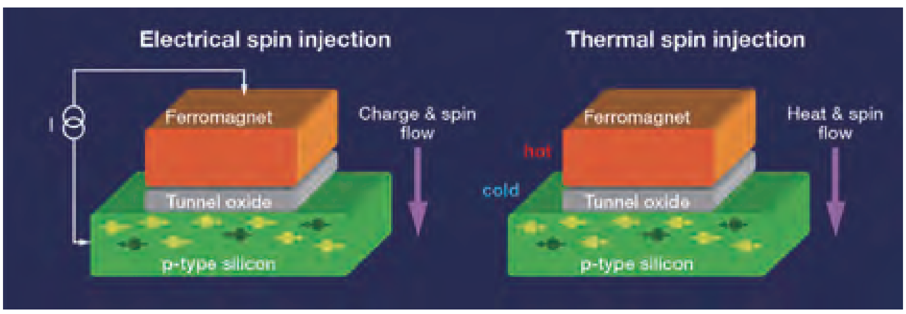
(1) Ishizaki *et al.,* Nature Photon. 2013.
(Cover picture of Vol.7, No. 2, 2013)



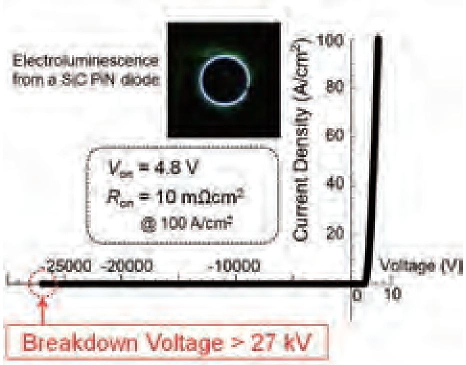
(2) Okamoto *et al.,* Science 2009.



(3) Funato *et al.,* APEX 2008.



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



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

Material Chemistry

Overviews

With the rapid development of society on the basis of science and technology, development of new materials is becoming increasingly important. This is because such materials support our contemporary way of life and industrial infrastructure, and expectations for the future roles of leading-edge chemistry are constantly rising.

Chemistry today is undergoing a transformation into an academic discipline that involves investigation of the backgrounds and properties of the molecules that compose substances, in addition to techniques for creating new substances and the search for functions inherent to substances. The Department of Material Chemistry engages in research and education for the purpose of designing materials that have new functions while elucidating their structures and properties at the molecular level, as well as establishing methods of synthesizing those materials, with an emphasis on inorganic, organic and polymer materials.

The Department of Material Chemistry consists of four 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).

Researches

The Department of Material Chemistry covers all the basic chemistry fields ranging from 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.

In order to promote the development of new functional materials based on integrated science, the Department engages in intra-departmental and extra-departmental research exchange and is developing a structure for research cooperation. The Department also accepts students and researchers from foreign countries, and actively promotes collaboration with overseas research institutions. In this way, we are undertaking the development of a research and education environment that will make the Department an international research and education center in the field of materials research.

Educational Policy

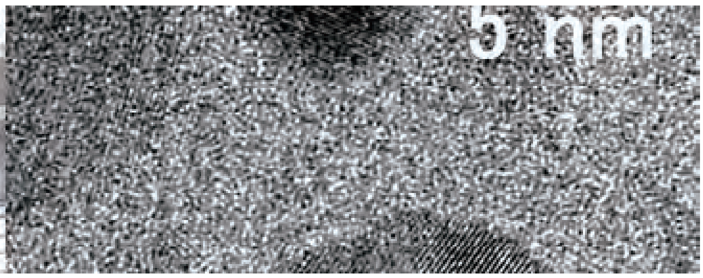
Chemistry today is undergoing a transformation into an academic discipline that involves investigation of the backgrounds and properties of the molecules that compose substances, in addition to techniques for creating new substances and the search for functions inherent to substances. The Department of Material Chemistry engages in research and education for the purpose of designing materials that have new functions and properties while elucidating their structures and properties at the molecular level, as well as establishing methods of synthesizing those materials, with an emphasis on inorganic, organic and polymer materials.

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

Overviews

The ultimate purpose of chemistry are 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.

The Department of Energy and Hydrocarbon Chemistry in the Graduate School of Engineering has designed as 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.

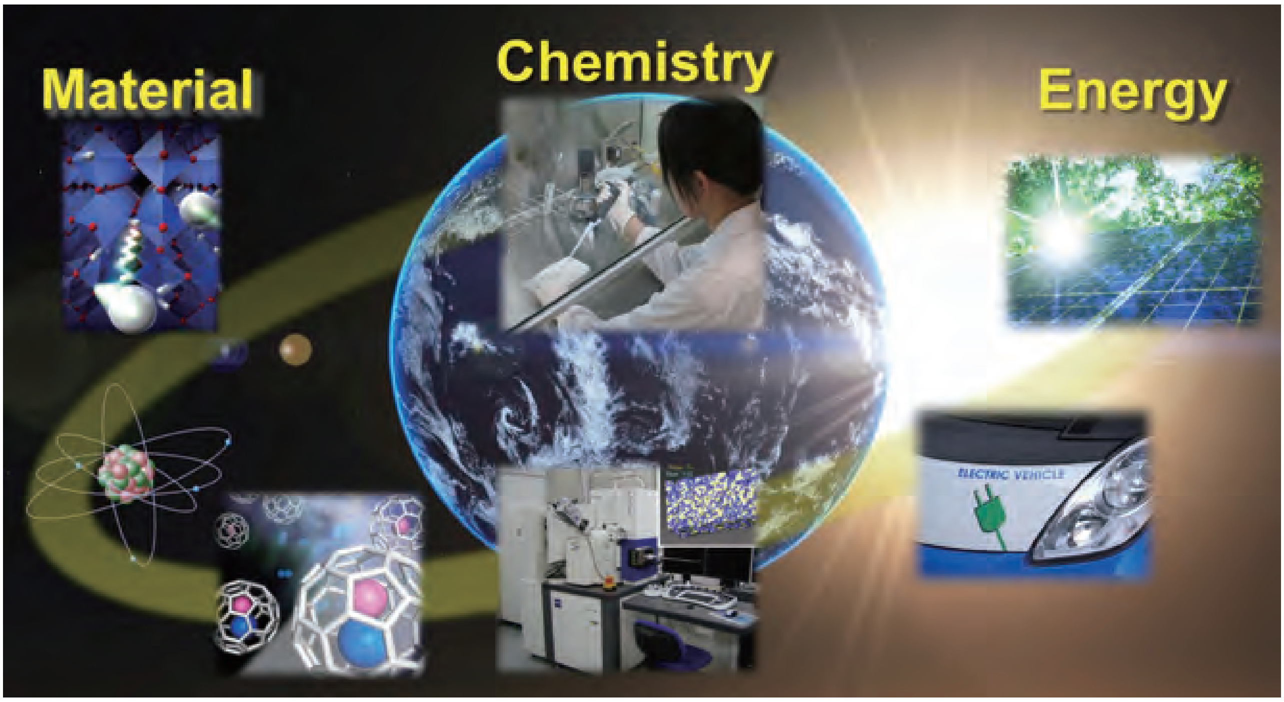
Researches

The civilization in our society was greatly developed in the 20th century; however, the rapid technological developments brought about shortage of natural resources and great stress on the global environment simultaneously. To encourage 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 recycle 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 researches are 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
- Creation of functional π–conjugated systems
- Development of molecular transformations exploiting underutilized resources
- Effective use of radioactive tracers
- Development of advanced batteries and their materials

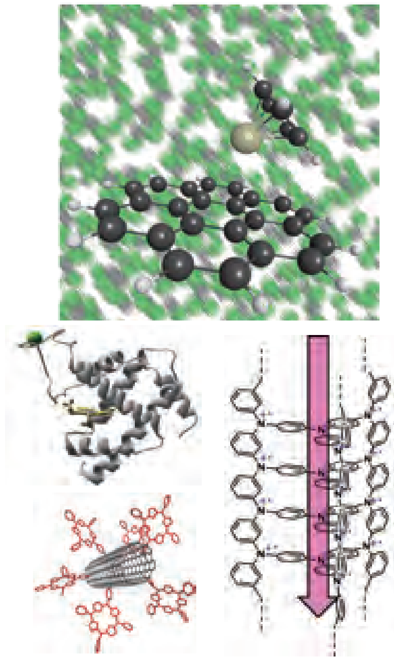


Curriculum

Thirty-five 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, catalyst science, electrochemistry, radiation chemistry, physical chemistry, organic chemistry, and other related areas.

Molecular Engineering

Overviews



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.

Researches

■ 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

Our Lab is devoted to develop molecular theories to describe chemical phenomena based on quantum chemistry and statistical mechanics. The current research activities cover understanding of various chemical processes including chemical reactions, chemical dynamics, and molecular properties, especially focusing on a molecule and a molecular assembly in condensed phases.

■ 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, and creation of water-tolerant acid-base catalyst.

■ 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.

■ Photochemical Reaction

The current researches cover a wide range of photochemical applications of metal-based nanomaterials and/or nanostructured devises, such as metal nanoparticles in the simplest form. The main purpose is to develop 'enhanced' photochemical processes and systems, featuring highly enhanced light absorption, fluorescence, Raman scattering, and photoelectric energy conversion.

■ Molecular Inorganic Materials Science

Our main subject is to create novel functional amorphous materials such as organic-inorganic hybrids, polycrystalline and amorphous inorganic oxides. Currently, we are trying to prepare novel amorphous-based optical functional materials such as proton conducting membrane, optical biosensor, and amorphous phosphor.

■ Molecular Rheology

This laboratory focuses on molecular origins of rheological properties of various softmatters that include polymers, suspensions, and emulsions. 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 to establish fundamental science on organic LEDs and organic solar cells. The development of high-performance devices is another target of our group. For the purpose, we have carried out molecular designs, syntheses, device fabrications, precise structure characterizations (by sophisticated solid-state NMR), and quantum chemical calculations.

■ Theoretical Solid State Chemistry

In our Lab, we use analytical theories and numerical simulations to study various types of cooperative phenomena in condensed phases, such as (non-)equilibrium phase transitions. We recently seek the fundamental understanding of the "glass transition", that is a new type of the phase transitions, characterized by the dramatic dynamical slowing down without structural anomalies.

Polymer Chemistry

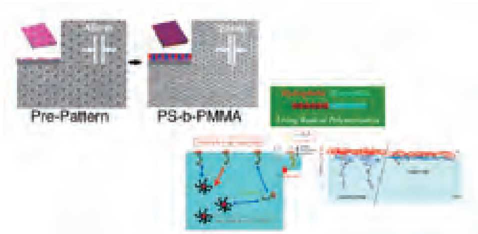
Overviews

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.

Researches

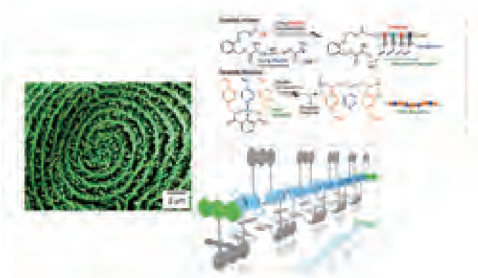
Advanced Polymer Chemistry

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.

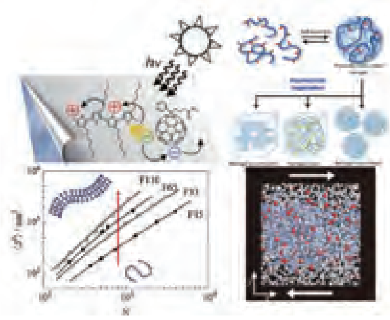


Polymer Physics

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.

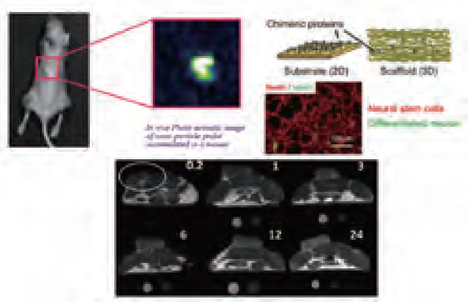
Polymer Design

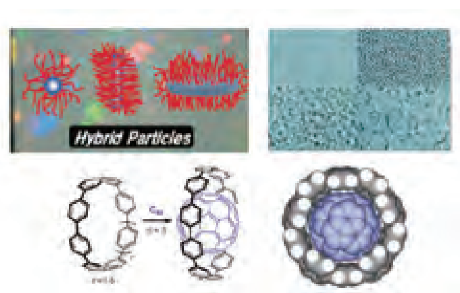
Education and research related to molecular design of functional polymers: in particular, functionalization of polymers by chemical reactions and analysis of static/dynamic structure in a micro to macro scale by e.g., electron microscopy and X-ray/neutron/light scattering techniques.



Biomedical Polymers

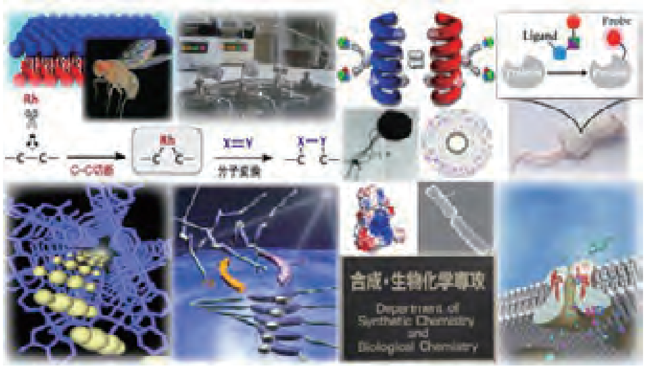
Education and research regarding basic biology and medicine as well as clinical medicine on the basis of polymer material sciences. The projects of interest are biomedical materials for surgeries (general surgery, ophthalmology, orthopedic surgery, neurosurgery or dentistry, etc.) and internal medicines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





Synthetic Chemistry and Biological Chemistry

Overviews



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.

Researches

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 Coordination Chemistry works to promote the design and synthesis of dynamic and adaptive structures of coordination polymers/and metal-organic frameworks toward new porous materials, ion conductors and catalysts.

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

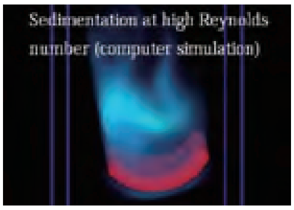
Overviews

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.

Researches

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.

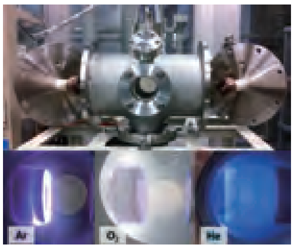


Surface Control Engineering

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.

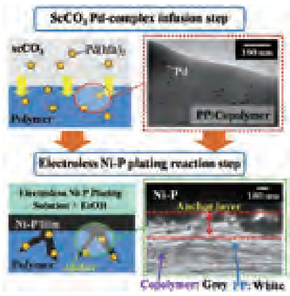


Separation Engineering

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

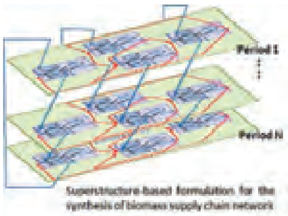
Materials Process Engineering

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.

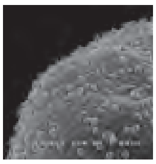


Environmental Process Engineering

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.

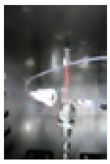
Particle Technology

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.



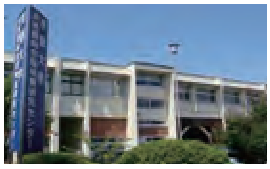
7. Research and Educational Facilities and Centers

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



Control, evaluation, and mitigation of environmental quality

The Research Center for Environmental Quality Control (RCEQC) was inaugurated in 1995 with three research and educational divisions: Environmental Quality Control, Environmental Quality Evaluation, and Environmental Quality Mitigation. 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.

Quantum Science and Engineering Center

Support for nanoscale material science research using particle beam accelerator quantum beams

Established in April 1999, the Quantum Science and Engineering Center seeks new principles in new phenomena, which are induced under an extreme environment and are observed in situ by quantum beams. The center also conducts basic studies of the nuclear fuel cycle, which is necessary for establishing a nuclear energy system, utilizing quantum beam technology. For this purpose, complex phenomena on a nano-meter scale under extreme environments are studied by employing accelerated quantum beams. The center also conducts basic studies of 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

Maintaining the Graduate school of engineering's information systems

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 training. 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.

Center for Global Leadership Engineering Education

Cultivating skilled technologists with the breadth of capabilities needed to serve actively as international leaders

This center strives to promote common educational programs for the Graduate School of Engineering as well as education aimed at internationalization. Unlike organizations that implement research and education in specialized and integrated disciplines, the center administers and implements common subjects for Graduate School of Engineering students to provide the kind of graduate-level grounding in liberal arts education and international skills needed by scientifically and technically trained researchers and engineers. That is, the center is cultivating skilled technologists with the breadth of capabilities needed to serve actively as international leaders.

Research Administration Center

Research Administration Center (RAC) in Graduate School of Engineering, established in December 2012, networking with other URA Office/Centers in Kyoto University, supports various research activities, promotes new research projects, and arranges joint research opportunities for matching research seeds with industry needs.

8. Statistics Data

1 Statistics of Academic & Administrative Staff

Academic Staff

Departments & Institutes	Academic Staff				Total
	Professors	Associate Professors	Senior Lecturers	Assistant Professors	
Civil and Earth Resources Engineering	14	16	1	11	42
Urban Management	12	16		13	41
Environmental Engineering	5	6	1	4	16
Architecture and Architectural Engineering	14	12		8	34
Mechanical Engineering and Science	12	7	4	12	35
Micro Engineering	5	4		5	14
Aeronautics and Astronautics	7	5	1	5	18
Nuclear Engineering	5	5	2	5	17
Materials Science and Engineering	12	9		14	35
Electrical Engineering	7	5	1	8	21
Electronic Science and Engineering	6	8	1	8	23
Material Chemistry	8	6		6	20
Energy and Hydrocarbon Chemistry	7	6	1	8	22
Molecular Engineering	5	6	1	4	16
Polymer Chemistry	7	7	1	8	23
Synthetic Chemistry and Biological Chemistry	9	6	2	14	31
Chemical Engineering	8	4	1	9	22
Photonics and Electronics Science and Engineering Center	2	1	1	2	6
Research Center for Environmental Quality Management	2	1	1	1	5
Quantum Science and Engineering Center	1	2		1	4
Center for Global Leadership Engineering Education			5		5
Total	148	132	24	146	450

Administrative Staff

Departments & Institutes		Admin. staff	Technical staff	Total
Civil and Earth Resources Engineering	C Cluster Office	15	3	24
Urban Management			2	
Environmental Engineering			2	
Architecture and Architectural Engineering			2	
Global Engineering	Global Engineering Office	4		4
Architecture	Architecture Office	2		2
Mechanical Engineering and Science	C Cluster Office	12	5	20
Micro Engineering			1	
Aeronautics and Astronautics				
Nuclear Engineering			2	
Materials Science and Engineering			4	4
Engineering Science	Engineering Science Office	4		4
Electrical Engineering	A Cluster Office	16		24
Electronic Science and Engineering				
Material Chemistry			1	
Energy and Hydrocarbon Chemistry				
Molecular Engineering			1	
Polymer Chemistry			1	
Synthetic Chemistry and Biological Chemistry			4	
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			1	1
Center for Information Technology			4	4
Occupational Health, Safety and Environmental Management Center			6	6
Research Administration Center			2	2
	Katsura Campus Office	65	4	69
	Yoshida Campus Office	12	1	13
Total		137	48	185

2 Statistics of Current Undergraduate & Graduate Students

1. Graduate School

As of Apr. 1, 2014

Departments \ Academic Year	Master's Course		Doctoral Course						Total	
	Year 1	Year 2	Year 1		Year 2		Year 3			
Civil and Earth Resources Engineering	80	72	24	(6)	13	(9)	33	(15)	222	(30)
Urban Management	63	65	19	(9)	19	(12)	22	(10)	188	(31)
Environmental Engineering	36	40	12	(7)	9	(5)	20	(9)	117	(21)
Architecture and Architectural Engineering	74	82	7	(1)	16	(5)	28	(12)	207	(18)
Mechanical Engineering and Science	60	59	3	(1)	11	(1)	18	(5)	151	(7)
Micro Engineering	28	27	4	(0)	9	(2)	7	(1)	75	(3)
Aeronautics and Astronautics	28	29	5	(0)	5	(0)	6	(0)	73	(0)
Nuclear Engineering	21	24	6	(0)	3	(1)	7	(2)	61	(3)
Materials Science and Engineering	43	40	15	(2)	10	(4)	11	(3)	119	(9)
Electrical Engineering	39	43	11	(0)	7	(2)	10	(0)	110	(2)
Electronic Science and Engineering	35	33	12	(2)	11	(1)	10	(2)	101	(5)
Material Chemistry	31	31	7	(1)	5	(0)	10	(0)	84	(1)
Energy and Hydrocarbon Chemistry	44	41	16	(2)	12	(1)	7	(2)	120	(5)
Molecular Engineering	33	34	5	(0)	4	(1)	11	(1)	87	(2)
Polymer Chemistry	49	54	9	(0)	9	(0)	14	(1)	135	(1)
Synthetic Chemistry and Biological Chemistry	33	40	13	(2)	11	(4)	18	(2)	115	(8)
Chemical Engineering	33	41	5	(2)	1	(0)	9	(3)	89	(5)
Total	730	755	173	(35)	155	(48)	241	(68)	2054	(151)
(Yoshida area)	43	40	15	(2)	10	(4)	11	(3)	119	(9)
(Katsura area)	687	715	158	(33)	145	(44)	230	(65)	1935	(142)

Note) Figures in parentheses are numbers of students entering in October 2013

2. Undergraduate

As of Apr.1,2014

Undergraduate Schools \ Academic Year	Year 1	Year 2	Year 3	Year 4	Total
Global Engineering	192	195	192	237	816
Architecture	85	82	84	99	350
Engineering Science	243	241	239	336	1059
Electrical and Electronic Engineering	137	138	140	204	619
Informatics and Mathematical Science	95	95	93	165	448
Industrial Chemistry	247	245	246	340	1078
Total	999	996	994	1381	4370

3 Statistics of Research Students, International Students and Guest Scholars

As of Apr. 1, 2014

	Status / Depts.	Japanese Students				International Students			International Research Students					Guest Scholars			Total
		Research Students	Research Fellows	Special Auditors	Special Research Students	Faculty	Master's Course (Graduate school)	Doctoral Course (Graduate school)	Research Students	Research Fellows	Special Auditors	Special Research Students	Short-term International Students	Guest Scholars	Guest Research Associates	Visiting Research Scholars	
Graduate School of Engineering	Civil and Earth Resources Engineering	1					12	37	1						2		53
	Urban Management						11	28			1		2	5	3		50
	Environmental Engineering				4		2	24	1					1	9		41
	Architecture and Architectural Engineering	3	1				9	13	1			1		2	1		31
	Mechanical Engineering and Science	1					11	9	1	1				3	5		31
	Micro Engineering						2	6			1			4	3		16
	Nuclear Engineering				2		6	13	3			1		2	7		34
	Materials Science and Engineering							5							2		7
	Aeronautics and Astronautics		1				1	3				1		1	1		8
	Electrical Engineering		1				3	9	1					1			15
	Electronic Science and Engineering				5		4	7		1							17
	Material Chemistry		1				1	3	2					3	4		14
	Energy and Hydrocarbon Chemistry				2		6	10				1					19
	Molecular Engineering							6							1		7
	Polymer Chemistry						7	8						1	6		22
	Synthetic Chemistry and Biological Chemistry						4	8						7	2		21
	Chemical Engineering						4	2									6
Faculty of Engineering	Global Engineering					54					1						55
	Architecture					8											8
	Engineering Science					18					4						22
	Electrical and Electronic Engineering					24											24
	Informatics and Mathematical Science					12					4						16
	Industrial Chemistry					22							2				24
	Total	5	4	0	13	138	83	191	10	2	11	4	4	30	46	0	541

As of Apr. 1, 2014

Status / Country and Region	International Students			International Research Students					Guest Scholars			Total
	Faculty	Master's Course (Graduate School)	Doctoral Course (Graduate School)	Research Students	Research Fellows (Country of the university one graduated from)	Special Auditors	Special Research Students	Short-term International Students	Guest Scholars	Guest Research Associates	Visiting Research Scholars	
Asia												
Cambodia			2									2
China	87	52	62	2	1	4	2		7	15		232
Hong Kong	1											1
India	1	1	4	1						3		10
Indonesia	7		10							1		18
Laos			1	1								2
Macau		1										1
Malaysia	2	1	8					2	2	1		16
Mongolia	1											1
Myanmar		2										2
Nepal		1	3									4
Pakistan		1	4									5
Singapore										1		1
Korea	25	7	37	2			1		4	5		81
Sri Lanka			2									2
Taiwan		5	6	1						5		17
Thailand	2		13							1		16
Viet Nam	3	3	9									15
Middle East												
Iran		2	4	2								8
Iraq		2										2
Israel										1		1
Syria			1									1
Europe												
Azerbaijan		1										1
Czech									1			1
Croatia			2									2
U.K.									1	3		4
Finland			1									1
France			1		1	1		2	1	1		7
Germany			1			1			2			4
Greece			1									1
Hungary	1											1
Italy									1			1
Poland									2	1		3
Russia			1									1
Slovakia							1					1
Sweden				1		2			1			4
Africa												
Egypt	2		7						1	2		12
Kenya	4											4
Libya			1									1
North America												
U.S.A.		2	2			1			6	4		15
Canada		2	1							2		5
Latin America												
Argentin	1											1
Brazil	1		1									2
Mexico			1			2						3
Paraguay			1									1
Peru			1									1
Uruguay			1									1
Oceania												
Australia									1			1
New Zealand			2									2
Total	138	83	191	10	2	11	4	4	30	46	0	519

4 Budgets

Category	F/Y2011 (¥1000)	F/Y2012 (¥1000)	F/Y2013 (¥1000)	Note
Personnel expenses	6,008,509	5,780,822	5,299,635	
General expenses	1,905,460	2,555,309	2,202,913	
Revenues from Sponsored Research	2,510,606	2,218,081	2,464,722	
Revenues from Collaborative Research	731,301	659,251	570,200	
Revenues from Donations for scholarships	497,695	440,329	376,139	
Subsidies for Scientific Research (Income)	2,638,847	2,652,130	2,569,650	
Other subsidies (Income)	827,417	1,280,878	623,063	
Other large-scale projects (Income)	689,706	3,212,651	1,438,433	

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

in Physics

Hideki Yukawa (1949)
Shinichiro Tomonaga (1965)
Makoto Kobayashi (2008)
Toshihide Maskawa (2008)
Isamu Akasaki (2014)

in Chemistry

Kenichi Fukui (1981)
Ryoji Noyori (2001)

in Physiology and Medicine

Susumu Tonegawa (1987)
Shinya Yamanaka (2012)

Fields Medal

Heisuke Hironaka (1970)
Shigefumi Mori (1990)

Gauss Prize

Kiyoshi Ito (2006)

Lasker Award

Susumu Tonegawa (1987)
Yasutomi Nishizuka (1989)
Yoshio Masui (1998)
Shinya Yamanaka (2009)
Kazutoshi Mori (2014)

Japan Prize

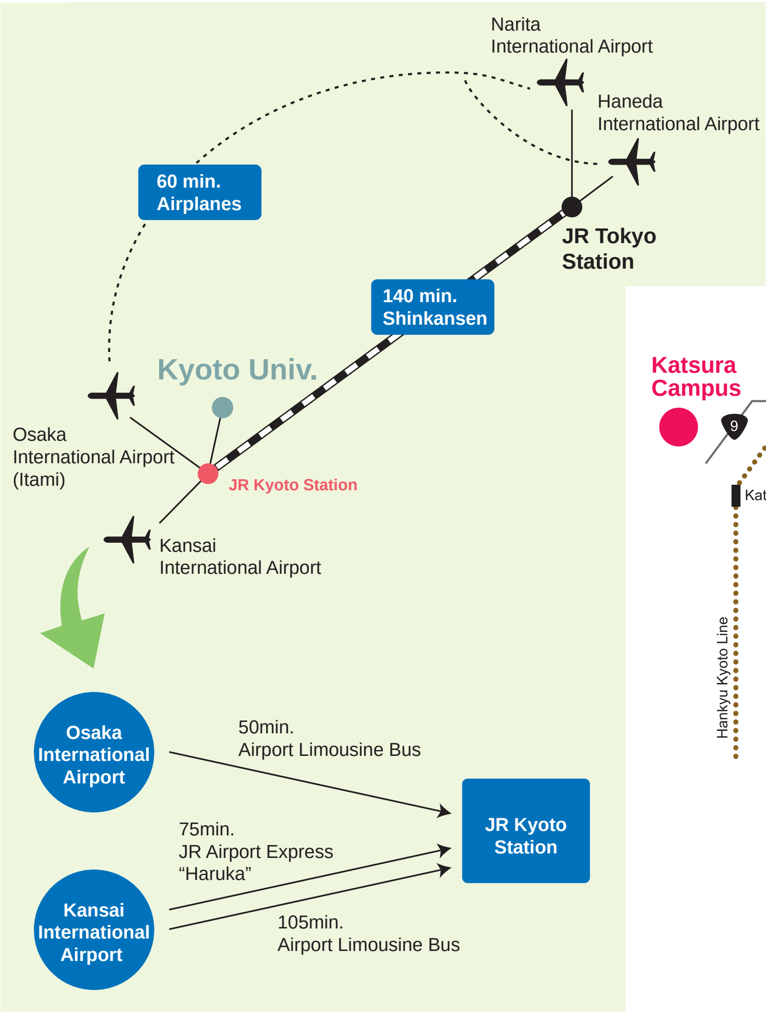
Makoto Nagao (2005)
Masatoshi Takeichi (2005)

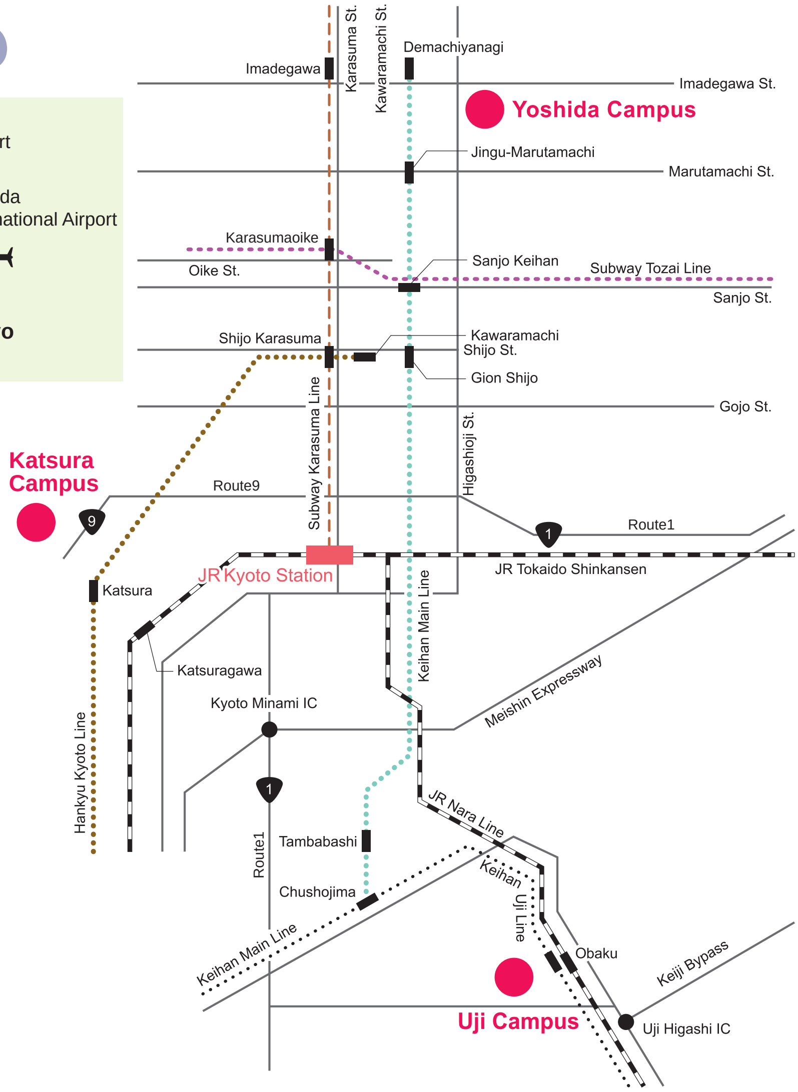
Kyoto Prize

Chushiro Hayashi (1995)
Kiyoshi Ito (1998)
Alan Curtis Kay (2004)
Isamu Akasaki (2009)
Shinya Yamanaka (2010)

10. Campus Map

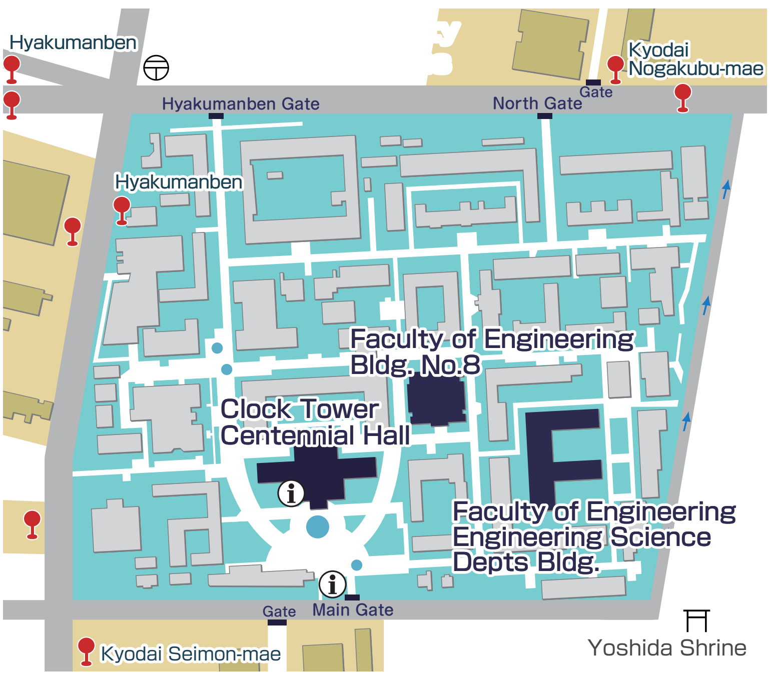
Access from International Airports





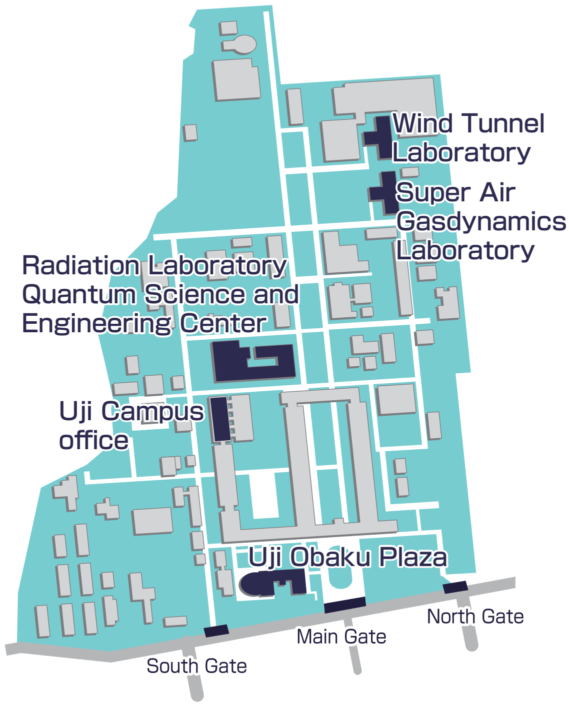
Kyoto University Yoshida Campus

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



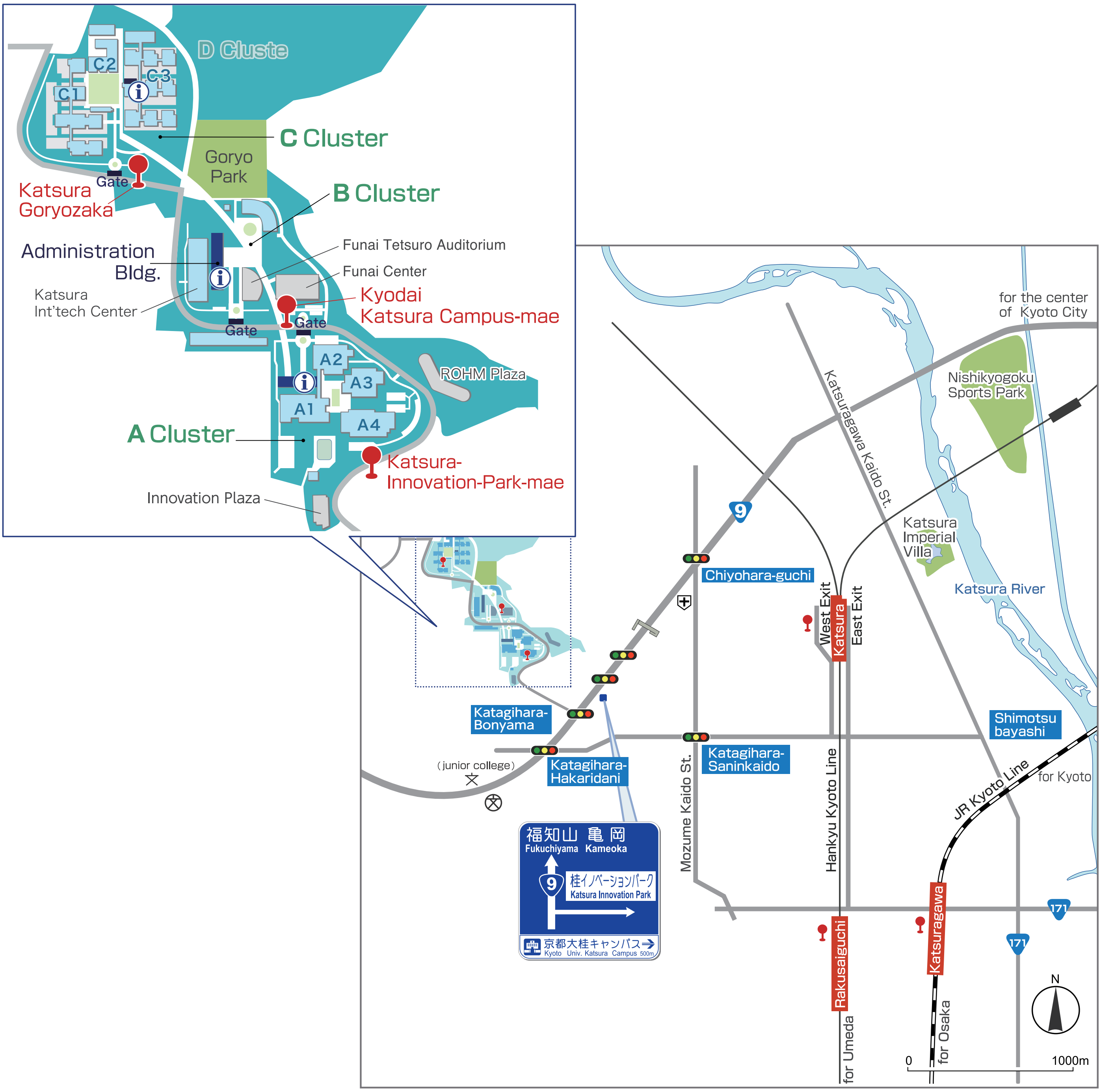
Kyoto University Uji Campus

Gokasho, Uji, Kyoto 611-0011



Kyoto University Katsura Campus

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

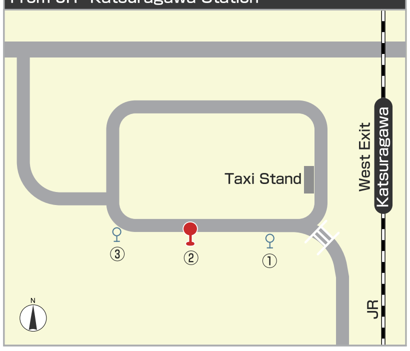


【 Bus Stop Information 】

From Hankyu Railway "Katsura Station"

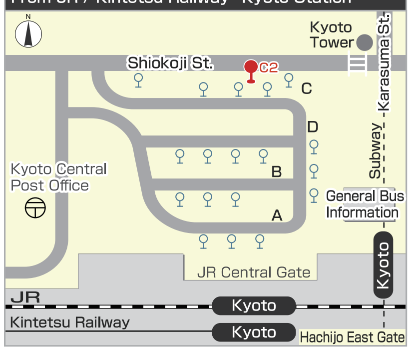
Katsura Station West Exit
Bus Stop "Katsura Station West Exit"/ 1
City Bus West6(西6) "for Katsurazaka-Chuo"
Keihan Kyoto Bus No. 20·20B "for Katsurazaka-Chuo"

From JR "Katsuragawa Station"



Katsuragawa Station West Exit
Bus Stop "Katsuragawa Station"/ 2
Yasaka Bus No.6 "for Katsurazaka-Chuo"

From JR / Kintetsu Railway "Kyoto Station"



JR Kyoto Station JR Central Gate
Bus Stop "Kyoto Station Bus Terminal"/ C2
Keihan Kyoto Bus No. 21·21A "for Katsurazaka-Chuo"

GRADUATE SCHOOL OF ENGINEERING
FACULTY OF ENGINEERING

Kyoto University Graduate School of Engineering
Faculty of Engineering Outline 2015

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