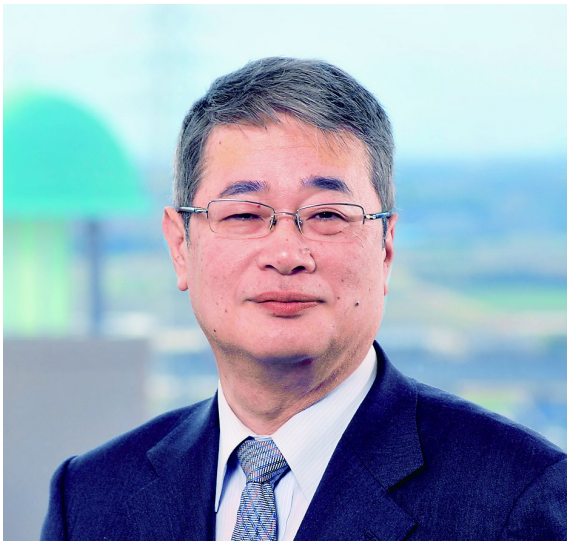
Greetings from the President



President
Shunichi Uchiyama

President Uchiyama (b. 1951) graduated from the Faculty of Engineering at Yokohama National University in 1974. After the Graduate School of Engineering at University of Tokyo, he received his ph.D. from the university. He became a professor of Saitama Institute of Technology in April, 1993, then Vice president of Saitama Institute of Technology in April, 2007. He was inaugurated as President of Saitama Institute of Technology in April, 2011. His special subjects of study include Electrochemistry and Analytical Chemistry.

The present and coming society is often called a “Knowledge Based Society” in the sense that the importance of new knowledge, information and technology is greatly increased as a basis for every kind of activity. In such a society, the creation of new knowledge, information and technology is highly important, and that specialized knowledge is needed to empower and enrich people culturally and materially, and to build a sustainable society.

In our university we have two graduate schools that are run in order to educate and train talented persons who can play an active part in this knowledge based society. They are the Graduate School of Engineering and the Graduate School of Human and Social Studies.

In the Graduate School of Engineering, there are three departments: the Department of System Engineering, the Department of Applied Chemistry and the Department of Electronic Engineering. In the Master’s Course, advanced special education and research is conducted with a broad range of vision, based on basic and special education and research in the Undergraduate Course, and further creative research is conducted in the Doctoral Course.

Special goals of the SIT Graduate School of Engineering (Master’s and Doctoral Courses) within these departments are to promote the most advanced education and research in System Engineering, Applied Chemistry and Electronic Engineering and to create technology that can coexist with the global and sustainable environment in the 21st century, and to produce technologists and researchers of character who can step in and be effective immediately.

In our graduate school, study and research is carried out, in close cooperation with the Advanced Science Research Laboratory. It is one of the research cores of high-technological science studies in the Northern Metropolitan area. Having so many high-technological devices and facilities, we are carrying on various project studies.

The activities of the SIT Graduate School of Engineering cover a wide range. They include the support of undergraduate education, acceptance of working members of society, promotion of international academic exchange, participation in venture business and so on. To have active contacts with various people and organizations in and outside the institute will give the students very precious experience and good opportunities to form a human network for the future. Such cooperation will not only serve as a great stimulant for younger students but also promote the future growth of SIT.

Today we see many young people trying to change the present situation for future generations, and playing a very active part internationally in various fields such as technology, human sciences and arts. We can expect much of such young people. We strongly hope that SIT students will make a great contribution to society, having their basis in the local community, its industry and culture. We feel happier when we try our best together to attain the same goal. In such a process, new discoveries are often made and various problems are successfully solved. With such a hope, we would like to welcome applicants who have original ideas, strong wills and dreams for the future.

Master's Courses

Department of Mechanical Engineering

Objectives

Nowadays, our comfortable and convenient life style largely depends on energy. Particularly, as can be seen in today's intellectually intensive industries, high efficiency in the energy production technology and load reduction to the environment have been the vital research subjects. On the other hand, the more the production system becomes advanced, the more demanded are the design and development of structural material with higher mechanical properties, newer processing technology, active and passive control against mechanical disturbances including natural disasters. Mechanical engineering is not only the base of manufacturing industries, but it plays a key role in realization of technological development that urges the change from rich to happy life. In responding to the forthcoming aging society as well as the social requirements mentioned above, the Department of Mechanical Engineering aims to perform an education and research into the advanced technology and cultivate human resources who can deal with various problems flexibly.

This department is composed of two divisions of research and education: Division of Energy Engineering and Division of Mechanical System Engineering.

Research Fields

Division of Energy Engineering

In connection with energy systems which play a key role in future prosperity of human beings, the Division of Energy Engineering performs the education and applied research in the following topics:

1) Energy transfer systems with high efficiency and low energy consumption
2) New energy production system
3) Various applications of fluids and shock waves
4) Efficiency improvement by low friction and low erosion

The field of Energy Engineering covers thermodynamics, heat transfer engineering, combustion engineering, fluid dynamics, tribology etc. and its application extends from the fields of agriculture using heat pipes and the medical treatment to the fields of advanced technology such as the design of supersonic aircraft engine.

Taking account of these background situations, the faculty members are mainly composed of researchers in the fields of thermodynamics and fluid dynamics forming the basis of the Energy Engineering. There is designed an education and research program comprehensive for the advanced technology of energy production.

Division of Mechanical System Engineering

In view of supporting human life from engineering point of view, the division of Mechanical System Engineering aims at the following research and development:

1) Analysis of the complicated dynamical characteristics
2) Application to a design
3) Automatic control and robotics
4) Scientific investigation of manufacturing and design methodology

For the sake of these objectives, this division is provided with an education and research program comprehensive for the Mechanical System Engineering by the faculty members in the fields of engineering mechanics, strength of materials, optimal design, manufacturing technology, dynamics of machinery, automatic control, and robotics.

Department of Mechanical Engineering / Professors and Specialities

Division of Energy Engineering

Professors / Specialties	Abstracts
Kosaka, Masataka ; Professor Dr. Eng. (Saga University) **Specialties :** Thermodynamics, Heat transfer, Aeroacoustics **Subjects:** 1. Research and development on system and element technologies related to hydrogen energy	Technology related to hydrogen energy is highly expected to construct the society of the next-generation. The research activities in Thermal Energy Engineering Laboratory are to seek for the effective utilization ways of hydrogen energy source, such as the hydrogen energy transport, storage and conversion. As topics, in these research activities, the hydrogen storage system using metal hydride (MH), the heat driven type MH refrigeration system and the new method for refueling hydrogen into the fuel cell vehicles (FCV) have been tried from thermal engineering point of view. Each of these researches carry out using experimental and theoretical approaches based on thermal engineering.
Hase, Alan; Associate Professor Dr. Eng. (Chiba University) **Specialties :** Tribology, Machining **Subjects:** 1. Studies on Elucidation and Evaluation of Tribological Phenomena. 2. Studies on Intelligent Machine Tool and the Monitoring of Machining Process.	Tribological phenomena (friction and wear phenomena) exist in the sliding area of mechanical parts on various mechanical systems--the energy loss by friction and the material loss by wear occur. For low environmental loading, we study the elucidation of tribological phenomena, the establishment of wear theory, and the evaluation of tribological characteristics. Also, we develop micro-machine tools, monitoring systems for precision machining processes, and intelligent machine tools.
Fukuchi B , Apollo; Associate Professor Dr. Eng. (Tokyo Metropolitan Institute of Technology) **Specialties :** Combustion and Propulsion Engineer **Subjects:** 1.Metal Combsution 2.Solid Peopellant Combustion 3.Hybrid Rocket Propulsion	Based on combustion engineering and propulsion engineering, the combustion of metals, the combustion of solid propellants, and the propulsion of hybrid rocket engines are studied. Combustion is a very complex phenomenon that involves heat transfer, flow, and chemical reaction, and is necessary for improving the performance of rockets and developing the environmental friendly propellants based on an understanding of each mechanism.

Department of Mechanical Engineering / Professors and Specialities

Mechanical System Engineering

Professors / Specialties	Abstracts
Zhao, Xilu ; Professor Dr. Eng. (Tokyo Institute of Technology) **Specialities :** CAD/CAE, Optimum Design **Subjects:** 1. Lightweight design of mechanical structure 2. Optimum design of manufacture process by CAE 3. Improving mechanical quality by optimum design	By using computer to solve problems of design and manufacture in the machinery industry. Analysis mechanical problems, such as structural strength, structural rigidity, vibration noise, crash characteristics, etc. The shape optimization of 3D complicated structure, Developing high performance vehicle body structure by origami engineering. Optimum design of manufacture process, such as stamping forming, plastic injection molding, die casting, etc. Optimum design of laminated plate and shell of composite materials.
Fukushima, Yoshio; Professor Dr. Eng. (Gunma University) **Specialities :** Injection Molding, CAD/CAE **Subjects:** 1. Analysis and Measurement about Injection Molding, Casting 2. Optimum Mold Design and Manufacturing 3. Research about Practical Design by using CAD/CAE	For the development of Japanese industries, fostering human resources in manufacturing is an important issue. Recently, the requirements of parts weight reduction and highly functional parts have been increasing. So the advancement of injection molding technology and casting technology is very important. We are going to research about above mentioned issues by using flow analysis(CAE), quality engineering (as optimization techniques).
Kohzuki, Yohichi; Professor Dr. Eng. (Kanazawa University) **Specialities :** Strength of Materials **Subjects:** Deformation characteristics based on dislocation motion are mainly investigated here and the following research themes are given as the examples. 1. Influence of an impurity size on the deformation characteristics during plastic deformation of single crystal 2. Influence of the state of crystal surface on the deformation characteristics during plastic deformation etc.	Plastic deformation occurs in the process of forming a metal,which is controlled by the dislocation (linear defect in crystal) motion on the slip plane containing many impurities and a few forest dislocations during plastic deformation . Plasticity of crystals in a microscopic viewpoint, especially on the basis of dislocation motion , is studied from the data obtained mainly by the strain-rate cycling tests associated with ultrasonic oscillation.

Department of Mechanical Engineering / Professors and Specialities

Mechanical System Engineering

Professors / Specialties	Abstracts
Minagawa, Keisuke; Associate Professor Dr. Eng. (Tokyo Denki University) **Specialities :** Mechanical Dynamics **Subjects:** 1. Seismic evaluation for mechanical structure 2. Vibration control	In Japan, earthquake is one of serious natural disasters, and it is very important to suppress damage from earthquakes by technologies. Our researches aim to develop these kinds of technologies. For example, vibration control is one of widespread technologies against earthquake. In our research, a vibration control damper suitable for long period seismic wave is developed. Another one of our research topics is seismic evaluation. Development of accurate and reasonable methods that can evaluate strength against earthquakes is very important to suppress damage from earthquakes.
Ando,Hiroki; Associate Professor Dr. Eng. (Nagoya University) **Specialities** : Controlled Mechanical System Design **Subjects:** Integrated design of flexible structure and its control system	My study aims to build an integrated design method of structural and control systems for controlled mechanical systems and break through the limits of the conventional design method in which both systems are designed separately. Especially, I focus on the integrated design for compliant mechanisms and continuum robots etc. that rely on large elastic deformation to transmit forces and motion.
Kawada,Naoki; Associate Professor Dr. Eng. (Gunma University) **Specialities :** Quality Engineering, Measurement and Control Engineering **Subjects:** 1. Study on evaluation and optimization of machining. 2. Development of monitoring system for various machines.	Production engineering is important for product quality in manufacturing factories. Product quality is controlled by optimizing and monitoring manufacturing conditions.Manufacturing equipment condition monitoring technology and product inspection technology are important for quality control. These techniques monitor the optimal conditions of the Manufacturing equipment. In addition to the condition monitoring technology, the research for the optimization of the production process is developed using IoT, AI, and pattern recognition technology.
Takahashi, Toshinori; Lecturer Dr. Eng. (The University of Tokyo) **Specialities :** Plastic working. **Subjects:** Small product forming by using plastic working.	Plastic working is one of the important processing method that is used at present. Accuracy of this method has improved. And the product that have various forms can be produced by using this method. We research the fundamental characteristic of this method. And we search after the method that can make especially a small product by using this method.

Department of Mechanical Engineering / Professors and Specialities

Mechanical System Engineering

Professors / Specialties	Abstracts
Hagiwara,Takaaki; Lecturer Dr. Eng. (Gunma University) **Specialities** : Control Engineering **Subjects:** 1. PID control 2. Control design method of considering the characteristic of the plant	The system that the control engineering targets is large-scale and complex according to the development of various elemental technologies. The control theory and the technology do a large contribution to the development of industry by the control theory's being used for a lot of products. And, when a new control theory and the technology arise, the increase of a further performance gain and the additional value is expected. Then, the research of a new control theory and the technology and the researches on those applications to the real system are done based on a current control theory.

Master's Courses

Department of Information Systems

Objectives

Electrical and electronic engineering, which was born in the 20th century, brought about an information revolution, produced high-performance computers, played a central role in the realization of the Internet society, and continues to make remarkable progress even today in the 21st century. While advances in information technology are expected, this department targets two fields of education and research: information engineering and electronic engineering. As a curriculum, we have lectures for systematically acquiring specialized knowledge, exercises, discussions, experiments, and research subjects for mastering the specialized knowledge. Students will experience and acquire simulation experiment technology, system construction technology, and prototype technology in the course of education and research, and will study by combining theory and practice. In this way, we will develop human resources with a wide range of perspectives and advanced expertise in fields such as information systems, intelligent systems, networks, and electronic communication systems.

Research Fields

Division of Information Technology

This division is the educational research field of fundamental research and applied technology development of systems adapting to new information society such as advanced information processing system, information network, and human friendly interface.

We conduct systematic educational reserch on fields of intelligent network system, information security using biometric information, medical image processing recognition and visualization, robot system such as intelligence, welfare, disaster prevention, human computer interaction, advanced reality concerning technology development such as virtual reality, neural network, and arificial intelligence.

Division of Electronics engineering

This division conducts with the following educational research.

- Analog / digital electronic device
- Plasma engineering
- Wired / wireless communication engineering
- Image engineering
- Signal processing and transmission system
- Development trial production of the brain / computer interface
- Design prototype of antenna corresponding to information system
- Design and construction of large capacity long distance optical fiber transmission technology
- System development using network technology
- Development of image conversion and restoration processing technology
- Optical measurement technology

・Information communication system such as measurement and analysis of electroencephalogram and magnetoencephalography
・Interaction of particle beam in matter
・Material design and evaluation for the development of new electronic devices
・Development of nanomaterials

Department of Information Systems / Professors and Specialities

Information Engineering

Professors / Specialties	Abstracts
Watabe, Daishi; Professor Dr. Sci. (Tohoku University) **Specialities :** ・Biometrics ・Media engineering **Subjects:** 1. Forensic assistance system based on ear biometrics 2. Application that unlocks smartphone using ear biometrics	With the 2020 Tokyo Olympic and Paralympic Games just a few years away, the issue of entry security at sporting venues and at the athletes' accommodations now under construction is growing increasingly important. Biometrics presents a prominent scheme for improving overall security. Recognition of fingerprints, irises, palms, finger and other veins, facial features, voiceprints, and handwriting can all be used to enhance security. Implementation is possible in areas such as user authentication of smartphones or computers, ATMs, entry control to high-security rooms, and forensics. We are making progress with our research on the topic of biometrics.
Hashimoto, Tomomi; Professor Dr. Eng. (Utsunomiya University) **Specialities :** Robotics, Cognitive Science. **Subjects:** 1. Proposal of engineering model of mind. 2. Human support robot.	I study two fields such as 1) proposal of engineering model of mind, and 2) Develoment of a human support robot.
Yamazaki, Takaharu; Professor Dr. Med. (Osaka University) **Specialities :** Medical Image Processing and Analysis **Subjects:** 1.3D morphological and kinematic analysis of bone joint 2.Development of new medical image processing method 3.Development of automated analysis software for medical image	In a medical institution, for the purpose of examination and visualization for the illness, Radiographic images including CT (Computed Tomography) image have been commonly used. Accurate processing, recognition and visualization for the medical image information are desirable, and accurate measurement and analysis of the image are very important for determining medical diagnosis and treatment planning. Our research theme is development of new medical image processing method, medical image analysis and its evaluation for clinical application.

Department of Information Systems / Professors and Specialities

Information Engineering

Professors / Specialties	Abstracts
Kujirai, Masahiro; Professor Dr. Eng. (Saitama University) **Specialities :** Multiple-Valued Logic, Computer Science, Interaction. **Subjects:** 1.Multiple-valued logic circuits, for r example: Multiple operand redundant binary adder and its applications. 2.User-friendly system-description-language based on object-oriented language. 3. Effective interaction method in virtual reality space.	Multiple-valued logic circuits have the great advantage to speed and less circuit elements. We are studying the redundant binary logic circuits and its applications, for example, multiple-operand adder. Hardware description languages are now in progress to the C-based system description language typified by SystemC. We are proposing a user-friendly, easily codeable and understandable object-oriented system-description-language. Another our subject is the interaction. In virtual reality space, effective interactions are highly needed. We are proposing a not only effective but low-cost system by using mobile phone.
Ohyama, Wataru; Professor Ph.D (Mie University) **Specialities :** Pattern Recognition, Data Science **Subjects:** 1. Realistic Data Analysis 2. Pattern Recognition and Machine Learning 3. Image Scensing	Our laboratory is researching pattern recognition, machine learning, and media processing as real data science. Current research topics include (1) personal authentication technologies such as signature verification, (2) recognition and analysis of documents and document images, and (3) image sensing technologies for industrial applications. We are also actively collaborating with other academic disciplines such as medicine (analysis of echocardiographic images), history (Analysis of ancient documents and Mokkan), and home economics (recognition of cooking operation).

Department of Information Systems / Professors and Specialities

Information Engineering

Professors / Specialties	Abstracts
Inoue, Satoru; Associate Professor Dr. Eng (University of Electro-Communications) **Specialities :** Biological Information Processing, Neural Network. **Subjects:** 1.Neural mechanism forming the sound location map with high accuracy in the brain of barn owl. 2.Mechanism of Working Memory performing the spatio-temporal task. 3.Method solving the Optimization problem by neural network theory.	Sensory Information processing system, for example visual and auditory, and control mechanism of motion induced by information processed in individual sensory brain area are studied. Such precise functions performed by brain of living thing are reproduced in computer system based on the neural network theory and sensory processing and motor control system are studied seamlessly. In addition, the method for applying the function of the brain industrially is also examined.
Maeda, Taiyo; Associate Professor Ph.D. (in Science. Kanazawa University) **Specialities :** Problem Solving Environments, Visualization **Subjects:** 1.Supporting System 2.Visualization System	For effective tasks and better understandings, researchers and engineers need tools by using information and communication technology. One of the approaches is Problem Solving Environments (PSEs) which would interact with on their technical terms. We focus on development of supporting system for them by using commodity computers and network technologies, and combination of several technologies for the system.
Murata, Masaki; Lectuer Ph.D. (in Science. Kyoto University) **Specialities :** Deep Learning, Particle Physics **Subjects:** 1. Application of Deep Learning 2. Explainable Deep Learning	Artificial Intelligence (AI) plays a significant role in industrial and academic fields. Modern AI systems are supported by Deep Learning. In this laboratory, we work on applying Deep Learning in various fields and on revealing the reasoning of decisions of Deep Learning.

Department of Information Systems / Professors and Specialities

Information Engineering

Professors / Specialties	Abstracts
Morikawa, Tomohiro; Lectuer Dr. Eng. (Waseda University) **Specialities :** Information Security, Intelligent Informatic **Subjects:** 1. Generation of Lightweight and high-performance URL blacklist 2. Automatic detection of promotional attackers in mobile app store 3. Context-specific fake information generation	Since the cyber attackers' modus operandi is rapidly evolving to evade the existing attack detection system, new types of attacks that can not be identified have continued to emerge in various security fields. By realizing the delayed countermeasures, we focus on not only detecting and preventing previously unknown attacks in the early stage using technologies such as natural language processing and machine learning, but also implement the abuse of the latest artificial intelligence technologies from the perspective of the attackers and establish an effective and efficient countermeasure against it.

Department of Information Systems / Professors and Specialities

Electronics engineering

Professors / Specialties	Abstracts
Cao, Jianting; Professor Ph.D. (Chiba University) **Specialities :** Advanced signal processing, intelligent systems. **Subjects:** 1. Study on analysis of EEG/MEG data and visualization of brain activities 2. Study on blind signal processing theory and its applications	Blind signal processing problems arises in many areas such as biomedical signal processing, image/speech signal processing and mobile communication. Each of these fields focuses on different aspects of the same problem in situations where neither input signals nor transmitting media are known. Such signal processing is frequently referred to as unsupervised in the most difficult environment. Our laboratory focuses on the problem of blind source signal separation, extraction, identification and equalization. We mainly investigate and develop advanced methods and novel algorithms based on statistical inference and information theory for processing and analysis of human brain signal detected by high density array electroencephalography (EEG) and magnetoencephalography (MEG) machines. We are also interesting in analyzing both biological and artificial neural network models associated with adaptive learning rules in order to understand human brain information processing and implement engineering designs of intelligent systems.
Yoshizawa, Hirokazu; Professor Ph.D. (Oregon State University) **Specialities :** Design of analog integrated circuits **Subjects:** 1.Low-voltage CMOS operational amplifier 2.Low-voltage DC-DC converter 3.Low-voltage current circuit	Most of the physical quantities in the nature are analog such as sound and light, etc. Analog/digital mixed-mode circuits play an important role of the interface between these analog quantities and digital electronic devices. Hence, the performances of the digital electronic devices are often limited by the performances of analog circuits used in the interface. In addition, there is a great demand for low-voltage low-power circuit operation because of a great increase of portable electronic devices such as a portable audio player and a cellular phone. Our research target is low-voltage, low-power, and/or high precision CMOS analog IC design.
Matsui, Akinori; Professor Ph.D. (Saitama University) **Specialities :** Electromagnetic Wave Engineering. **Subjects:** Study on the radiation properties of planar antenna Study on the radio communication circuit with multi function for high frequency region.	Antenna utilized in radio communication is needed to develop the configuration for the use. Planar antenna, especially, is used in many application fields due to the low-profile property. In our laboratory, we propose the new type of the planar antenna for the application and analyze the radiation characteristics through the experiments, the theory and the computer simulation.

Department of Information Systems / Professors and Specialities

Electronics engineering

Professors / Specialties	Abstracts
Sato, Susumu ; Professor Ph. D. (Saitama University) **Specialities :** Application of microwave. Ion beam and plasma engineering. **Subjects:** 1. A study of ion beam application. 2. Development of microwave induced plasma in liquid. 3. Chemical synthesis by microwave irradiation.	Microwave oven is using in many homes. In this way, the electromagnetic wave is used as electricity energy in home and industry. One of electromagnetic wave applications is plasma generating. Generated plasma is used in producing of semiconductor device or in other industries. The research activity in this laboratory is microwave application, electromagnetic wave induced plasma and this application. Especially, microwave induced plasma in liquid is novel technique. Through these novel technology developments, we bring up engineer and researcher in next generation.
Itami Fumio; Associate Professor Dr.Eng. (Shibaura Institute of Technology) **Specialities :** Circuits and Systems for Signal Processing **Subjects:** Filters, Multi-rate Systems, Image Analysis.	Mathematical transformations such as Fourier, cosine and wavelet ones are used as tools for signal analysis on signal system theory. This study proposes circuits and systems for signal analysis based on filters and multi-rate systems, which are able to represent various transformations systematically. Formulation for systems for various signal forms by using filters and sampling-rate conversion, and simulation study on the systems are given. Applications to image such as compression, recognition and resolution conversion by using the systems are also proposed.
Fujita Kazuhiro; Associate Professor Dr.Eng. (Hokkaido University) **Specialities :** Computational Electromagnetics, Electromagnetic Compatibility, Accelerator Engineering **Subjects:** 1. Fast and accurrate methods for electromagnetic field analysis 2. Electromagnetic compatibility in electronic equipment 3. Modeling, analysis and designs of particle accelerator components	For development of electric and electronic equipment, it is necessary to model and simulate electromagnetic phenomena in complex systems, and to predict unintended characteristics in early design stages. Computational electromangetics technology is widely used to solve electric and magnetic problems even in the field of industry from science. This laboratory addresses advancement and improvement of electromagnetic field analysis techniques and their applications for finding generation mechanisms of electromagnetic noize in electronic equipment and contributing to effectiveness of designs.

Department of Information Systems / Professors and Specialities

Electronics engineering

Professors / Specialties	Abstracts
Uchida, Masaya; Professor Ph.D. (The Graduate University for Advanced Studies) **Specialities :** Electron Microscopy, Nanotechnology, Quantum Materials Science **Subjects:** Control and Manipulation of Wavefunctions by Nanotechnology	Recently, innovative materials and devices such as quantum dots and metamaterials have been generated by nanotechnology. Its essence lies in the control and manipulation of wavefunctions by nanostructures. Electron beams carrying orbital angular momentum, which we discovered for the first time, are one of them. In our laboratory, we aim to find novel quantum phenomena, innovative materials and devices, and new analytical methods for materials, by controlling and manipulating wavefunctions using nanotechnology.
Matsuda, Tomohiro; Professor Dr.Sci. (The University of Tokyo) **Specialities :** Particle Cosmology. **Subjects:** Early Universe, GUT and their consistencies.	A unified theory would be a mathematical framework in which all the different kinds of forces and particles occur naturally. Many aspects of the very early universe can be described with unified models of particle physics. We are now beginning to learn things about particle physics through observations that use telescopes and other methods to look far into the universe and deep into its past. The recent abundance of results from such observations has made the subject of particle cosmology blossom. Our research concerns the interplay between gravity and particle physics in the very early universe. We study the cosmological implications of quantum field theories, General Relativity, and superstring (brane) theories.

Master's Courses

Department of Life Science and Green Chemistry

Objectives

In the extreme progress of science and technology, the fields of development of new materials, solving of environmental problems, and biotechnology, are significant matters in this century.

The Department of Life Science and Green chemistry is composed of three divisions of education and research: Division of Materials Chemistry, Division of Environmental Chemistry, and Division of Life Chemistry, corresponding to the above fields, This department flexibly deals with the advance on science and technology and actively carries out the education and research project on the most advanced science and technology, and raises excellent engineers and researchers who will be able to support Japan in this century.

Research Fields

Division of Materials Chemistry

To develop new materials improving the quality of our lives, the Division of Materials Chemistry performs education and research on materials chemistry such as organic synthesis catalyzed by organometallic complexes, development of high performance chemical and biological sensors, and creation of photo- and electro- active materials for optoelectronic devices, based on synthtic organic chemistry, organometallic chemistry, analytical chemistry, electrochemistry, micro/nano chemistry, functional material chemistry, liquid crystal chemistry, and photochemistry.

Division of Environmental Chemistry

To solve the global problems on environments, the Division of Environmental Chemistry performs education and research on environmental chemistry such as development of novel inorganic materials for environmental conservation, creation of environmental purification materials, synthesis of functional materials from wastes, and development of energy - conversion devices, based on catalytic chemistry, inorganic material science, environmental materials chemistry, surface electrochemistry,and analytical chemistry.

Division of Life Chemistry

To contribute to further progress of new biotechnology, the Division of Life Chemistry performs education and research on life chemistry such as studies on taste signal transduction and cell- networks, development of bio-functional devices, control of gene expression, development of useful substances derived from microorganisms, and breeding of novel plants, based on sensory physiology, neuroscience, bioelectrochemistry, applied biomolecular chemistry, genetic engineering, molecular biology, applied microbiology, plant molecular biology, and plant physiology.

Department of Life Science and Green Chemistry / Professors and Specialities

Division of Materials Chemistry

Professors / Specialties	Abstracts
Iwasaki, Masakazu; Professor Dr. Eng. (The University of Tokyo) **Specialities :** Synthetic organic chemistry, Organometallic chemistry. **Subjects:** Organic synthesis catalyzed by organometallic complexes.	In my group, it is investigated to develop a novel reaction for organic synthesis using carbon monoxide as a carbon source and transition metal complexes as catalysts. Carbon monoxide is inexpensive carbon source readily available from coal or petroleum and its interaction with metals is well studied. Besides bulk syntheses of simple compounds, syntheses of highly value-added compounds by carefully tuned and designed reactions are also studied in my group. As a research activity in an academic organization, understanding of the reaction mechanism is strongly emphasized and the reactions of model complexes are studied intensively.
Niwa, Osamu; Professor Dr. Eng. (Kyushu University) **Specialities :** Analytical Chemistry, Electrochemistry, Micro/nano Chemistry **Subjects:** 1. Development of Chemical and Biochemical Sensors based on Sputtered Nanocarbon Film 2. Development of Highly Electrocatalytic Electrodes using Metal Nanoparticles Embedded Carbon Film 3. Development of Metal Oxide Electrodes with Direct Electron Transfer Between Enzymes and Their Application for Evaluating Drug Metabolisis	In order to realize high performance chemical and biochemical sensors, it is very important to develop materials with new functions. In our laboratory, we will develop new carbon based electrode materials including nanocarbon films with atomic level flat surface, metal nanoparticles embedded carbon films and metal oxide films by employing vacuum technology such as sputtering. Based on above electrode materials, we will realize various sensors for detecting environmental pollutants, biomarkers for diseases, and antioxidants in foods and beverages. Not only to develop sensing methods, microsensing devices will be developed based on micro/nanotechnology.
Tanaka, Mutsuo; Professor Dr. Eng. (Osaka University) **Specialities :** Material Chemistry, Surface Chemistry Molecular Recognition Chemistry **Subjects:** Studies on Functional Materials, for example, Surface Modification Materials, Polymers, Permeation Membrane Materials Lipids, and Nucleic Acids	There are so many functional materials to support our life. Among materilas, plastics, paints, and medicines are visible and easy to recognize those functions, while some materilas such as sensors and displays look like a kind of black-box beyond understanding. Our laboratory, fabrication of new functional materials are examined through understanding the nature and structures of materilas at atomic and molecular level. Not only organic but also inorganic materilas are used to realize desirable functions.

Department of Life Science and Green Chemistry / Professors and Specialities

Division of Materials Chemistry

Professors / Specialties	Abstracts
Kinosita, Motoi; Professor Dr. Eng. (Osaka University) **Specialities :** Functional material chemistry, Liquid crystal chemistry, Photochemistry. **Subjects:** Creation of photo- and electro-active materials with cooperative nature and their applications in optoelectronic devices.	Functional molecular systems have attention as one of the low environmental-load materials. Among them, liquid crystals (LC) show a self-organizing nature, cooperative motion, and anisotropy in various physical properties such as transition moment, dielectric constant and refractive index. Modulation of alignment changes in LCs by external stimuli such as optical, electrical and magnetic fields gives rise to a change in physical properties of LCs. It is a key issue to control of molecular alignment for developing smart optical and electronic devices. We focus on creation of smart materials with cooperative nature, which respond to external stimuli such as light because of clean energy, fast response and remote controllable.

Department of Life Science and Green Chemistry / Professors and Specialities

Division of Environmental Chemistry

Professors / Specialties	Abstracts
Aritani, Hirofumi; Professor Dr.Eng. (Kyoto University) **Specialities :** Catalysis, Inorganic Material Science. **Subjects:** Development of novel inorganic materials environmental conservation.	Inorganic materials show several unique properties under high temperature and/or pressure. Functionalized inorganic materials should be applied to clean exhaust gases from chemical industry or automobiles for environmental conservation. The properties on inorganic materials can be controlled by control of structural and/or characteristic parameters. Characterization of active sites on the materials is very important to obtain structural information of the unique property, and development of novel functional materials should be based on the structural information. Our study is focused on the design of active structure in functional inorganic materials in order to develop inorganic materials with high activity.
Matsuura, Hiroaki; Associate Professor Dr.Sci. (University of Tsukuba) **Specialities :** Surface Electrochemistry, Analytical chemistry **Subjects:** Studies on electrochemical modification and development of novel functional materials.	The development of novel materials with high performance is desired in industry, energy conversion systems, chemical sensing techniques and many other fields. Our research target is to develop carbon-based novel functional electrodes. We are studying about the development of carbon-based catalytic electrodes fabricated by using electrochemical techniques. In addition, we are developing energy conversion devices such as fuel cells and electrochemical sensing technology including inorganic/organic compounds.
Hongo, Teruhisa; Associate Professor Dr. Sci. (Tokyo Institute of Technology) **Specialities :** Materials chemistry, Environmental system engineering **Subjects:** Creation of environmental purification materials, Development of global warming prevention technology, Development of recycling sistem	In order to realize a sustainable society, there are various problems which must be solved. Among them, environmental pollution, resource depletion, and global warming problems are urgently needed to be resolved. We are exploring environmental purification materials constructed by abundant common elements. Moreover, we are studying on development of carbon dioxide fixation technology, and recycling system that uses waste as resources and energy.

Department of Life Science and Green Chemistry / Professors and Specialities

Division of Life Chemistry

Professors / Specialties	Abstracts
Kumazawa, Takashi; Professor Phar. D. (Hokkaido University) **Specialities :** Sensory Physiology, Neuroscience **Subjects:** Studies on taste signal transduction and cell-networks in taste buds.	We refer to taste sensations by salty, sour, sweet, bitter and umami. Though taste receptor cells in the taste buds have highly sensitivities to these chemical substances, taste receptor mechanisms are not always clear. In our Laboratory, we study characteristics of taste receptor molecules and signal transduction mechanisms by measuring taste responses with electrophysiological and optical recordings. We also research about cell-networks among taste bud cells.
Hasebe, Yasushi; Professor Phar. D. (Tohoku University) **Specialities :** Applied Biological Chemistry **Subjects:** The studies on the development of novel bio-functional devices based on specific features of biological molecules.	Main topic of our research is the development of novel electrochemical biosensors and bio-functional devices based on excellent features (i.e. molecular-recognition abilities and catalytic activities) of biological molecules such as proteins and nucleic acids. We have already developed various biosensors using 1) functionally modified enzymes, 2) artificial biomolecular films possessing catalytic activity, and 3) biomolecule-modified conductive porous materials. Our present research is focused on the elucidation of the mechanism of functional change of biological molecules and nano-structure of bio-functional interfaces. The final goal of our research is the construction of novel bio-functional devices that can be matched on practical needs in medical, food, environmental and new-energy fields.
Ishikawa, Masahide; Professor Dr.Eng. (The University of Tokyo) **Specialities :** Genetic Engineering, Molecular Biology. **Subjects:** Study on gene expression	In all organisms, genetic information on DNA is transcribed into RNA, and then translated into protein. We study on this gene expression, which is most important for all organisms. The purpose of our researches is the clarification of the relationship between structures and gene expression using genetic engineering.
Hatada, Yuji; Professor Dr. Eng. (Hiroshima University) **Specialities :** Applied microbiology **Subjects:** Research and development of useful substances derived from microorganisms	It's still fresh in our memory how Dr. Satoshi Omura was awarded the 2015 Nobel Prize in Physiology or Medicine. He isolated a bacterial strain of Streptomyces avermitilis that produce the anti-parasitical compound avermectin. The study to explore the useful material from the microorganism has contributed greatly to the improvement of the quality of our lives. We are now studying on the application of a variety of functions of the microorganism to the fields such as agriculture, food, industry, and health.
Akita, Yusuke; Associate Professor Dr. Life Sci. (Tohoku University) **Specialities :** Plant Molecular Biology, Plant Physiology **Subjects:** Study on molecular mechanisms about plant characters, toward more efficient breeding	For the purpose of efficient breeding, we study on the molecular mechanisms about plant characters, especially flower morphology, coloration, and fragrance. Using the information, we try to make more efficient methods for plant breeding, such as molecular markers and 'targeted mutation breeding'.

Master's Program（2021）

Department of Mechanical Engineering

Division of Energy Engineering

Lectures	Credits	Professors		
High-Speed Gas Dynamics	2	Kobayashi, Susumu	Professor	Dr.Eng. (The Univ.of Tokyo)
Advanced Fluid Mechanics	2	Kobayashi, Susumu	Professor	Dr.Eng. (The Univ.of Tokyo)
Advanced Heat Energy Engineering	2	Kosaka, Masataka	Professor	Dr. Eng. (Saga University)
Intermediate Heat Transfer	2	Kosaka, Masataka	Professor	Dr. Eng. (Saga University)
Advanced Study for Tribology	2	Hase,Alan	Associate Professor	Dr.Eng. (Chiba University)
Advanced Combustion Engineering	2	Fukuchi, Apollo	Associate Professor	Dr.Eng. (Tokyo Metropolitan Institute of Technology)
Advanced Theory of Thermal Engineering	2	Kosaka, Masataka	Professor	Dr. Eng. (Saga University)
Advanced Course in Thermodynamics	2	Ishihara, Atsushi		Ph.D. (The Univ.of Illinois)
Advanced Exercise in Energy Engineering Ⅰ～Ⅳ	1	All Professors		
Advanced Colloquium in Energy Engineering Ⅰ～Ⅳ	1	All Professors		
Advanced Experiments in Energy Engineering Ⅰ～Ⅱ	4	All Professors		

Division of Mechanical System Engineering

Lectures	Credits	Professors		
Advanced CAE Engineering	2	Chou,Shiru	Professor	Dr.Eng. (Tokyo Institute of Technology)
Advanced Molding	2	Fukushima, Yoshio	Professor	Dr. Eng. (Gunma University)
Advanced Material Strength	2	Kohzuki, Yohichi	Professor	Dr. Eng. (Kanazawa University)
Advanced Course of Dynamics of Machinery	2	Minagawa, Keisuke	Associate Professor	Dr.Eng. (Tokyo Denki University)
Advanced Multibody System Engineering	2	Ando,Hiroki	Associate Professor	Dr. Eng. (Nagoya University)
Advanced Quality Engineering	2	Kawada,Naoki	Associate Professor	Dr. Eng. (Gunma University)
Advanced Biomechanical Engineering	2	Nagai,chikara	Associate Professor	Dr. Eng. (Akita University)
Advanced Special Lecture on Plastic Working	2	Takahashi, Toshinori	Lecturer	Dr.Eng. (The Univ.of Tokyo)
Advanced Control Engineering	2	Hagiwara, Takaaki	Lecturer	Dr.Eng. (Gunma University)
Advanced Exercise in Mechanical System Engineering Ⅰ～Ⅳ	1	All Professors		
Advanced Colloquium in Mechanical System Engineering Ⅰ～Ⅳ	1	All Professors		
Advanced Experiments in Mechanical System Engineering Ⅰ～Ⅱ	4	All Professors		

Common Subject for All Divisions

Lectures	Credits	Professors		
Internship	2	Hagiwara, Takaaki	Lecturer	Dr.Eng. (Gunma University)

Department of Information Systems

Division of Information Enginering

Lectures	Credits	Professors		
Advanced Media Engineering	2	Watabe, Daishi	Professor	Dr.Sci. (Tohoku university)
Advanced Intelligent Robot Engineering	2	Hashimoto, Tomomi	Professor	Dr.Eng. (Utsunomiya University)
Advanced Medical Image Informatics	2	Yamazaki, Takaharu	Professor	Dr. Med. (Osaka University)
Advanced Physical Computing	2	Kujirai, Masahiro	Professor	Dr. Eng. (Saitama University)
Advanced Pattern Recognition	2	Ohyama, Wataru	Professor	Dr. Eng. (Mie University)
Advanced Neural Information Prosessing	2	Inoue, Satoru	Associate Professor	Dr.Eng. (Univ.of Elec-Communi)
Advanced Network Computing	2	Maeda,Taiyo	Associate Professor	Dr.Sci. (Kanazawa university)
Advanced Cyber Security	2	Morikawa, Tomohiro	Lecturer	Dr. Eng. (Waseda University)
Advanced Deep Learning	2	Murata,Masaki	Lecturer	Dr.Sci. (Kyoto university)
Advanced Exercise in Information Engineering Ⅰ～Ⅳ	1	All Professors		
Advanced Colloquium in Information Engineering Ⅰ～Ⅳ	1	All Professors		
Advanced Experiments in Information Engineering Ⅰ～Ⅱ	4	All Professors		

Division of Advanced Electronics

Lectures	Credits	Professors		
Advanced Signal Processing	2	Cao, Jianting	Professor	Ph.D. (Chiba University)
Integrated Circuit Engineering	2	Yoshizawa, Hirokazu	Professor	Ph.D. (Oregon State University)
Advanced Course of Electromagnetic Engineering	2	Matsui, Akinori	Professor	Ph.D. (Saitama University)
Advanced Course of Optical Fiber Communication	2	Aoki, Yasuhiro	Professor	Ph.D. (Osaka University)
Advanced Synchrotron Radiation Engineering	2	Sato,Susumu	Professor	Ph. D. (Saitama University)
Advanced Course of Circuits and Systems	2	Itami, Fumio	Associate Professor	Dr.Eng. (Shibaura Institute of Technology)
Advanced Course on Nanomaterials	2	Uchida, Masaya	Professor	Ph.D. (The Graduate University for Advanced Studies)
Advanced Plasma Engineering	2	Sato,Susumu	Professor	Ph. D. (Saitama University)
Advanced Thermal and Statistical pysicsni	2	Matsuda, Tomohiro	Professor	Dr.Sci. (The Univ.of Tokyo)
Advanced Exercise in Electronics Ⅰ～Ⅳ	1	All Professors		
Advanced Colloquium in Electronics Ⅰ～Ⅳ	1	All Professors		
Advanced Experiments in Electronics Ⅰ～Ⅱ	4	All Professors		

Common subject for all divisions

Lectures	Credits	Professors		
Internship				

Department of Life Science and Green Chemistry

Division of Materials Chemistry

Lectures	Credits	Professors		
Advanced Lecture on Organometallic Chemistry	2	Iwasaki, Masakazu	Professor	Dr.Eng. (The Univ.of Tokyo)
Advanced Organic Synthetic Chemistry	2	Tanaka, Mutsuo	Professor	Dr.Eng. (Osaka University)
Advanced Functional Material Chemistry	2	Kinoshita, Motoi	Professor	Dr.Eng. (Osaka University)
Advanced Macromolecular Chemistry	2			
Advanced Materials Chemistry	2			
Advanced Exercise in Materials Chemistry I-IV	1	All Professors		
Advanced Colloquium in Materials Chemistry I-IV	1	All Professors		
Advanced Experiments in Materials Chemistry I,II	4	All Professors		

Division of Environmental Chemistry

Lectures	Credits	Professors		
Advanced Lecture on Analytical Chemistry	2	Niwa, Osamu	Professor	Dr.Eng. (The Univ.of Tokyo)
Advanced Lecture on Inorganic Materials	2	Aritani, Hirofumi	Professor	Dr.Eng. (Kyoto University)
Advanced Applied Electrochemistry	2	Matsuura, Hiroaki	Associate Professor	Dr.Sci. (Univ.of Tsukuba)
Advanced Environmental Chemistry	2	Hongo, Teruhisa	Associate Professor	Dr.Sci. (Tokyo Institute of Technology)
Advanced Photochemistry and Plasma Chemistry	2	Yajima, Tatsuhiko		
Advanced Exercise in Environmental Chemistry I-IV	1	All Professors		
Advanced Colloquium in Environmental Chemistry I-IV	1	All Professors		
Advanced Experiments in Environmental Chemistry I,II	4	All Professors		

Division of Life Chemistry

Lectures	Credits	Professors		
Advanced Lecture on Signal Transduction	2	Kumazawa, Takashi	Professor	Phar.D. (Hokkaido University)
Advanced Lecture on Applied Biomolecular Chemistry	2	Hasebe, Yasushi	Professor	Phar.D. (Tohoku University)
Advanced Lecture on Applications of Microbial Engineering	2	Hatada, Yugi	Professor	Dr.Eng. (Hiroshima University)
Advanced Lecture on Genetic Engineering	2	Ishikawa, Masahide	Professor	Dr.Eng. (The Univ.of Tokyo)
Advanced Lecture on Life Chemistry	2	Akita, Yusuke	Associate Professor	Dr.Life Sci. (Tohoku University)
Advanced Exercise in Life Chemistry I-IV	1	All Professors		
Advanced Colloquium in Life Chemistry I-IV	1	All Professors		
Advanced Experiments in Life Chemistry I,II	4	All Professors		

Common subject for all divisions

Lectures	Credits	Professors		
Internship	2	Matsuura, Hiroaki	Associate Professor	Dr.Sci. (Univ.of Tsukuba)

Doctor's Courses

Department of Mechanical Engineering

Objectives

Nowadays, our comfortable and convenient life style largely depends on energy.Particularly, as can be seen in today's intellectually intensive industries, high efficiency in the energy production technology and load reduction to the environment have been the vital research subjects. On the other hand, the more the production system becomes advanced, the more demanded are the design and development of structural material with higher mechanical properties, newer processing technology, active and passive control against mechanical disturbances including natural disasters. Mechanical engineering is not only the base of manufacturing industries, but it plays a key role in realization of technological development that urges the change from rich to happy life. In responding to the forthcoming aging society as well as the social requirements mentioned above, the Department of Mechanical Engineering aims to perform an education and research into the advanced technology and cultivate human resources who can deal with various problems flexibly and develop new ideas.

This department is composed of two divisions of research and education: Division of Energy Engineering and Division of Mechanical System Engineering.

Research Fields

Division of Energy Engineering

Thermodynamics and fluid mechanics play an important role in the energy engineering.The Division of Energy Engineering performs the education and applied research in the following topics:

1) Energy transfer systems with high efficiency and low energy consumption
2) New energy production system
3) Various applications of fluids and shock waves
4) Efficiency improvement by low friction and low erosion

The field of Energy Engineering covers thermodynamics, heat transfer engineering, combustion engineering, fluid dynamics, tribology etc. and its application extends from the fields of agriculture using heat pipes and the medical treatment to the fields of advanced technology such as the design of supersonic aircraft engine.

Taking account of these background situations, the faculty members are mainly composed of researchers in the fields of thermodynamics and fluid dynamics forming the basis of the Energy Engineering. There is designed an education and research program comprehensive for the advanced technology of energy production.

Division of Mechanical System Engineering

Engineering is the science which makes a human life rich and comfortable. From this point of view, the Division of Mechanical System Engineering aims at the following research and development:

1) Analysis of complicated dynamical characteristics
2) Application to a design
3) Automatic control and robotics
4) Scientific investigation of manufacturing and design methodology

For the sake of these objectives, this division is provided with an education and research program comprehensive for the Mechanical System Engineering by the faculty members in the fields of engineering mechanics, strength of materials, optimal design, manufacturing technology, dynamics of machinery, automatic control, and robotics.

Department of Mechanical Engineering / Professors and Specialities

Division of Energy Engineering

Professors / Specialties	Abstracts
Kosaka, Masataka ; Professor Dr. Eng. (Saga University) **Examples of subject themes** Thermodynamics, Heat transfer, Aeroacoustics 1. Research and development on system and element technologies related to hydrogen energy	Technology related to hydrogen energy is highly expected to construct the society of the next-generation. The research activities in Thermal Energy Engineering Laboratory are to seek for the effective utilization ways of hydrogen energy source, such as the hydrogen energy transport, storage and conversion. As topics, in these research activities, the hydrogen storage system using metal hydride (MH), the heat driven type MH refrigeration system and the new method for refueling hydrogen into the fuel cell vehicles (FCV) have been tried from thermal engineering point of view. Each of these researches carry out using experimental and theoretical approaches based on thermal engineering.
Hase, Alan; Associate Professor Dr. Eng. (Chiba University) **Examples of subject themes** 1. Elucidation of Adhesive Wear Mechanism Using Scanning Probe Microscopy. 2. Wear Simulation Using Molecular Dynamics. 3. Study on the Diagnosis and Evaluation of Tribological Phenomena. 4. Research and Development of Intelligent Micro-Machine Tool Using Acoustic Emission Technique.	Tribological phenomena (friction and wear phenomena) are very complex because they are influenced by a lot of factors such as materials, surfaces, ambient atmosphere, sliding conditions, etc. and they occur in nano-scale. Then, we study the elucidation of tribological phenomena, the establishment of wear theory using a scanning probe microscopy, a molecular dynamics simulation, etc. Also, we perform studies on the evaluation of tribological characteristics using an acoustic emission (AE) technique and an in-situ observation method. In order to make an intelligent micro-machine tool, the precise monitoring and evaluation of the state of machining in optimum conditions are needed. Then, we perform advanced studies on the monitoring of machining state using an AE technique particularly for super-precision machine tools and micro-machine tools.

Department of Mechanical Engineering / Professors and Specialities

Division of Human Supportive System Engineering

Professors / Specialties	Abstracts
Zhao, Xilu ; Professor Dr. Eng. (Tokyo Institute of Technology) **Examples of subject themes** 1. Lightweight design of mechanical structure 2. Optimum design of manufacture process CAE 3. Improving mechanical quality by optimum design	By using computer to solve problems of design and manufacture in the machinery industry. Analysis mechanical problems, such as structural strength, structural rigidity, vibration noise, crash characteristics, etc. The shape optimization of 3D complicated structure, Developing high performance vehicle body structure by origami engineering. Optimum design of manufacture process, such as stamping forming, plastic injection molding, die casting, etc. Optimum design of laminated plate and shell of composite materials.
Fukushima, Yoshio ; Professor Dr. Eng. (Gunma University) **Examples of subject themes** Injection Molding,CAD/CAE 1. Analysis and Measurement about Injection Molding, Casting 2. Optimum Mold Design and Manufacturing 3. Research about Practical Design by using CAD/CAE	For the development of Japanese industries, fostering human resources in manufacturing is an important issue. Recently, the requirements of parts weight reduction and highly functional parts have been increasing. So the advancement of injection molding technology and casting technology is very important. We are going to research about above mentioned issues by using flow analysis(CAE), quality engineering (as optimization techniques).
Kohzuki, Yohichi; Professor Dr. Eng. (Kanazawa University) **Examples of subject themes** Deformation characteristics based on dislocation motion are mainly investigated here and the following research themes are given as the examples. 1. Influence of an impurity size on the deformation characteristics during plastic deformation of single crystal 2. Influence of the state of crystal surface on the deformation characteristics during plastic deformation etc.	Plastic deformation occurs in the process of forming a metal,which is controlled by the dislocation (linear defect in crystal) motion on the slip plane containing many impurities and a few forest dislocations during plastic deformation . Plasticity of crystals in a microscopic viewpoint, especially on the basis of dislocation motion , is studied from the data obtained mainly by the strain-rate cycling tests associated with ultrasonic oscillation.

Department of Mechanical Engineering / Professors and Specialities

Division of Human Supportive System Engineering

Professors / Specialties	Abstracts
Minagawa, Keisuke; Associate Professor Dr. Eng. (Tokyo Denki University) **Examples of subject themes** 1. Seismic evaluation method based on energy balance 2. Damage monitoring method for piping focused on vibration properties	In Japan, mechanical structures installed in industrial plants are generally designed statically and elastically against earthquakes. However fracture of structures during earthquakes is produced not only by momentary large load but also by cumulative fatigue damage. The conventional method based on static load cannot evaluate such cumulative damage. Therefore methods that are able to evaluate cumulative damage have been required. Our researches aim to develop evaluation and monitoring method for cumulative damage.
Ando, Hiroki; Associate Professor Dr. Eng. (Nagoya University) **Examples of subject themes** Controlled Mechanical System Design Integrated design of flexible structure and its control system	My study aims to build an integrated design method of structural and control systems for controlled mechanical systems and break through the limits of the conventional design method in which both systems are designed separately. Especially, I focus on the integrated design for compliant mechanisms and continuum robots etc. that rely on large elastic deformation to transmit forces and motion.
Hagiwara,Takaaki; Lecturer Dr. Eng. (Gunma University) **Examples of subject themes** 1. PID control 2. Control design method of of considering the characteristic of the plant	The system that the control engineering targets is large-scale and complex according to the development of various elemental technologies. The control theory and the technology do a large contribution to the development of industry by the control theory's being used for a lot of products. And, when a new control theory and the technology arise, the increase of a further performance gain and the additional value is expected. Then, the research of a new control theory and the technology and the researches on those applications to the real system are done based on a current control theory.

Doctor's Courses

Department of Information Systems

Objectives

Electrical and electronic engineering that began early in the 20th century brought information revolution. Electrical and electronic engineering invents high-performance computers and plays a central role in realizing the Internet society.And, it continues remarkable development today in the 21st century.

Advancement of information technology is expected, and this department targets two education reserch fields of information engineering, electronics engineering, advanced materials and quantum physics. As a curriculum, we have lectures on expert knowledge, exercises to practice expert knowledge, discussion, experiments, and research subjects. Students will acquire experiences of simulation experimental technology, system construction technology,and prototype technology in education and research courses as well as to combine theory and practice. As a result, we develop human resources with a wide range of perspectives and highly specialized expertise in the fields of information systems, intelligent systems, networks, electronic communication systems, advanced materials, and quantum physics.

Research Fields

Division of Information Technology

This division is the educational research field of fundamental research and applied technology development of systems adapting to new information society such as advanced information processing system, information network, and human friendly interface.

We conduct systematic educational reserch on fields of intelligent network system, information security using biometric information, medical image processing recognition and visualization, robot system such as intelligence, welfare, disaster prevention, human computer interaction, advanced reality concerning technology development such as virtual reality, neural network, and arificial intelligence.

Division of Electronics engineering

This division conducts with the following educational research.

- Analog / digital electronic device
- Plasma engineering
- Wired / wireless communication engineering
- Image engineering
- Signal processing and transmission system
- Development trial production of the brain / computer interface
- Design prototype of antenna corresponding to information system
- Design and construction of large capacity long distance optical fiber transmission technology
- System development using network technology
- Development of image conversion and restoration processing technology
- Optical measurement technology

・Information communication system such as measurement and analysis of electroencephalogram and magnetoencephalography
・Interaction of particle beam in matter
・Material design and evaluation for the development of new electronic devices
・Development of nanomaterials

Department of Information Systems / Professors and Specialities

Information Technology

Professors / Specialties	Abstracts
Watabe, Daishi; Professor Dr. Sci. (Tohoku University) **Examples of subject themes** 1. Forensic assistance system based on ear biometrics 2. Application that unlocks smartphone using ear biometrics	With the 2020 Tokyo Olympic and Paralympic Games just a few years away, the issue of entry security at sporting venues and at the athletes' accommodations now under construction is growing increasingly important. Biometrics presents a prominent scheme for improving overall security. Recognition of fingerprints, irises, palms, finger and other veins, facial features, voiceprints, and handwriting can all be used to enhance security. Implementation is possible in areas such as user authentication of smartphones or computers, ATMs, entry control to high-security rooms, and forensics. We are making progress with our research on the topic of biometrics.
Hashimoto, Tomomi; Professor Dr. Eng. (Utsunomiya University) **Examples of subject themes** 1.Proposal of engineering model of mind. 2.Human support robot.	I study two fields such as 1) proposal of engineering model of mind, and 2) Develoment of a human support robot.
Yamazaki, Takaharu; Professor Dr. Med.(Osaka University) **Examples of subject themes** 1. 3D morphological and kinematic analysis of bone joint 2. Development of new medical image processing method 3. Development of automated analysis software for medical image	In a medical institution, for the purpose of examination and visualization for the illness, Radiographic images including CT (Computed Tomography) image have been commonly used. Accurate processing, recognition and visualization for the medical image information are desirable, and accurate measurement and analysis of the image are very important for determining medical diagnosis and treatment planning. Our research theme is development of new medical image processing method, medical image analysis and its evaluation for clinical application.
Kujirai, Masahiro; Professor Dr. Eng. (Saitama University) **Examples of subject themes** 1.Multiple-valued logic circuits, for example: Multiple-operand redundant binary adder and its applications. 2.User-friendly system-description-language based on object-oriented language. 3.Effective interaction method in virtual reality	Multiple-valued logic circuits have the great advantage to speed and less circuit elements. We are studying the redundant binary logic circuits and its applications, for example, multiple-operand adder. Hardware description languages are now in progress to the C-based system description language typified by SystemC. We are proposing a user-friendly, easily codeable and understandable object-oriented system-description-language. Another our subject is the interaction. In virtual reality space, effective interactions are highly needed. We are proposing a not only effective but low-cost system by using mobile phone.

Department of Information Systems / Professors and Specialities

Information Technology

Professors / Specialties	Abstracts
Ohyama, Wataru; Professor Ph.D (Mie University) **Examples of subject themes** 1. Realistic Data Analysis 2. Pattern Recognition and Machine Learni 3. Image Scensing	Our laboratory is researching pattern recognition, machine learning, and media processing as real data science. Current research topics include (1) personal authentication technologies such as signature verification, (2) recognition and analysis of documents and document images, and (3) image sensing technologies for industrial applications. We are also actively collaborating with other academic disciplines such as medicine (analysis of echocardiographic images), history (Analysis of ancient documents and Mokkan), and home economics (recognition of cooking operation).
Inoue, Satoru; Associate Professor Dr.Eng. (Universityof Electro-Communications) **Examples of subject themes** 1.Neural mechanism forming the sound location map with high accuracy in the brain of barn owl. 2.Binding method of information processed	Sensory Information processing system, for example visual and auditory, and control mechanism of motion induced by information processed in individual sensory brain area are studied. Such precise functions performed by brain of living thing are reproduced in computer system based on the neural network theory and sensory processing and motor control system are studied seamlessly. In addition, the method for applying the function of the brain industrially is also examined.
Maeda, Taiyo; Associate Professor Ph.D. in Science. Kanazawa University **Examples of subject themes** 1.Supporting System 2.Visualization System	For effective tasks and better understandings, researchers and engineers need tools by using information and communication technology. One of the approaches is Problem Solving Environments (PSEs) which would interact with on their technical terms. We focus on development of supporting system for them by using commodity computers and network technologies, and combination of several technologies for the system.
Murata, Masaki; Lectuer Ph.D. (in Science. Kyoto University) **Examples of subject themes** 1.Application of Deep Learning 2.Explainable Deep Learning	Artificial Intelligence (AI) plays a significant role in industrial and academic fields. Modern AI systems are supported by Deep Learning. In this laboratory, we work on applying Deep Learning in various fields and on revealing the reasoning of decisions of Deep Learning.

Department of Information Systems / Professors and Specialities

Information Technology

Professors / Specialties	Abstracts
Morikawa, Tomohiro; Lectuer Dr. Eng. (Waseda University) **Examples of subject themes** 1. Generation of Lightweight and high-performance URL blacklist 2. Automatic detection of promotional attackers in mobile app store 3. Context-specific fake information generation	Since the cyber attackers' modus operandi is rapidly evolving to evade the existing attack detection system, new types of attacks that can not be identified have continued to emerge in various security fields. By realizing the delayed countermeasures, we focus on not only detecting and preventing previously unknown attacks in the early stage using technologies such as natural language processing and machine learning, but also implement the abuse of the latest artificial intelligence technologies from the perspective of the attackers and establish an effective and efficient countermeasure against it.

Department of Information Systems / Professors and Specialities

Electronics and Information Engineering

Professors / Specialties	Abstracts
Cao, Jianting; Professor Ph.D. (Chiba University) **Examples of subject themes** 1. Study on analysis of EEG/MEG data and visualization of brain activities 2. Study on blind signal processing theory and its applications	Blind signal processing problems arises in many areas such as biomedical signal processing, image/speech signal processing and mobile communication. Each of these fields focuses on different aspects of the same problem in situations where neither input signals nor transmitting media are known. Such signal processing is frequently referred to as unsupervised in the most difficult environment. Our laboratory focuses on the problem of blind source signal separation, extraction, identification and equalization. We mainly investigate and develop advanced methods and novel algorithms based on statistical inference and information theory for processing and analysis of human brain signal detected by high density array electroencephalography (EEG) and magnetoencephalography (MEG) machines. We are also interesting in analyzing both biological and artificial neural network models associated with adaptive learning rules in order to understand human brain information processing and implement engineering designs of intelligent
Yoshizawa, Hirokazu; Professor Ph.D. (Oregon State University) **Examples of subject themes** 1.Low-voltage CMOS operational amplifier 2.Low-voltage DC-DC converter 3.Low-voltage current circuit	Most of the physical quantities in the nature are analog such as sound and light, etc. Analog/digital mixed-mode circuits play an important role of the interface between these analog quantities and digital electronic devices. Hence, the performances of the digital electronic devices are often limited by the performances of analog circuits used in the interface. In addition, there is a great demand for low-voltage low-power circuit operation because of a great increase of portable electronic devices such as a portable audio player and a cellular phone. Our research target is low-voltage, low-power, and/or high precision CMOS analog IC design.
Matsui, Akinori; Professor Ph.D. (Saitama University) **Examples of subject themes** Study on the radiation properties of planar antenna Study on the radio communication circuit with multi function for high frequency region.	Antenna utilized in radio communication is needed to develop the configuration for the use. Planar antenna, especially, is used in many application fields due to the low-profile property. In our laboratory, we propose the new type of the planar antenna for the application and analyze the radiation characteristics through the experiments, the theory and the computer simulation.

Department of Information Systems / Professors and Specialities

Electronics and Information Engineering

Professors / Specialties	Abstracts
Sato, Susumu ; Professor Ph. D. (Saitama University) **Examples of subject themes** 1. A study of ion beam application. 2. Development of microwave induced plasma in liquid. 3. Chemical synthesis by microwave irradiation.	Microwave oven is using in many homes. In this way, the electromagnetic wave is used as electricity energy in home and industry. One of electromagnetic wave applications is plasma generating. Generated plasma is used in producing of semiconductor device or in other industries. The research activity in this laboratory is microwave application, electromagnetic wave induced plasma and this application. Especially, microwave induced plasma in liquid is novel technique. Through these novel technology developments, we bring up engineer and researcher in next generation.
Fujita Kazuhiro; Associate Professor Dr.Eng. (Hokkaido University) **Examples of subject themes** 1. Fast and accurate methods for electromagnetic field analysis 2. Electromagnetic compatibility in electronic equipment 3. Modeling, analysis and designs of particle accelerator components	For development of electric and electronic equipment, it is necessary to model and simulate electromagnetic phenomena in complex systems, and to predict unintended characteristics in early design stages. Computational electromangetics technology is widely used to solve electric and magnetic problems even in the field of industry from science. This laboratory addresses advancement and improvement of electromagnetic field analysis techniques and their applications for finding generation mechanisms of electromagnetic noize in electronic equipment and contributing to effectiveness of designs.

Department of Information Systems / Professors and Specialities

Electronics and Information Engineerimg

Professors / Specialties	Abstracts
Uchida, Masaya; Professor Ph.D. (The Graduate University for Advanced Studies) **Examples of subject themes** Control and Manipulation of Wavefunctions by Nanotechnology	Recently, innovative materials and devices such as quantum dots and metamaterials have been generated by nanotechnology. Its essence lies in the control and manipulation of wavefunctions by nanostructures. Electron beams carrying orbital angular momentum, which we discovered for the first time, are one of them. In our laboratory, we aim to find novel quantum phenomena, innovative materials and devices, and new analytical methods for materials, by controlling and manipulating wavefunctions using nanotechnology.
Matsuda, Tomohiro; Professor Dr.Sci. (The University of Tokyo) **Examples of subject themes** Early Universe, GUT and their consistencies.	A unified theory would be a mathematical framework in which all the different kinds of forces and particles occur naturally. Many aspects of the very early universe can be described with unified models of particle physics. We are now beginning to learn things about particle physics through observations that use telescopes and other methods to look far into the universe and deep into its past. The recent abundance of results from such observations has made the subject of particle cosmology blossom. Our research concerns the interplay between gravity and particle physics in the very early universe. We study the cosmological implications of quantum field theories, General Relativity, and superstring (brane) theories.

Doctor's Courses

Department of Life Science and Green Chemistry

Objectives

In the extreme progress of science and technology, the fields of development of new materials, solving of environmental problems, and biotechnology, are significant matters in this century.

The Department of Life Science and Green chemistry is composed of three divisions of education and research: Division of Materials Chemistry, Division of Environmental Chemistry, and Division of Life Chemistry, corresponding to the above fields, This department flexibly deals with the advance on science and technology and actively carries out the education and research project on the most advanced science and technology, and raises excellent engineers and researchers who will be able to support Japan in this century.

Research Fields

Division of Materials Chemistry

To develop new materials improving the quality of our lives, the Division of Materials Chemistry performs education and research on materials chemistry such as development of a novel reaction for organic synthesis, syntheses of highly value- added compounds, development of high performance chemical and biological sensors, development of photo- alignment materials, and creation of photo- and electro- active mateoals for optoelectronic device, based on synthetic organic chemistry, organometallic chemistry, analytival chemistory, electrochemistry, micro/nano chemistry, functional material chemistry, liquid crystal chemistry, and photochemistry.

Division of Environmental Chemistry

To solve the global problems on environments, the Division of Environmental Chemistry performs education and research on environmental chemistry such as development of novel inorganic materials for environmental conservation, creation of environmental purification materials, synthesis of functional materials from wastes, and development of energy - conversion devices, and calibration- free sensing techniques, based on catalytic chemistry, inorganic material science, environmental materials chemistry, surface electrochemistry,and analytical chemistry.

Division of Life Chemistry

To contribute to further progress of new biotechnology, the Division of Life Chemistry performs education and research on life chemistry such as elucidation of biological signal transduction, development of bio- functional devices, control of gene expression, and development of useful substances derived from microorganisms, based on sensory physiology, neuroscience, bioelectrochemistry, applied biomolecular chemistry, genetic engineering, molecular biology, applied microbiology, and protein engineering.

Department of Life Science and Green Chemistry / Professors and Specialities

Materials Chemistry

Professors / Specialties	Abstracts
Iwasaki, Masakazu; Professor Dr. Eng. (The University of Tokyo) **Examples of subject themes** Organic synthesis catalyzed by organometallic complexes.	In my group, it is investigated to develop a novel reaction for organic synthesis using carbon monoxide as a carbon source and transition metal complexes as catalysts. Carbon monoxide is inexpensive carbon source readily available from coal or petroleum and its interaction with metals is well studied. Besides bulk syntheses of simple compounds, syntheses of highly value-added compounds by carefully tuned and designed reactions are also studied in my group. As a research activity in an academic organization, understanding of the reaction mechanism is strongly emphasized and the reactions of model complexes are studied intensively.
Niwa, Osamu; Professor Dr. Eng. (Kyushu University) **Examples of subject themes** 1. Development of Chemical and Biochemica Sensors based on Sputtered Nanocarbon Film 2. Development of Highly Electrocatalytic Electrodes using Metal Nanoparticles Embedded Carbon Film 3. Development of Metal Oxide Electrodes with Direct Electron Transfer Between Enzymes and Their Application for Evaluating Drug Metabolisis	In order to realize high performance chemical and biochemical sensors, it is very important to develop materials with new functions. In our laboratory, we will develop new carbon based electrode materials including nanocarbon films with atomic level flat surface, metal nanoparticles embedded carbon films and metal oxide films by employing vacuum technology such as sputtering. Based on above electrode materials, we will realize various sensors for detecting environmental pollutants, biomarkers for diseases, and antioxidants in foods and beverages. Not only to develop sensing methods, microsensing devices will be developed based on micro/nanotechnology.
Tanaka, Mutuo; Professor Dr. Eng. (Osaka University) **Examples of subject themes** Studies on Functional Materials, for Lipids and Nucleic Acids example, Surface Modification Materials, Polymers, Permeation Membrane Materials, Lipids, and Nucleic Acids	There are so many functional materials to support our life. Among materilas, plastics, paints, and medicines are visible and easy to recognize those functions, while some materilas such as sensors and displays look like a kind of black-box beyond understanding. Our laboratory, fabrication of new functional materials are examined through understanding the nature and structures of materilas at atomic and molecular level. Not only organic but also inorganic materilas are used to realize desirable functions.

Department of Life Science and Green Chemistry / Professors and Specialities

Materials Chemistry

Professors / Specialties	Abstracts
Kinosita, Motoi; Professor Dr. Eng. (Osaka University) **Examples of subject themes** Creation of photo- and electro-active materials with cooperative nature and their applications in optoelectronic devices.	Functional molecular systems have attention as one of the low environmental-load materials. Among them, liquid crystals (LC) show a self-organizing nature, cooperative motion, and anisotropy in various physical properties such as transition moment, dielectric constant and refractive index. Modulation of alignment changes in LCs by external stimuli such as optical, electrical and magnetic fields gives rise to a change in physical properties of LCs. It is a key issue to control of molecular alignment for developing smart optical and electronic devices. We focus on creation of smart materials with cooperative nature, which respond to external stimuli such as light because of clean energy, fast response and remote controllable.

Department of Life Science and Green Chemistry / Professors and Specialities

Environmental Chemistry

Professors / Specialties	Abstracts
Aritani, Hirofumi; Professor Dr.Eng. (Kyoto University) **Examples of subject themes** Development of novel inorganic materials for environmental conservation.	Inorganic materials show several unique properties under high temperature and/or pressure. Functionalized inorganic materials should be applied to clean exhaust gases from chemical industry or automobiles for environmental conservation. The properties on inorganic materials can be controlled by control of structural and/or characteristic parameters. Characterization of active sites on the materials is very important to obtain structural information of the unique property, and development of novel functional materials should be based on the structural information. Our study is focused on the design of active structure in functional inorganic materials in order to develop inorganic materials with high activity.
Matsuura, Hiroaki; Associate Professor Dr.Sci. (University of Tsukuba) **Examples of subject themes** Studies on electrochemical modification and development of novel functional materials.	The development of novel materials with high performance is desired in industry, energy conversion systems, chemical sensing techniques and many other fields. Our research target is to develop carbon-based novel functional electrodes. We are studying about the development of carbon-based catalytic electrodes fabricated by using electrochemical techniques. In addition, we are developing energy conversion devices such as fuel cells and electrochemical sensing technology including inorganic/organic compounds.
Hongo, Teruhisa; Associate Professor Dr. Sci. (Tokyo Institute of Technology) **Examples of subject themes** Creation of environmental purification materials, Development of global warming prevention technology, Development of recycling system.	In order to realize a sustainable society, there are various problems which must be solved. Among them, environmental pollution, resource depletion,and global warming problems are urgently needed to be resolved. We are exploring environmental purification materials constructed by abundant common elements. Moreover, we are studying on development of carbon dioxide fixation technology, and recycling system that uses waste as resources and energy.

Department of Life Science and Green Chemistry / Professors and Specialities

Life Chemistry

Professors / Specialties	Abstracts
Kumazawa, Takashi; Professor Phar. D. (Hokkaido University) **Examples of subject themes** Studies on taste signal transduction and cell-networks in taste buds.	We refer to taste sensations by salty, sour, sweet, bitter and umami. Though taste receptor cells in the taste buds have highly sensitivities to these chemical substances, taste receptor mechanisms are not always clear. In our Laboratory, we study characteristics of taste receptor molecules and signal transduction mechanisms by measuring taste responses with electrophysiological and optical recordings. We also research about cell-networks among taste bud cells.
Hasebe, Yasushi; Professor Phar. D. (Tohoku University) **Examples of subject themes** The studies on the development of novel bio-functional devices based on specific features of biological molecules.	Main topic of our research is the development of novel electrochemical biosensors and bio-functional devices based on excellent features (i.e. molecular-recognition abilities and catalytic activities) of biological molecules such as proteins and nucleic acids. We have already developed various biosensors using 1) functionally modified enzymes, 2) artificial biomolecular films possessing catalytic activity, and 3) biomolecule-modified conductive porous materials. Our present research is focused on the elucidation of the mechanism of functional change of biological molecules and nano-structure of bio-functional interfaces. The final goal of our research is the construction of novel bio-functional devices that can be matched on practical needs in medical, food, environmental and new-energy fields.
Ishikawa, Masahide; Professor Dr.Eng. (The University of Tokyo) **Examples of subject themes** Study on gene expression	In all organisms, genetic information on DNA is transcribed into RNA, and then translated into protein. We study on this gene expression, which is most important for all organisms. The purpose of our researches is the clarification of the relationship between structures and gene expression using genetic engineering.
Hatada, Yuji; Professor Dr. Eng. (Hiroshima University) **Examples of subject themes** Research and development of useful substances derived from microorganisms	It's still fresh in our memory how Dr. Satoshi Omura was awarded the 2015 Nobel Prize in Physiology or Medicine. He isolated a bacterial strain of Streptomyces avermitilis that produce the anti-parasitical compound avermectin. The study to explore the useful material from the microorganism has contributed greatly to the improvement of the quality of our lives. We are now studying on the application of a variety of functions of the microorganism to the fields such as agriculture, food, industry, and health.
Akita, Yusuke; Associate Professor Dr. Life Sci. (Tohoku University) **Examples of subject themes** Study on molecular mechanisms about plant characters, toward more efficient breeding	For the purpose of efficient breeding, we study on the molecular mechanisms about plant characters, especially flower morphology, coloration, and fragrance. Using the information, we try to make more efficient methods for plant breeding, such as molecular markers and 'targeted mutation breeding'.

Doctoral Program

Department of System Engineering

Division of Energy Engineering

Lectures	Credits	Professors		
High-Speed Gas Dynamics	2	Kobayashi, Susumu	Professor	Dr.Eng. (The Univ.of Tokyo)
Advanced Fluid Mechanics	2	Kobayashi, Susumu	Professor	Dr.Eng. (The Univ.of Tokyo)
Advanced Heat Energy Engineering	2	Kosaka, Masataka	Professor	Dr. Eng. (Saga University)
Advanced Theory of Thermal Engineering	2	Kosaka, Masataka	Professor	Dr. Eng. (Saga University)
Advanced Study for Tribology	2	Hase,Alan	Associate Professor	Dr.Eng. (Chiba University)
Advanced Course in Thermodynamics	2	Ishihara, Atsushi		Ph.D. (The Univ.of Illinois)
Advanced Research in Energy Engineering	4	All Professors		
Advanced Lectures and Colloquium in Energy Engineering	4	All Professors		

Division of Human Supportive System Engineering

Lectures	Credits	Professors		
Advanced CAE Engineering	2	Chou,Shiru	Professor	Dr.Eng. (Tokyo Institute of Technology)
Advanced Molding	2	Fukushima, Yoshio	Professor	Dr. Eng. (Gunma University)
Advanced Material Strength	2	Kohzuki, Yohichi	Professor	Dr. Eng. (Kanazawa University)
Advanced Course of Dynamics of Machinery	2	Minagawa, Keisuke	Associate Professor	Dr.Eng. (Tokyo Denki University)
Advanced Multibody System Engineering	2	Ando,Hiroki	Associate Professor	Dr. Eng. (Nagoya University)
Advanced Biomechanical Engineering	2	Nagai,chikara	Associate Professor	Dr. Eng. (Akita University)
Advanced Control Engineering	2	Hagiwara, Takaaki	Lecturer	Dr.Eng. (Gunma University)
Advanced Research in Human Supportive System Engineering	4	All Professors		
Advanced Lectures and Colloquium in Human Supportive System Engineering	4	All Professors		

Common Subject for All Divisions

Lectures	Credits	Professors		
Internship	2	Hagiwara, Takaaki	Lecturer	Dr.Eng. (Gunma University)

Department of Information Systems

Division of Information Engineering

Lectures	Credits	Professors		
Advanced Media Engineering	2	Watabe, Daishi	Professor	Dr.Sci. (Tohoku university)
Advanced Intelligent Robot Engineering	2	Hashimoto, Tomomi	Professor	Dr.Eng. (Utsunomiya University)
Advanced Medical Image Informatics	2	Yamazaki, Takaharu	Professor	Dr. Med. (Osaka University)
Advanced Physical Computing	2	Kujirai, Masahiro	Professor	Dr. Eng. (Saitama University)
Advanced Pattern Recognition	2	Ohyama, Wataru	Professor	Dr. Eng. (Mie University)
Advanced Neural Information Prosessing	2	Inoue, Satoru	Associate Professor	Dr.Eng. (Univ.of Elec-Communi)
Advanced Network Computing	2	Maeda,Taiyo	Associate Professor	Dr.Sci. (Kanazawa university)
Advanced Cyber Security	2	Morikawa, Tomohiro	Lecturer	Dr. Eng. (Waseda University)
Advanced Deep Learning	2	Murata,Masaki	Lecturer	Dr.Sci. (Kyoto university)
Advanced Research in Information Engineering	4	All Professors		
Advanced Lectures and Colloquium in Information Engineering	4	All Professors		

Division of Electron and Information Engineering

Lectures	Credits	Professors		
Advanced Signal Processing	2	Cao, Jianting	Professor	Ph.D. (Chiba University)
Integrated Circuit Engineering	2	Yoshizawa, Hirokazu	Professor	Ph.D. (Oregon State University)
Advanced Course of Electromagnetic Engineering	2	Matsui, Akinori	Professor	Ph.D. (Saitama University)
Advanced Course of Optical Fiber Communication	2	Aoki,Yasuhiro	Professor	Ph.D. (Osaka University)
Advanced Synchrotron Radiation Engineering	2	Sato,Susumu	Professor	Ph. D. (Saitama University)
Advanced Course on Nanomaterials	2	Uchida, Masaya	Professor	Ph.D. (The Graduate University for Advanced Studies)
Advanced Plasma Engineering	2	Sato,Susumu	Professor	Ph. D. (Saitama University)
Advanced Thermal and Statistical Physics	2	Matsuda, Tomohiro	Professor	Dr.Sci. (The Univ.of Tokyo)
Advanced Lectures and Colloquium in Electronic and Information Engineering	4	All Professors		

Common Subject for All Divisions

Lectures	Credits	Professors		
Internship	2			

Department of Life Science and Green Chemistry

Division of Materials Chemistry

Lectures	Credits	Professors		
Advanced Lecture on Organometallic Chemistry	2	Iwasaki, Masakazu	Professor	Dr.Eng. (The Univ.of Tokyo)
Advanced Organic Synthetic Chemistry	2	Tanaka, Mutsuo	Professor	Dr.Eng. (Osaka University)
Advanced Functional Material Chemistry	2	Kinoshita, Motoi	Professor	Dr.Eng. (Osaka University)
Advanced Macromolecular Chemistry	2			
Advanced Materials Chemistry	2			
Advanced Research in Material Chemistry	4	All Professors		
Advanced lecture and Colloquium in Material Chemistry	4	All Professors		

Division of Environmental Chemistry

Lectures	Credits	Professors		
Advanced Lecture on Analytical Chemistry	2	Niwa, Osamu	Professor	Dr.Eng. (The Univ.of Tokyo)
Advanced Lecture on Inorganic Materials	2	Aritani, Hirofumi	Professor	Dr.Eng. (Kyoto University)
Advanced Applied Electrochemistry	2	Matsuura, Hiroaki	Associate Professor	Dr.Sci. (Univ.of Tsukuba)
Advanced Environmental Chemistry	2	Hongo, Teruhisa	Associate Professor	Dr.Sci (Tokyo Institute of Technology)
Advanced Photochemistry and Plasma Chemistry	2	Yajima, Tatsuhiko		
Advanced Research in Environmental Chemistry	4	All Professors		
Advanced lecture and Colloquium in Environmental Chemistry	4	All Professors		

Division of Life Chemistry

Lectures	Credits	Professors		
Advanced Lecture on Signal Transduction	2	Kumazawa, Takashi	Professor	Phar.D. (Hokkaido University)
Advanced Lecture on Applied Biomolecular Chemistry	2	Hasebe, Yasushi	Professor	Phar.D. (Tohoku University)
Advanced Lecture on Applications of Microbial Engineering	2	Hatada, Yugi	Professor	Dr.Eng. (Hiroshima University)
Advanced Lecture on Genetic Engneering	2	Ishikawa, Masahide	Professor	Dr.Eng. (The Univ.of Tokyo)
Advanced Lecture on Life Chemistry	2	Akita, Yusuke	Associate Professor	Dr.Life Sci. (Tohoku University)
Advanced Research in Life Chemistry	4	All Professors		
Advanced lecture and Colloquium in Life Chemistry	4	All Professors		

Common subject for all divisions

Lectures	Credits	Professors		
Internship	2	Matsuura, Hiroaki	Associate Professor	Dr.Sci. (Univ.of Tsukuba)

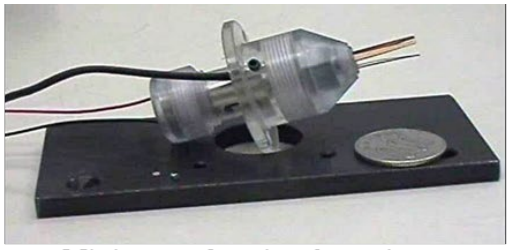
Introduction to the Laboratory

Robot Design Laboratory, Department of Mechanical Engineering
Dr. Eng. Hiroki Ando, Associate Professor

Structures made flexible in certain areas can be considered as mechanisms without kinematic joints. Recently, attempts to give structures new functions using flexibility positively have been attracting attention, and many studies on the flexible mechanisms such as compliant mechanisms, functional continuums and continuum robots have been actively conducted in Japan and abroad.

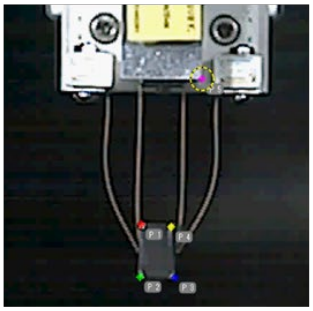
In those studies, the flexible mechanisms utilize structural elasticity for mechanism function and have advantages that are cost reduction (part-count reduction, reduced assembly time, and simplified manufacturing processes) and increased performance (increased precision, increased reliability, reduced wear, reduced weight, and reduced maintenance). Moreover, developments of miniature robots with extraordinary ability in movement have been carried out.

In our laboratory, we are interested in optimal design of the structure and control system of the flexible mechanisms and aim to apply the flexible mechanisms to technical issues in industry, medical care, welfare, and agriculture.

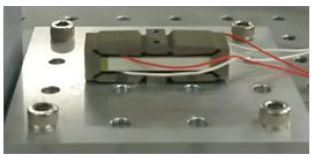


Miniature electric robot gripper

Electric tweezer-type soldering iron device



Elastic fingered robot gripper



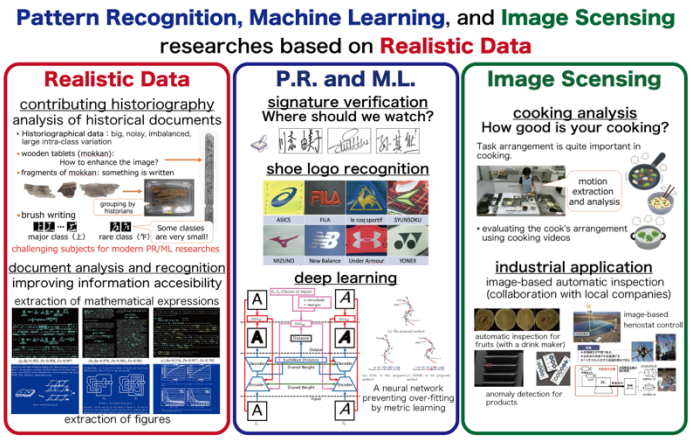
PZT actuator

Flexible forceps for flexible endoscopy

Electric tweezers for people with impaired hand function

Introduction to the laboratory

Intelligent Media Processing Laboratory
Professor Wataru Ohyama,



Our laboratory is researching pattern recognition, machine learning, and media processing as real data science. Current research topics include (1) personal authentication technologies such as signature verification, (2) recognition and analysis of documents and document images, and (3) image sensing technologies for industrial applications. We are also actively collaborating with other academic disciplines such as medicine (analysis of echocardiographic images), history (Analysis of ancient documents and Mokkan), and home economics (recognition of cooking operation).

(1) Signature verification:

Many situations in daily life require identity verification, such as logging in to a smartphone or PC, withdrawing money from a bank account using an ATM, and shopping with a credit card. Signatures are not widely used in modern Japan, but they are a standard method of personal authentication used in Western countries since ancient times. Like other authentication methods, signature verification has many advantages and disadvantages. The biggest problem with signature verification is that authentication is less accurate than other authentication methods (iris or fingerprint). We are conducting various studies to solve this problem.

(2) Industrial applications of image sensing technology:

With the spread of FA (Factory Automation) and the development of machine learning technology, image recognition technology is expected as a means of production instruction and quality control in the production process. We focus on industrial applications of image analysis and recognition technologies through collaboration with local SMEs. Examples of research include the detection and identification of logo marks in images, application of image analysis technology to high-precision control of a reflector called a heliostat used in solar thermal power generation, automation of manual fruit sorting work in food factories, recognition of cooking operations, and evaluation of cooking preparation ability.

Recently, the importance of training engineers who are familiar with mathematical and data science and can utilize new artificial intelligence (AI) technologies such as deep learning attract social attention. Our laboratory researches data science technologies based on actual data. Through these researches, we train engineers who can see everything from the basics to application and implementation.

Introduction to the Laboratory

Advanced Science Research Laboratory, Laboratory for Micro and Nano chemistry
Dr. Osamu Niwa (Professor)

The size of 1 nm nanoparticles becomes the size of sesame seed if 1 m size is expanded to the size of Japan Archipelage (about 2000 km). These very small metal nanoparticles or atomically flat nanocarbon films show unique functions including catalytic effect. In our laboratory, we are studying such nanomaterials in order to apply for chemical and biochemical sensors and analytical instruments for future contribution of biomedical, health and environmental fields.

1. Detection of toxic heavy metal cations in the environmental water

The concentrations of toxic heavy metals such as cadmium and arsenic ($As^{3+)}$ ions are strictly regulated less than 10 ppb level (about 5 mg in 500 mL pet bottle). The pollution by heavy metals in drinking water is now big problem in Asian countries. Our laboratory developed gold (Au) nanoparticles embedded carbon film electrode as shown in Fig.1. As^{3+} was preconcentrated onto the Au nanoparticles surface by negative potential application and detection limit lower than 10 ppb was achieved.

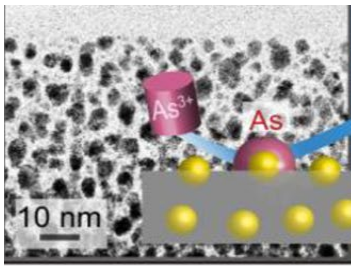


Fig.1 Gold nanoparticles embedded carbon film for As^{3+} detection

2. Nanostructured electrode based biosensors

Direct electron transfer (DET) between enzyme and electrode is very efficient on the surface of nanostructured electrodes. Our laboratory has been studying to develop simple biosensors by modifying enzymes on the surface of nanostructured electrodes fabricated by irradiating deep UV or plasma(Fig. 2). Various applications including drug metabolisim and inhibition sensors, health care sensors and biofuel cells are expected.

Our laboratory is collaborating to develop analytical instruments (Fig. 3) with AIST (Tsukuba) and companies in Saitama prefectural project. Our laboratory also contributed to establish sensor & IoT consortium and now planning the project about health care and safe and secure sensors combined with IoT with various companies and universities including Tokyo Medical and Dental Univ., Yamagata Univ. and Univ. of Tokyo.

Fig. 2 N_2 plasma treatment equipment.

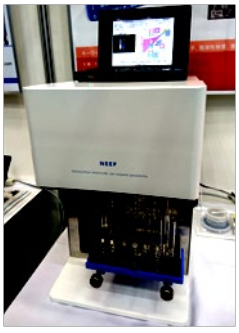


Fig. 3 Instrument developing in Saitama Project.

Introduction to the Laboratory

Applied microorganism engineering
Hatada, Yuji; Professor

Microscopic organisms, known as microorganisms or microbes, are found in huge numbers in almost every environment on Earth. They are invisible to the human eye. Microorganisms support material recycling on the earth, for example, circulation of carbon (C), nitrogen (N), sulfur (S) and phosphorus (P).

Approximately three million kinds of microorganisms are presumed to exist on the earth. However, the identity of which has been revealed to date is only 1%, the remaining 99% are unresearched microorganisms whose ability has not been evaluated.

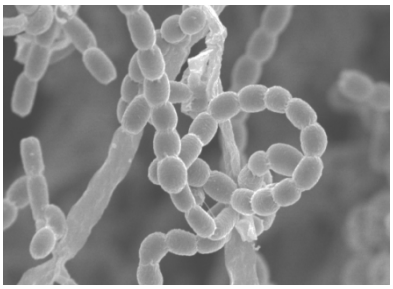


Fig. 1 An antibiotic producing microorganism was observed by an electron microscope.

Microorganisms have been used to produce fermented foods, and many drugs such as antibiotics have been found in microorganisms (Fig. 1) as seen in the Nobel Prize of Dr. Satoshi Omura. In the future, the ability of microorganisms is expected to be great in the development field of new energy to replace fossil fuel.

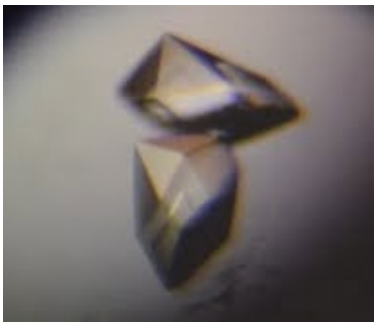
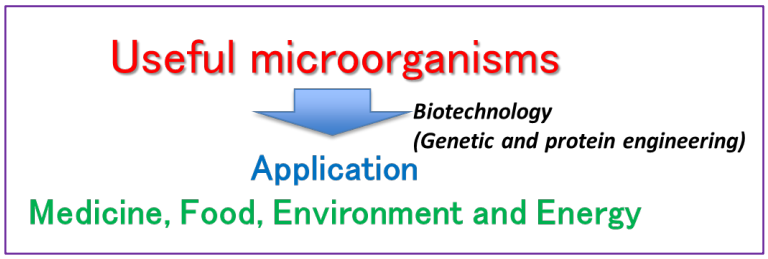


Fig. 2 Structural analysis of useful enzyme to improve the function.

We are now searching for new antibiotics from microorganisms, and useful microorganisms or enzymes (Fig. 2) that can be used for fermented-food production and for environmental-improvement.



Educational Facilities

3D printer (optical shaping apparatus):

Figure 1 shows our optical shaping apparatus called “ATOMm4000” which can make A4-size objects with the accuracy upto 0.1mm. Through CAD data, we can make prototypes of various mechanical parts. Students can experience research study based on the rapid-prototyping development method. Figure 2 shows an example of prototype made by using this machine.

Fig.1 Optical shaping apparatus

Fig.2 Example of prototype

Research platform for self-driving car

Figure 3 shows our research platform for self-driving car called "Robocar /Autoware package". This system has a computer with GPGPU that quickly processes 3D information from LiDAR sensors and high resolution 2D cameras, and performs self-localization, path-planning and obstacle detection. By modifying or replacing AI software installed in this computer, students can experience research study regarding the development of self-driving car.

Fig. 3 Research platform for self-driving car

High-Speed Video Camera

Figure 4 shows the tennis impact using the high-speed video camera. This study made clear for the first time the mechanism of actual top spin using high-speed video analysis, which is contrary to the hypothetical conventional spin theory. As the main strings stretch and slide side ways and they spring back, the ball is given spin when the ball is released from the strings. Figure 5 shows the analysis of super-high speed NANBA running of humanoid biped robot also using the high-speed video camera which is very useful for research on dynamics of sports engineering and Robotics.

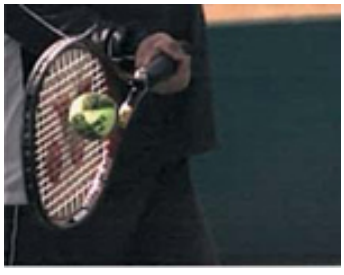


Fig.4 The mechanism of actual top spin were made clear for the first time using the high-speed video analysis.

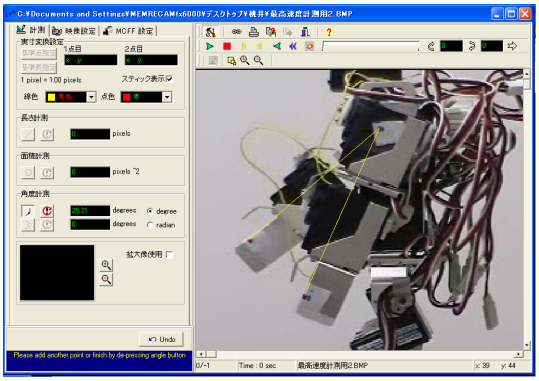


Fig.5 Analysis of super-high speed running of humanoid biped robot using the high-speed video camera.

Instruments for DNA purification and analysis

This system is consisted of following five instruments

1. Ultrapure water system

(Milli-Q SP VOC, Millipore)Preparation of ultrapure water

2. HPLC system (Gilson) Purification of oligonucleotides

3. Advanced multicycler (T3 thermocycler, Biometra) DNA amplification and re-action of DNA sequencing

4. Genetic Analyzer (ABI PRISM 310, ABI), Determination of DNA sequences

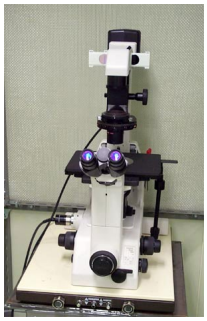
5. Microplate Specrofluorometer (SPACTRAmax GEMINI, Molecular Devices) Measurement of fluorescence of multi sample

BIO-CLEAN ROOM

This facility is designed in the P2 level with the pre- and the main room for safety culture of cells and bacteria. The main room has a clean bench, a safety cabinet, an autoclave, an incubator, an ultra-low freezer an inverted microscope and other equipments.

Ultra-low Freezer and Incubator

Biological Safety Cabinet, Incubator Shaker and Sterilizer

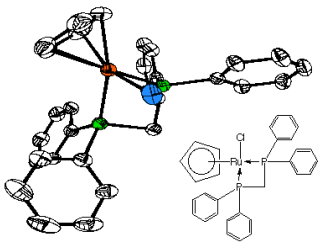


Bio-inverted Micro-scope System

X-ray diffractometer for single crystal structure analysis

When a single crystal, typically with a size of 0.2mm each edge, is exposed in a X-ray beam, the beam is diffracted (reflected) in various directions. The intensities and the reflection angles of the diffracted X-rays are precisely measured, analyzed to provide the relative position of the each atom in the sample crystal. This method is mainly utilized to determine the "shape" of a molecule in a atom level. The great advantage of this method is that it gives quite clear information on the shape of a molecule, while the other methods are somewhat indirect.

X-ray diffractometer
(RIGAKU R-AXIS RAPID)



Example of Structure Analysis

LC-TOFMS（JEOL　JMS-T100LP）

JMS-T100LP is a high performance Time-of-Flight type mass spectrometer. The mass range of T100LP is 6 to 10000(m/z) and the resolution is over 6000. It is equipped with ESI and APCI ionization unit and good for analysis of amino acid and protein. This TOF-MS is also equipped DART (Direct Analysis in Real Time) ion source, which can analyze solid, liquid and/or gaseous samples at atmospheric pressure.

◆SIT Library

The SIT Library has a special reading room for graduate students, in which are provided reading desks, AV booths and a library for graduate students. In addition, students can ask the staff to lend them books which the SIT Library does not have from other libraries and make photocopies. They can also receive various kinds of other services.

Reading Room for Graduate Students

Library Reference System

Any book can be easily searched for using keywords, titles or authors' names.

AV-booth

Audio-visual materials can be used with VTRs or DVDs in a comfortable space.

High-Technology Research Center

High-Technology Research Center (HRC) was established in 1999, which aimed for enhancing the advanced science research work of Saitama Institute of Technology. Ministry of Education, Culture, Sports, Science and Technology （MEXT） carried out "High Technology Research Center Project" in order to enhance the advanced science business of private universities. With supported by that project, three research projects has been continuously carried on for five years by HRC, which were development of intelligent system on high reliability environment, manufacture system of super-function materials and advanced computer simulation system, respectively. A lot of research results have been achieved, such as "Creation of a new performance and highly reliable material that harmonized with the environment" has been authorized and applied, and a new HRC project has been executed since 2004. The project has obtained many results and ended March in 2009. "Research on the innovation creation of the environment and energy to support the recycling society" was authorized in 2007. In the latter case, the research project contains the restoration, improvement, and purification of destroyed environment, as well as the energy crisis and energy conservation technique. The research work mainly aims at supporting the recycling society, which is giving priority to "Basic research", "Applied research" related to the environment and energy. And "Training of young researchers" is another aim of this project, which can enhance the students' ability to challenge the innovation development. With the support of HRC, "The 3rd International Symposium on Environment Economy and Technology" was held successfully in Saitama Institute of Technology as part of this project in August, 2008.

Subsequently "creation of new surface and biosensing technology by functional nanomaterials" is approved as the private universities strategic-research base formation support enterprise in 2011,and the original research which took in fusion of the bio-field expected in the 21st century and the sensing field tackles.

As mentioned above, HRC has been carrying on advanced research work, except organizing international conference and seminar. Moreover, the research equipments of HRC are open to graduate students, local corporations, and other research organizations.

The HRC include:

(1) High-Tech Research Center, which mainly supports the teachers and students to perform science and technology research work.

(2) Clinical Psychology Center, which supports the teachers and students to perform clinical psychology research work.

(3) International Exchange Research Center, which supports the international exchanged researchers and students to perform research work.

(4) Science & Buddhism Thought Research Center, which supports to hold periodical symposium. In addition, in order to strengthen the cooperation between university and industry, HRC organizes the cooperation association with local industry and holds the periodical seminar. For the purpose of enhancing the young research ability, the Young Research Forum was held every year, which invited young famous researchers to report.

(5) Partnership center between universities, industry and government, which was established April in 2009 in order to coordinate partnership between universities, industry and government.

（6） AI Research Center

The AI Research Center aims to realize artificial intelligence that can contribute to a recycling-oriented society with high affinity with humans and society, and is promoting the development of AI technology that can be applied to various problems in the real world.

Support Systems for Graduate Students

■**SIT Graduate School Scholarships**

To support the research activities of graduate students, scholarships will be awarded to those fulfilling the following conditions:

Among those whose research paper is published in an academic society journal with a referee, one selected as superior by the Dean of the Graduate School and recommended to the President of SIT[￥100,000; 2 scholarships a year for each Course].

※ However, when it is difficult to select in the above-mentioned style, the number of awardees or the amount of money can be changed in either case.

■**Japan Student Services Organization (JASSO) Scholarship Loan Programs for Japanese Students**

JASSO provides students fulfilling the conditions with the following Scholarship Loans:

[Interest-free loans] ￥50,000/￥88,000 / month (Master's Course)
￥80,000/￥122,000 / month (Doctoral Course)

[Low-interest loans] One of ￥50,000, ￥80,000, ￥100,000, ￥130,000 ￥150,000 can be chosen (Master's or Doctoral Course)

■**Teaching Assistant System**

・A graduate student can be a teaching assistant for classes such as experiments and practices.
・The pay is￥1,500 / hour (Master's Course student).
The pay is￥2,000 / hour (Doctoral Course student).
・A graduate school student can work as a teaching assistant in the undergraduate school. A limit of 8 hours a week is allowed. However, the number of hours available varies depending on the type of assistance work being performed.

■**Support System for Admission**

A successful applicant who has difficulty in admission for economic reasons can get the admission supporting scholarship [Loan].

■**Admission-fee-exempting System**

A graduate or graduate-to-be of Saitama Institute of Technology can be exempted from the admission fee for the Master's Course [￥250,000].

A student who has completed or is to complete the Master's Course or a graduate of Saitama Institute of Technology can be exempted from the admission fee for the Doctoral Course [￥250,000].