Welcome to the School of Science and Technology of Gunma University

The School of Science and Technology celebrated its centenary in 2015. It was originally established as a private school by the citizens of Kiryu City in 1896. In those days, Kiryu City was a center of the textile industry, then a key industry of Japan. In 1915, the school was reestablished by the government as the Kiryu National Technical College of Textile Science to teach the latest textile science technologies. After the end of World War II, the college was rebuilt as a school of the Gunma University.

Over the following years, the school has developed advanced fields as a pathfinder of change in the world’s key industries. Lately, interdisciplinary research projects have been developed in collaboration with other schools of the university. Examples include the “Adoption of NextGen Transportation Systems” project targeting automated driving for cars in the local area, the “Gunma University Medical Innovation” project for promoting collaboration between medical science and technology, and the “Element Innovation” project, which includes material science, machinery, electronics, and even medical science.

We now have departments in four fields: Chemistry and Chemical Biology, Mechanical Science and Technology, Environmental Engineering Science, and Electronics and Informatics. Through the above projects, the four departments provide our students with educational programs offering a balance between basic science and advanced technology in interdisciplinary fields. Furthermore, the school offers the Global Frontier Course educational program to nurture global leaders at the forefront of each domain.

In this rich, natural environment and warm, friendly town, we nurture engineers who will build a fertile future society and researchers who will make scientific discoveries that will amaze the world. Advanced academic programs and vibrant research projects await you.

Yoichi Seki
Dean of Graduate School of Science and Technology

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"Gunma University Medical Innovation Project" is a research project that started in 2014 with financial support from the Ministry of Education, Culture, Sports, Science and Technology of Japan. The main goals of the project are to develop new medical instruments, health monitoring devices, and diagnostic and cure medicines. Young students are educated to become a new type of global engineer with professional engineering skills as well as the ability to create new prospects comprehensively.

This newly founded center investigates advanced carbon materials and high-quality silicon compounds. Advanced research into carbon materials aims to realize a low-carbon society that uses hydrogen energy.

One of the pillars of Gunma University’s educational philosophy is to cultivate students “who understand the culture, history, and tradition of their own country as well as other countries, who have communication skills in a foreign language, and who can assume a role of leadership in a global setting.” For this reason, the Global Frontier Leadership Program, GFL, was created. The program was established in 2013 through the cooperation of the Faculty of Medicine and the School of Science and Technology. Participants in the program can learn about many different cultures, hone their communication skills in both Japanese and a foreign language, and gain a broader international understanding. Finally, participants are required to study abroad at some time during their academic careers.

The Global Frontier Leadership (GFL) Program develops the following five areas:

1. Independent inquiry in a specific theme or topic
2. Broad knowledge supported by a deep understanding of areas of expertise
3. Ability to design a comprehensive plan with a clear purpose
4. Communication skills for international activity
5. Ability to carry out a plan as a team or an organization

In order to support the five areas above, the program includes the following educational programs (Fig. 1).

An abundance of appealing research fields!
Gunma Prefecture has a long history as a technology and innovation leader in Japan, starting with the Tomioka Silk Mill, which was established by the Japanese government in 1872 as Japan's first model silk-reeling factory. At the end of its Edo period in the mid-19th century, Japan opened its doors to the world, ending a long period of seclusion, and in 1859 began to trade with Western countries.

Many well-known carmakers have production sites in Gunma, which has a widespread manufacturing sector. A number of other production plants also take advantage of the advanced technologies available in Gunma Prefecture.

Gunma prefecture is located inland, away from the threat of tsunami. The prefecture has a low risk of disaster, offering a high level of safety. Gunma is situated in the center of the Japanese archipelago, 100 km northwest of Tokyo. The journey takes about 90 minutes by train.

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Many well-known carmakers have production sites in Gunma, which has a widespread manufacturing sector. A number of other production plants also take advantage of the advanced technologies available in Gunma Prefecture.

Gunma Prefecture is a tourist destination full of charming hot springs, natural beauty and culture. It is gaining popularity as a convenient travel destination from the Tokyo Metropolitan Area.

**Reason 2** 
A safe location where industry is growing

**Point 1** Location

Gunma prefecture is located inland, away from the threat of tsunami. The prefecture has a low risk of disaster, offering a high level of safety. Gunma is situated in the center of the Japanese archipelago, 100 km northwest of Tokyo. The journey takes about 90 minutes by train.

**Point 2** A leader in industry and innovation

Gunma Prefecture has a long history as a technology and innovation leader in Japan, starting with the Tomioka Silk Mill, which was established by the Japanese government in 1872 as Japan’s first model silk-reeling factory. At the end of its Edo period in the mid-19th century, Japan opened its doors to the world, ending a long period of seclusion, and in 1859 began to trade with Western countries.

**Point 3** Full utilization of advanced technologies

Many well-known carmakers have production sites in Gunma, which has a widespread manufacturing sector. A number of other production plants also take advantage of the advanced technologies available in Gunma Prefecture.

**Reason 5** 
Superb seasonal changes and activities

Gunma is a tourist destination full of charming hot springs, natural beauty and culture. It is gaining popularity as a convenient travel destination from the Tokyo Metropolitan Area.

**Service 1** Gunma University International Center

The Gunma University International Center (GUIC) promotes a comfortable living and studying environment for international students of Gunma University. GUIC offers the following services:

1. Japanese language, Japanese culture, and current affairs
3. Counseling on daily life and studies
4. Advice for Japanese students intending to study abroad
5. Research activities on the education of international students and educational materials

**Service 2** Japanese language courses

Japanese language classes for international students are offered at various levels in order to help them pursue their academic goals. International students at Gunma University are encouraged to take Japanese classes in accordance with their individual levels. GUIC offers two Japanese programs: Preliminary Intensive Japanese Language Courses for Japanese Government Scholarship Students and “Japanese Language & Japanese Studies.” The classes are offered as elective liberal arts subjects for registered undergraduate international students. Supplementary Japanese classes may be offered for graduate/research students.

**Service 3** Student Support Section

The Student Support Section is committed to providing a supportive and positive environment for our students. We want all students to have a successful, fulfilling experience at Gunma University. We are responsible for providing services and opportunities for our students that will enhance their experiences here at Gunma University and support their efforts to engage in academic studies.

**Services offered**

- Comprehensive consultation
- Student activities
- Tuition fee exemption
- Scholarships
- Tutorial system
- Career exploration and preparation
- University housing (International House)
- Immigration matters: Certificate of Eligibility / Extension of period / Part-time job permission
- Off-campus resources: Rental bicycles / Part-time jobs / Housing comprehensive security
- Healthcare

**Service Hours**

Monday - Friday (except holidays) 8:30 am to 5:15 pm

http://www.guic.gunma-u.ac.jp/english
Gunma University Medical Innovation Project

"Gunma University Medical Innovation Project" is a multi-disciplinary five-year research project started in 2014 with financial support from the Ministry of Education, Culture, Sports, Science and Technology of Japan. A number of researchers belonging to different organizations in Gunma University, such as the Graduate School of Science and Technology, the Graduate School of Medicine, and the University Hospital, are participating in the project. The main goals of the project are to develop new medical instruments, health monitoring devices, diagnostic and cure medicines, and so on, through tight collaboration among professionals from a variety of fields. Another important mission of the project is to educate young students to be a new type of global engineer who has professional engineering skills as well as an ability to create new prospects comprehensively in the field of medical engineering from a wide variety of knowledge.

Micro-dosimeter for heavy ion dose monitoring

Accurate dose distribution monitoring is a critical issue for the quality control of radiation cancer treatment. Therefore, there is a need to develop dosimetry at the microimeter scale (micro-dosimetry) with high spatial resolution and radiation sensitivity. In this study, we have successfully controlled the shape of a radio-frequency production source (R-FPS) glass dosimeter with different types of actuators for charged particle detection. An R-FPS response around 500 - 600 nm was obtained under different radiation exposures. Moreover, dose distribution imaging was successfully visualized with a fabricated R-FPS glass dosimeter irradiated with a focused proton microbeam. The typical spatial resolution recorded was better than 10 μm. We were also the first to succeed in fabricating glass elements with micrometer-scale. These R&D achievements will enable us to obtain three-dimensional dose distribution with quite a convenient procedure.

Luminescent probes for in vivo oxygen imaging

The oxygen level of the interior of living cells and tissues is one of the central parameters in many physiological, pathological, and therapeutic processes. Oxygen deprivation (hypoxia) is connected with various diseases such as cerebral infarction and ischemic heart disease, and is known to occur in tumor microenvironments. We are developing optical probes to visualize the oxygen level of biological cells and tissues on the basis of photoluminescence and chemical biology.

Identification and production of biologically active compounds

Screening and design of novel drugs is one of our most exciting efforts to support drug development. We have established an in vivo, in vitro, and in silico drug characterization systems and successfully identified new drug candidates, such as analgesics and antimicrobial drugs. We are also trying to express cancer vaccines using transgenic silkworms. The purified vaccines were shown to activate human T-cells and hold potential for cancer immunotherapy.

Silicon nanowire based high-sensitivity biosensor

A portable sensor with high sensitivity is needed for the detection of chemical or biological molecules in the fields of biotechnology and medical science. A silicon nanowire (SiNW)-based field effect transistor device has the potential to detect small quantities of biomolecules. To realize high sensitivity for negatively charged biomolecules such as antibodies, the DNA, it is effective to use an n-type SiNW and to reduce the wire width. In this project, we fabricated an n-type SiNW using electron beam lithography, and evaluated its sensitivity for biomolecule detection. Currently, we have succeeded in fabricating an n-type SiNW with 180 nm width and detecting IgG antibodies with the extremely low concentration of 10^{-11} molar.

Intuitive hands free interface

Facial orientation is one form of body language that can be used to ask someone to move something. It is enough to indicate the intention by upward, downward, right, and left facing actions. Here, we applied these intuitive actions for auto-workbench operations. We focused on the change nostril shape to recognize the facial orientation on the grounds that it can be regarded as a more stable shape than any other facial feature points. In addition, the gazing action was also imparted to a computer to operate a communication-aid for input characters. The nostril shape was approximated by the Bézier curve and its curvature was reflected on input operation.
About the Center

The International Research and Education Center for Element Science was founded in April 2015, based on the Element Innovation Project team. The faculty of Science and Technology at Gunma University has a long history of materials innovation based on carbon and silicon. The newly founded center mainly investigates advanced carbon materials and high-quality silicon compounds for use in dye-sensitized solar cells, non-precious catalysts for use in fuel cells, electrochemical double layer capacitors, and new active materials for lithium ion batteries and other applications. It also covers the areas of graphene physics and chemistry, as well as plasma chemistry to produce novel functional materials. The center has three faculty members and other members from other departments of the faculty. The laboratories of the center are well equipped with the latest instruments for nano-material science.

Fascinating carbon materials

Have you ever heard of “carbon materials”? You can find the materials around you in your everyday life: pencil lead, bikes, rackets, refrigerator deodorizers, and so forth. I have been fascinated by this material for over thirty years because of its versatile properties, which can be tuned easily by preparation. Can you imagine ten-orders of magnitude changes? You can see such a big change when you carbonize organic molecules and measure their electrical conductivity. I was so excited by this fact when I was a masters student. Now my colleagues and I are interested in carbon catalysts that will replace precious metal catalysts, for example in fuel cells and chemical syntheses.

Nanoscale exploration of graphene and silicon surfaces

Our research is focused on understanding the fundamentals of molecule-surface interaction and properties of the resulting interfaces, leading to the development of an entirely new class of materials and sub-nanometer structures on surfaces. While silicon is the cornerstone of modern semiconductor technology, carbon materials such as graphene have emerged as the most promising materials for next-generation technology. We are investigating two technologically important materials: (1) graphene and (2) silicon surfaces. Our fundamental study will develop basic principles that will guide us in exploiting the findings in numerous socially pervasive applications, such as information technology, biotechnology, and renewable energy.

Surface chemistry of nano carbonsurface

Nano carbons, such as carbon nanotubes, fullerenes, and graphenes, are expected as high-performance electrode materials used in sensors and batteries due to their high surface areas, chemical stability, and electric conductivity. It is well known that the surface state of nano carbons strongly affects their performance as does the structural morphology at the nano scale. Thus analyzing and designing the surface and morphology are important issues for enhancing performance. My research subject is to develop useful techniques for preparing nano carbon materials.

Aiming to Realize a Low-Carbon Society by Using Carbon Materials!

Aiming for a Hydrogen Energy-Based Society

Although we need to minimize the load we place on the environment, we must also maintain our quality of life. This presents a significant challenge. To make this possible, society needs to derive clean energy from hydrogen, and it is therefore desirable to build a hydrogen energy-based society. In order to achieve this goal, we need to establish an efficient system to produce hydrogen gas with carbon and store it for use as an energy source.

The fuel cell is a central part of the technology for using hydrogen. It is a power generation system that uses oxygen and hydrogen, and differs from conventional disposable batteries and rechargeable batteries as well as secondary batteries such as the ones used in mobile phones and digital cameras. It is able to generate electricity almost permanently as long as we continue to supply its fuel, which is of course hydrogen.

Replacing Platinum in Fuel Cells with Carbon—a Cheap and Abundant Resource

Although platinum is the most common and active catalyst for proton exchange membrane fuel cells (PEMFC) to produce electricity, it is an extremely rare and expensive metal that is usually found only in parts of South Africa and Russia. This has hindered the spread of fuel cells, mainly because of unstable prices due to limited reserves and lack of political stability in the regions it is found.

That is why we are now focusing our research on technology using the element carbon. Carbon enables a significant cost reduction without any concern for resource depletion or unstable prices. Carbon atoms are almost limitless in nature and are found in abundance all over the planet.

Gunma University has been researching carbon materials for 60 years. Carbon Alloy Catalysts are carbon based materials that have been developed at Gunma University after many years of research. Carbon Alloy Catalysts can be prepared by carbonizing mixtures of metal compounds and polymers. They also display high activity for oxygen reduction reaction, which is the cathode reaction of a PEMFC. Therefore the Carbon Alloy Catalysts are now expected to replace platinum as catalysts. Joint research with a chemical company is already under way to make this technology practical.
A Human Resources Education System for Those Who Will Take Up the Baton of State-of-the-Art Technology, Backed by the Full Potential of the University

Roots of Engineering Excellence

Although Gunma University was only established in 1949, the engineering, education and medical faculties that amalgamated to form the university date back to the beginning of the 20th century. The Faculty of Engineering’s Kiryu location is a reflection of its roots as a school to educate the craftsmen needed for the textile industry that flourished in Kiryu at the time. The Kiryu School of Textiles was established in 1915. Later it expanded and the name was changed in 1920 to the Kiryu School of Technology. In 1944, the school became the Kiryu College of Technology on its promotion to college status. Finally, it joined with the medical and education colleges located in Maebashi to form Gunma University in 1949.

Expansion & Renewal: The New Graduate School of Engineering

In 2013, the faculty instituted major reforms to meet the ever-changing demands of a modern technological society, and its seven existing departments were reorganized into four interdisciplinary departments. These departments offer students balanced educational programs of both basic science and advanced technology in interdisciplinary fields. Through this new system, we nurture engineers with a solid grounding in the natural sciences as well as a broad knowledge of modern technology.

Each department has a Cooperative Graduate School System or contributed laboratories that are responsible for managing the advanced educational activities and collaborative research carried out by staff specialists utilizing advanced technology in collaboration with other institutes and/or companies. Through these programs, our research activities as a Center of Excellence (COE) continue to advance to higher levels.

Increased Educational Opportunities

Entrance examinations for the Graduate School of Science and Technology are held three times a year. The administrative examination is offered in the beginning of July, the summer examination at the end of August, and the winter examination at the end of December. In addition, special examinations are available for working students and international students. In order to help you achieve your dreams, we have prepared many programs, facilities and systems for education, campus life and the graduate school community. Furthermore, our programs also allow students to obtain a doctoral diploma if they have graduated from a university, a college of technology, or other institution of higher learning without a master’s diploma. These openings are for those individuals who have been recognized as possessing advanced knowledge, research achievements, and/or special abilities. The Graduate School of Science and Technology aims to carry out to research and develop advanced science and technology as a world-leading university. We look forward to seeing you on the Kiryu and Ota campuses.

Organization Chart

- School of Science and Technology
- Chemistry and Chemical Biology
- Mechanical Science and Technology
- Environmental Engineering Science
- Electronics and Informatics
- Integrated Science and Technology

Campus Photo
Materials and Bioscience

In order to confront the complicated problems that contemporary society faces, the integration of science and chemical technology in harmony with a broad field of studies has become increasingly important. The disciplines of chemistry and biology have contributed in this endeavor and it is certain that synergy between these branches of science will produce further breakthroughs by combining their common research interests and “functional organization of interactions.”

To promote these developments, a new department was established in 2007 that fused chemistry and chemical biology, which has grown into the Division of Molecular Science. We are home to more than 30 research groups in major research areas of Molecular Science, Material Science and Chemical Biology. Each research group pursues its own research mission as well as collaborating on joint research projects with others.

New functional bio-based plastics and clarifying the biodegradation mechanism of plastics

Ken-ichi Kasuya leads the Green Polymer research group at Gunma University. Research in his group focuses on the development of new functional bio-based plastics and clarifying the biodegradation mechanism of plastics.

Kasuya has been addressing the development of novel biodegradable plastics in order to solve profound problems caused by microplastics in the ocean.

Toward understanding the biological function of carbohydrate through chemical synthesis

The main research focus in Professor Matsuo’s laboratory is carbohydrate chemistry. Carbohydrates play various biological roles such as cell-cell recognition, differentiation, malignant transformation, bacterial infection, and glycoprotein quality control. Our research group is working on synthesis of glycoconjugates (e.g. N-linked and O-linked glycoproteins, glycolipids, and glycolipidic natural products) and chemically modified glycans, with the aim of clarifying the biological roles of carbohydrates, developing diagnosis systems for carbohydrate-related diseases, performing functional analysis of glycosyltransferases/glycosylases, and developing glycosylated new materials.

Professor Ichiro Matsuo

Education Program of Materials and Bioscience

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Professor Ichiro Matsuo
Computing systems are playing important roles in our daily lives. VLSI chips implementing controlling and computing functions, for example, have high performance not only for operations. In our laboratory, we are trying to find new VLSI algorithms to implement high-speed computing and communication, but also for viewing video and photo images with high quality. Specifically, we present new methods for designing VLSI chips for self-driving vehicles.

**New Arithmetic Circuits and Signal Processing**
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**Professor Shugang Wei**

**Application of Fluid Mechanics, Cleaning of Semiconductor Wafers, Visualization and Measurement of Flow Behaviors**
Fluid mechanics is a fundamental research field in mechanical science and technology with a wide range of applications, including the aircraft technology, car engineering, cleaning of electronics devices, and control of air pollution. Our laboratory studies a wide range of problems concerned with the cleaning process of semiconductor wafers based on experimental and modeling methods of fluid mechanics. We have also developed quantitative visualization and measurement techniques for fluid flows and some chemical substances. As application themes of fluid mechanics, we also study micro-bubble flow and liquid atomization phenomena.

**Professor Kenji Amagai**

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**Education Program of Mechanical Science and Technology**

**Faculty Members**

**Fields of Specialization**

<table>
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<td>Kenji Amagai</td>
<td>Thermo-fluid engineering, Interface flow, Ablation, Environmental fluid engineering</td>
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<td>The experimental elucidation for flow heat and mass transfer and laser application for flow including small particle</td>
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<td>Mixture formation and combustion of internal combustion engines, liquid atomization</td>
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<td>Ryo Soh</td>
<td>Heterogeneous interface science, micro-jetting, electronics packaging materials, brazing, surface treatment and corrosion of metals</td>
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<td>Tomoko Suzuki</td>
<td>Micro-Nano Systems and Control, Bio-applications</td>
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<td>Tatsuhiko Furukawa</td>
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<td>Developing a high efficiency ultra-precision polishing machine, Research for the application of ELID process. Creating a desktop machining machine and tool.</td>
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**Associate Professors**

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<td>Microscopic evaluation of metal strength and destruction, and character of fluid by simulation</td>
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<td>Minoru Araki</td>
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<td>Tomohiro Ando</td>
<td>Robust control theory and its application to the machine motion control and safety of the micro-machine</td>
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<tr>
<td>Masahiro Itani</td>
<td>Development and characterization of organic-metal inorganic hybrid materials, and their application to novel electronic systems</td>
</tr>
<tr>
<td>Atsushi Tasaki</td>
<td>Structural health monitoring and composite material</td>
</tr>
<tr>
<td>Takao Ogiwa</td>
<td>Car Robotics, Intelligent Transportation Systems</td>
</tr>
<tr>
<td>Hiroshi Kawai</td>
<td>Bubble dynamics, heat and fluid flow measurement, and multiphase flow</td>
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<tr>
<td>Shigeo Koyama</td>
<td>Precision bonding, surface hardening, corrosion resistance, wear resistance</td>
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<tr>
<td>Yoshio Yamashita</td>
<td>Spray flow, Quantitative visualization measurement, Automotive engineering</td>
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<tr>
<td>Yoshio Shinohara</td>
<td>Design automation algorithms, combinatorial optimization algorithms</td>
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<tr>
<td>Makoto Nakamura</td>
<td>Nanoscale fabrication, Nano-scale control of light, and motion planning for a robot</td>
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<tr>
<td>Masahiro Funato</td>
<td>Random and high-temperature gas dynamics, Thermal protection system for space vehicle, Plasma diagnostics by spectroscopy</td>
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<tr>
<td>Tsukasa Matsuura</td>
<td>Human vision and its signal processing, Human robotics, Visual interface (optical design of information display)</td>
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<tr>
<td>Yasuo Misumi</td>
<td>Mathematical engineering, multivariate analysis, inverse problem, neural network, reproducing kernel theory</td>
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<tr>
<td>Shizuo Matsumura</td>
<td>Vibration analysis and measurements of machines and structures, Nonlinear phenomenon</td>
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<tr>
<td>Tooru Nakajima</td>
<td>Applied electromagnetics, actuators, Applied of superconducting levitation, Jumping robot</td>
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**Visiting Professors**

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<td>Robust control theory and its application to the machine motion control and safety of the micro-machine</td>
</tr>
<tr>
<td>Masahiro Itani</td>
<td>Development and characterization of organic-metal inorganic hybrid materials, and their application to novel electronic systems</td>
</tr>
<tr>
<td>Atsushi Tasaki</td>
<td>Structural health monitoring and composite material</td>
</tr>
<tr>
<td>Takao Ogiwa</td>
<td>Car Robotics, Intelligent Transportation Systems</td>
</tr>
<tr>
<td>Hiroshi Kawai</td>
<td>Bubble dynamics, heat and fluid flow measurement, and multiphase flow</td>
</tr>
<tr>
<td>Shigeo Koyama</td>
<td>Precision bonding, surface hardening, corrosion resistance, wear resistance</td>
</tr>
<tr>
<td>Yoshio Yamashita</td>
<td>Spray flow, Quantitative visualization measurement, Automotive engineering</td>
</tr>
<tr>
<td>Yoshio Shinohara</td>
<td>Design automation algorithms, combinatorial optimization algorithms</td>
</tr>
<tr>
<td>Makoto Nakamura</td>
<td>Nanoscale fabrication, Nano-scale control of light, and motion planning for a robot</td>
</tr>
<tr>
<td>Masahiro Funato</td>
<td>Random and high-temperature gas dynamics, Thermal protection system for space vehicle, Plasma diagnostics by spectroscopy</td>
</tr>
<tr>
<td>Tsukasa Matsuura</td>
<td>Human vision and its signal processing, Human robotics, Visual interface (optical design of information display)</td>
</tr>
<tr>
<td>Yasuo Misumi</td>
<td>Mathematical engineering, multivariate analysis, inverse problem, neural network, reproducing kernel theory</td>
</tr>
<tr>
<td>Shizuo Matsumura</td>
<td>Vibration analysis and measurements of machines and structures, Nonlinear phenomenon</td>
</tr>
<tr>
<td>Tooru Nakajima</td>
<td>Applied electromagnetics, actuators, Applied of superconducting levitation, Jumping robot</td>
</tr>
</tbody>
</table>

**Visiting Professors**

<table>
<thead>
<tr>
<th>Professor</th>
<th>Fields of Specialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shuji Matsumura</td>
<td>Structural health monitoring and composite material</td>
</tr>
</tbody>
</table>

---

**New Arithmetic Circuits and Signal Processing**
Computing systems are playing important roles in our daily lives. VLSI chips implementing controlling and computing functions, for example, have high performance not only for operations. In our laboratory, we are trying to find new VLSI algorithms to implement high-speed computing and communication, but also for viewing video and photo images with high quality. Specifically, we present new methods for designing VLSI chips for self-driving vehicles.

**Professor Shugang Wei**

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**Application of Fluid Mechanics, Cleaning of Semiconductor Wafers, Visualization and Measurement of Flow Behaviors**
Fluid mechanics is a fundamental research field in mechanical science and technology with a wide range of applications, including the aircraft technology, car engineering, cleaning of electronics devices, and control of air pollution. Our laboratory studies a wide range of problems concerned with the cleaning process of semiconductor wafers based on experimental and modeling methods of fluid mechanics. We have also developed quantitative visualization and measurement techniques for fluid flows and some chemical substances. As application themes of fluid mechanics, we also study micro-bubble flow and liquid atomization phenomena.

**Professor Kenji Amagai**

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**Students Voice**
In October 2015, I came to Gunma University for my Master’s and Engineering doctoral studies. At first, the cultural difference between the Japanese and Chinese confused me a lot. As such, I felt uneasy and it was difficult for me to understand Japanese people’s feelings. I also realized that the importance of talking to other people actively.

At present, I am studying in the laboratory of Energy and Environment. With the great help of my advisor and group members, I consider that my professional knowledge has greatly improved. Their conscientious and rigorous research attitude has made me develop good habits. The greatest feeling for me has been an advanced Japanese ability, which I consider necessary when undertaking any research in Japan.
Environmental Engineering Science

Environmental challenges such as climate change, natural disasters, growth of energy consumption, shortage of natural resources, are affecting people both globally and locally. This situation is creating demand for human resources who can resolve these challenges. The university’s Environmental Engineering Science program aims to educate engineers and researchers who can contribute to establish safe and sustainable society in harmony with the environment through collaboration between Chemical & Environmental Engineering and Civil & Environmental Engineering.

The program conducts academic activities from two aspects: 1) environmental/energy conservation and 2) infrastructure management/disaster prevention. From the environmental and energy perspectives, the program develops engineering knowledge and skills in environmental, energy, material, and biological fields for realizing a sustainable society based on chemical engineering. From the infrastructure and disaster prevention perspectives, the program develops human resources for planning, design, construction, and maintenance of safe and sustainable infrastructure and social systems.

### Education Program of Environmental Engineering Science

**Faculty Members**

**Professors**
- Hideyuki Ito: Specialization of metal lens, compacting capability of natural water samples, and solvent extraction of metal lens based on the HSAB principles
- Takahiro Chihara: Applications of pulsed electric field biotechnology, Development of water treatment system with high-voltage devices
- Jun-ichi Ozaki: Design and preparation of catalytic carbon materials, particularly used in the applications of fuel cell and biomass conversion
- Shigeru Nakata: Development of manipulation technologies for biological molecules and their industry applications
- Yutaka Kawashima: Biomass science, development of bio-based materials and utilization of natural fibrous resources
- Shin-ichi Tanaka: Development of functional and high-performance materials through the surface and interface control by means of plasma and photon techniques
- Yoshihiko Shinma: Mechanics of sediment transport, fluvial process in stream with vegetation, and river management
- Shin-ichi Yamada: Study of new materials for advanced high energy batteries and new energy conversion technology
- Atsushi Hara: Development of bio-molecular manipulation methods and application of reaction process analysis by using molecular design techniques
- Akiko Wakai: Numerical simulation of slope failures induced by earthquake
- Tomohiro Watanabe: Biological wastewater treatment, microbial and physicochemical degradation of water pollutants, Advanced water / wastewater treatment, resource recovery
- Associate Professors
- Tsukasa Ito: Water treatment, environmental microbiology and biodegradation of environmental pollutants
- Kenji Ichikawa: Three-dimensional structure of wind-driven currents accompanied with river including the coastal zone secondary circulations, regional sediment transport process in the Tama
- Masayuki Ogasawara: Development of efficient liquid fuel cell by means of catalyst preparation and by optimizing the electrode structures
- Mitsuo Ohashi: Fire resistance of concrete, Control of stress change in concrete at early age
- Masanori Kurihara: Risk communication, Community activity for disaster prevention, Disaster education
- Takahiro Satoh: Applied mechanics, computational mechanics and non-destructive evaluation for civil engineering structures
- Fumio Ito: Earthquake-resistant measures for ground and earth structures, safety evaluation of landslides, and shallow ground thermal energy utilization
- Kazuyoshi Satoh: Synthesis and processing of ceramic materials and application for energy and environmental devices
- Reiji Noda: Development and evaluation of waste/biomass energy conversion processes, Evaluation and design of a local society based on energy/mass flow analysis
- Ryoko Hara: Environmental combustion engineering, clean energy conversion engineering
- Jun-ichi Kudo: Development of bio-micro-electromechanical systems
- Associate Professors
- Akira Hara: Numerical simulation of slope failures induced by earthquake
- Tomohiro Watanabe: Biological wastewater treatment, microbial and physicochemical degradation of water pollutants, Advanced water / wastewater treatment, resource recovery
- Visit Professors
- Hiroshi Shino: Environmental combustion engineering, clean energy conversion engineering
- Haruo Kato: Aerosol engineering, clean coal technology
- Visit Associate Professors
- Kenji Tanaka: Numerical simulation, Energy control

**Visiting Professors**

- Reiji Noda: Development of bio-molecular manipulation methods and application of reaction process analysis by using molecular design techniques
- Atsushi Hara: Development of bio-molecular manipulation methods and application of reaction process analysis by using molecular design techniques
- Hideyuki Morimoto: Development of all-solid-state batteries and novel battery materials
- Yoshihiko Shimizu: Development of droplet levitation device and its application for microchemical process
- Jun-ichi Ozaki: Development of bio-molecular manipulation methods and application of reaction process analysis by using molecular design techniques
- Masanori Kurihara: Risk communication, Community activity for disaster prevention, Disaster education
- Takahiro Satoh: Applied mechanics, computational mechanics and non-destructive evaluation for civil engineering structures
- Fumio Ito: Earthquake-resistant measures for ground and earth structures, safety evaluation of landslides, and shallow ground thermal energy utilization
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- Visit Associate Professors
- Kenji Tanaka: Numerical simulation, Energy control

**Students Voice**

**Daily life in my laboratory is very busy, because we must organize everything from research planning to design, construction and operation of experimental setups and summarization of experimental results. But, I like my laboratory life. That is because being busy also leads to my own growth. Whenever I failed and felt down, my supervisor and lab members always cheered me up. They also let me know “give someone a fish and you feed them for a day; teach someone to fish and you feed them for a lifetime.”**

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**Numerical Simulation for Earthquake-Induced Landslides**

Development of effective procedures to predict earthquake-induced landslides accompanying catastrophic slope failure is one of the important issues to be resolved in our ongoing efforts for improvement of disaster prevention. We have proposed a new elastic-plastic constitutive model to simulate strain-softening behaviors of sensitive soils under cyclic loading, which has been applied to the finite element simulation of a past catastrophic landslides caused by each earthquake motion.

We are trying to analyze the mechanisms of catastrophic failure in detail with clarifying the relationships between the slope stability and the strain-softening characteristics of contained soils.

Professor Akiko Wakai

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**Development of Steam/Hydrogenation Hybrid Process for High-Grade Oil Production from Biomass**

Biomass resources such as agricultural wastes or animal mature are widely spread, causing high collection and transportation costs and hindering efforts to establish large scale utilization. To utilize this biomass requires the development of small-scale plants with high economic efficiency. We are working to establish an economically efficient plant by developing a small-scale process for unutilized biomass, which produces high-grade oil and electricity matching with local demand.

Associate Professor Reiji Noda
Evolve and spread in a wide range of fields. Industry structure will also be greatly affected by these technologies. We are developing AI-based control technology. For example, we apply our AI technology to the energy harvesting system, vibration power generation combined with the deep learning technique is applied to drive a wireless sensor node for factory diagnosis. In the process control learning algorithm based on the precisely controlled by using a automation, and human-machine interfaces

Producing next generation media technology

Rapid progress of high-speed image processing and image projection technologies is increasing demand for high-speed, adaptive image acquisition and projection. Our laboratory proposes a new media technology named Dynamic Image Control (DIC) that refers to a technical concept of dynamic and adaptive control of image acquisition and projection depending on the scene. DIC requires optimization of all components of imaging and projection systems, including imagers, optics, and illumination. Thus, both devices and system/application are studied in this laboratory. Envisaged application fields of DIC are image industries such as film and advertising, medicine and biology requiring microscopic measurement, factory automation, and human-machine interfaces requiring comprehensible images.

Associate Professor Hiromasa Oku

Industrial application of AI-based control technology

For the next ten years, new technologies such as AI, big data, and IT evolve and spread in a wide range of fields. Industry structure will also be greatly affected by these technologies. We are developing AI-based energy harvesting system, process control system, and so on. For example, the self-powered system based on vibration power generation combined with the deep learning technique is applied to drive a wireless sensor node for factory diagnosis. In the process control system, the temperature is precisely controlled by using a learning algorithm based on the neural network.

Professor Seiji Hashimoto

Electronics and Informatics, Mathematic and and Physics

Division of Electronics and Informatics covers informatics and communication technology areas and it consists of two courses: electronics course and informatics course. Each course has three major areas.

1) Electronics course is hardware and software oriented. Our target is to contribute electronics, communication and computer as well as power electronics. We provide students education of fundamental and advanced electronics, semiconductor, electromagnetics, wave theory, communication, power & energy electronics, control, measurement, computer hardware & software, circuits & systems and signal processing algorithm as well as their related research activities.

2) Informatics course is software and mathematics oriented. Our target is to contribute computer software & hardware, multimedia, communication and network areas. We provide students education of fundamental and advanced electronics, semiconductor, electromagnetics, wave theory, communication, power & energy electronics, control, measurement, computer hardware & software, circuits & systems and signal processing algorithm as well as their related research activities.

Kazuo Saito
Koji Asami
Toshimitsu Takaesu
Takeshi Ohtsuka
Hirofumi Yokouchi
You Yin
Ushio Yamamoto
Yoshifumi Morita
Takashi Miwa
Kenta Miura
Ken-etsu Fujita
Toshiya Hikihara
Makoto Hamana
Toshiki Takahashi
Nobukazu Takai
Masako Suzuki
Morihiko Sato
Ken-ichi Kawanishi
Tsuyoshi Kato
Hiromasa Oku

Associate Professor

Tetsu Arai
Graph theory, Graph algorithm, Combinatorial optimization
Tadashi Itô
Composed tomography and its applications, inverse problems in measurement
Norimasa Oku
Dynamic image control, high-speed image processing, high-speed optical devices
Sujoy Debi
Optoelectronics and quantum electronics
Hirofumi Nagashima
Analytic number theory, value distribution of arithmetic functions
Masahiro Hama
Foundations of programming languages, functional programming, term rewriting
Toshihiko Mihara
Low-dimensional strongly correlated electron systems, quantum spin systems, numerical calculation
Kensuke Futagami
Logic of programming, programming languages
Shin-ichi Fujita
Physics of solid state physics, nanoelectronics, solid state device
Ken-ichi Murata
Light-emitting materials and devices, Phosphor e-devices
Takashi Miki
Applied measurement for electromagnetic and ultrasonic waves
Takaharu Miyazaki
Experimental Diaphragnm equation, Diaphragnm analysis
Yoshifumi Morita
Theoretical study on low dimensional quantum systems and superconductors
Unle Tanimoto
Human interface, computer networks, and multi-agent systems
Yu Yin
Materials and devices for bionerchip and information storage, nano-fabrication, nanophotonics
Yasuji Tsuchikawa
Molecule dynamic simulation, Nanometer dynamics of lubrication and wearing
Takashi Ohkawa
Geometric surface evolution equation, Singular limit of reaction diffusion equation
Tatsunori Takezawa
Spectral Analysis and Scattering Theory for Realistic Quantum Field Models
Yukie Ichinashi
Geometric surface evolution equation, Singular limit of reaction diffusion equation
Yusuke Matsumoto
Spectral Analysis and Scattering Theory for Realistic Quantum Field Models
Ko Iwai
Measuring and testing techniques for RF, analog and mixed-signal LSIs.
Naoyuki Kaneda
Testing methodologies for ULS circuits.
Takao Koba
Magnetic memory, Spin polarized scanning electron microscopy
Kazuo Sato
Advanced electronic engineering
Masato Sawa
Molecule dynamical simulation, Nanometer dynamics of lubrication and wearing
Takahiro Kikuchi
Analytical integrated circuit design

Education Program of Electronics and Informatics, Mathematics and Physics

<table>
<thead>
<tr>
<th>Faculty Members</th>
<th>Fields of Specialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kazuo Saito</td>
<td>Computational complexity, theory of algorithms, machine learning</td>
</tr>
<tr>
<td>Norimasa Oku</td>
<td>Transcendental number theory, Diophantine approximations</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Image processing, computer vision, and pattern recognition</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Electrical machines, power electronics, optimal design, and computer simulation by magnetic diffraction, scattering and absorption of synchrotron radiation</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Magnetic wave devices, measurement using x-rays</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Data imaging, statistical learning theory and applied data analysis</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Nanometer measurement and fabrication, nanoelectronics devices, high-sensitive biosensor for medical use, crystal growth</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Design and characterization of optical fiber and WDM devices, optical sensors</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Theoretical study on electronic properties and magneto in transition metal compounds</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Electromagnetic waves, inver problems</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Graph algorithm, and Information visualization</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Motion control, system identification, vibration control, precision control, renewable energy</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Devices for optical communication, Microphotonics</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Radio wave propagation, Wireless measurement, Electromagnetic wave simulation</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Theory of strongly correlated electron system</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Ultrasonic imaging systems for medical diagnosis, and measurement using ultrasonic waves</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Combinatorial optimization, approximation and randomized algorithms, computational complexity</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Data compression, data structures, and information theory</td>
</tr>
<tr>
<td>Sujoy Debi</td>
<td>Integral transforms of Fourier type, commutation relations in quantum mechanics and their applications</td>
</tr>
</tbody>
</table>

* will retire in March 2020

Graduate Student / Yifei Sun

My current research is about electro-magnetic interference (EMI) reduction techniques in switching power converters. EMI problem is a big issue for electronic appliances; if they do not meet EMI regulations, they cannot be in the commercial market. Then the EMI noise spectrum spread technique of suppressing the peak levels at the fundamental frequency is widely used. However, it spreads the EMI noise also in the radio receiver signal band, which disturbs the radio receiver performance. Based on this background, my research target is to reduce the EMI noise diffusion at the specific frequencies (radio receiver bands) when the EMI spectrum technique is employed. I have come up with new ideas to solve this problem, verified them with simulations and experiments, and presented their contents in international conferences.
Procedures for Entering Japan

Students admitted to Gunma University as an "International Student (Ryugakusei)" should have a Certificate of Eligibility as a student. If a foreign student does not possess this status, services to international students, including scholarship applications, will not be available.

Procedures for Entering Japan

All future international students need to hold a valid passport issued by their home countries and a corresponding Student Visa issued by the Japanese Embassy or Consulate. In order to receive a Student Visa, you must first obtain a Certificate of Admission from Gunma University and then a Certificate of Eligibility from the Tokyo Immigration Office. Once you decide to enter Gunma University, we recommend that you apply as soon as possible for a Certificate of Eligibility through Gunma University. It takes one to two months. Should you have any questions regarding the application procedures, please contact the supervisor.

Flow Chart of Immigration and Admission Procedures

1. Application 5-6 months before entry
   Contact supervisor
2. Qualification Assessment 4-5 months before entry
   We consider your enrollment by application screening
3. Visa 3-4 months before entry
   Gunma University will apply
   Longer than 90 days
   Less than 90 days
4. Certificate of Eligibility 1-2 months before entry
   We will send you a Certificate of Eligibility
5. Embassy 1 month before entry
   Go to the Japanese Embassy in your country
6. Enrollment 1 month before entry
   Enter Gunma University

See if you need a visa for entering Japan. The visa applications are different according to countries or regions. Please refer to the website of the Ministry of Foreign Affairs of Japan. Also contact the Japanese diplomatic missions in the country of your nationality for more details regarding required documentation. Engaging in paid activities in Japan is not allowed.

Procedures for Foreign Nationals Currently Residing in Japan

After completing the procedures for admission to Gunma University, you need to apply for a "Change of Residence Status" at the local immigration office. This is only necessary if your current status is not "Student." If you will be moving to or near the campus from another city or town, you should go to your new town or city office to apply for resident's registration and for a change in your National Health Insurance status.

Academic Calendar

- 4 April
- 5 May
- 6 June  June 1 University Foundation
- 7 July
- 8 August  Summer vacation (Aug, through Sep)
- 9 September

- 10 October
- 11 November
- 12 December  Winter vacation (late Dec. to early Jan.)
- 1 January
- 2 February  Spring vacation (early Feb. to early Apr.)
- 3 March

Tuition and Fees

Studying in Japan inevitably requires a certain amount of financial resources as outlined below. The university requires students to confirm a sufficient preparation of funds before enrolling at Gunma University.

<table>
<thead>
<tr>
<th>Type</th>
<th>Entrance Examination Fee</th>
<th>Admission Fee</th>
<th>Tuition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Student</td>
<td>30,000 yen</td>
<td>282,000 yen</td>
<td>535,800 yen (per annum)</td>
</tr>
<tr>
<td>Research student</td>
<td>9,800 yen</td>
<td>84,600 yen</td>
<td>29,700 yen (per month)</td>
</tr>
</tbody>
</table>

* Additional charges such as a faculty membership fee and an insurance fee are required to paid.
* If tuition is revised, the new tuition fee is applied from the time of the revision.

Exemptions from Tuition Fees

Students enrolled in graduate and undergraduate courses are eligible for a 50 % or 100 % remission of fees if they are facing financial difficulties and are maintaining a record of excellent scholastic achievement, subject to their performance on a strict examination. The free tuition system applies to exchange students from sister schools based on inter-university exchange agreements.

Living Conditions and Accommodation

Private Housing

Rental apartment fees in Gunma are as follows:

- Private apartments and lodging houses (as of April 2013)
- Apartment Six tatami mats
  - 20,000 to 30,000 yen
- With toilet: 14,200 yen
- With toilet and bath: 19,400 yen

International House

- Six tatami mats
  - 11,900 yen (family)

Private Dormitory

- Keishin Dormitory
  - Single room
    - 5,900 yen
  - Couple room
    - 11,900 yen

Other Expenses

In addition, expenses for food (approx. 30,000 to 50,000 yen a month), textbooks and materials, as well as other miscellaneous costs should be taken into account.

International Student Housing Comprehensive Security

Gunma University cooperates with the "International Student Housing Comprehensive Security" program. When international students are covered by this insurance program, Gunma University becomes the guarantor, and the student can then rent a private apartment by signing an occupancy contract. Under this scheme, if a fire caused by negligence occurs in an occupied housing unit of an international student and the student is forced to pay damage compensation to the owner of the apartment, the owner can request the guarantor to be responsible for paying the guaranteed liabilities to the owner. The guarantor can pay the compensation directly to the owner.

Scholarship

The following scholarships are available for international students studying in Japan.

1. JASSO Honors Scholarship
2. Other Scholarships
   - Private organizations provide scholarships for highly qualified international students studying in Japanese universities at their own expense. The stipends range from 20,000 yen to 150,000 yen depending on the organization. In 2013, 17 students from Gunma University qualified for these scholarships.

Japanese Government Scholarship

In 2013, the monthly stipends are 143,000 to 146,000 yen for postgraduate students and 117,000 yen for undergraduate students. For further details, please inquire at the Japanese Embassy in your country. As of June 2013, 31 students of Gunma University qualified for the scholarships.

Tutorial system

International students often run into difficulties studying or conducting their research after they start their student life in Japan. Gunma University provides a tutorial system for those students. A tutor and an international student pair up and conduct regular activities. Tutors support their partner students in their studies and/or research. International students are encouraged to take advantage of this system, not only to assist them in their studies, but to increase their communication opportunities with many other students.
Graduate School Entrance Examination

1. Contact supervisor
Send a letter stating your request for research guidance to the faculty member of your preference. You can find the appropriate address for the faculty member by contacting the office directly. To see the focus research areas of each faculty member, please refer to the website.

2. Qualification assessment (if required)
We have established deadlines for confirming an applicant’s qualifications (see the following table for details). You need to provide an Entrance Qualification Examination Application prior to the deadline for the course you wish to enter.

3. Application
Be sure to file your application in accordance with the established deadlines for your preferred course (see the following table for details). The following materials are required:

- Application for admission
- A certificate of your graduation from the last university you attended, as well as transcript
- A certificate of your nationality and/or residence status if currently residing in Japan
- An outline of your past research achievements and your intentions for future research activities
- Two photographs (4cm × 3cm)
- Testing fee (30,000 yen)
- Authorization document from the head of the department of your current academic institution or place of employment if applicable

4. Screening examination
The screening examinations are held at Kiryu campus on the scheduled day for examination for each course (see the following table for details).

5. Announcement of results
Successful applicants will receive an announcement in the mail on the scheduled day for announcing the results of the examinations for each course (see the following table for details). Examinee numbers will also be posted on the website.

Table of Admission Procedures

<table>
<thead>
<tr>
<th>Programs/Course</th>
<th>Distribution of essential points</th>
<th>Qualification assessment</th>
<th>Application</th>
<th>Screening examination</th>
<th>Examination categories</th>
<th>Announcement of results</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD (Winter)</td>
<td>Late Oct.</td>
<td>Mid.-Nov.</td>
<td>Late Nov.</td>
<td>Late Dec.</td>
<td>I</td>
<td>Mid.-Jan.</td>
</tr>
</tbody>
</table>

The content of the examination categories marked with an asterisk (*) varies depending upon the field of specialization. Be sure to confirm the content for your particular field of specialization in the application guidelines.


Research Students
Gunma University has a system of for research students which allows applicants to study in specialized research fields after screening, provided that the university has enough capacity for education and research. With regard to the admissions application periods and the screening methods, and related matters, situations vary depending upon the course to which you wish to be admitted. The following table is meant to serve as a general outline. Be sure to confirm the details on the website of the particular faculty and course that you are considering. In order to proceed smoothly with regard to professional guidance in your preferred field of research after being admitted, you should determine your field of research and laboratory after you have established contact with a faculty member who deals with your preferred field of specialization.

The following materials are required:

- Application for admission
- A certificate of graduation from the last school you attended, as well as a transcript
- A certified copy of a certificate verifying your nationality and/or residence status if currently residing in Japan
- An outline of your past research achievements and your intentions for future research activities
- Two photographs (4cm × 3cm),
- Testing fee (9,800 yen)
- Authorization document confirming your status as a student or employee from the head of the department of your current academic institution or place of employment

Under Graduate School Entrance Examination
In order to enter a faculty as a regular student, you need to take the Examination for Japanese University Admission for International Students (EJU) held in June and November. Make sure you know which test subjects you are required to take for the faculty you have chosen.

Application packages with application forms will be distributed from October. Please have one sent to you by Gunma University.

Applications will be accepted from January, Entrance examinations will be held in February.

Detailed information on entrance examinations and other items is posted in the Information on entrance examinations & applications for Gunma University website.

http://www.guic.gunma-u.ac.jp/english_sag/applications

Student Canteen
Reasonable pricing food
with good taste!!

http://www.guic.gunma-u.ac.jp/english_sag/applications

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### Number of Students in school of Science and Technology

<table>
<thead>
<tr>
<th>Area</th>
<th>Countries and Regions</th>
<th>Students</th>
<th>Master's Program</th>
<th>Doctoral Program</th>
<th>Graduate Students</th>
<th>Exchange Students</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>Japan</td>
<td>2,246</td>
<td>615</td>
<td>78</td>
<td>9</td>
<td>2</td>
<td>2,950</td>
</tr>
<tr>
<td></td>
<td>Malaysia</td>
<td>37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>37</td>
</tr>
<tr>
<td></td>
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### Agreements between Universities

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### Agreements between Faculties

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