

Graduate School of Science and Engineering, Ehime University
Organization, Outlines of Research & Education
(Master's/Doctoral Program)

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I. Organization of the Graduate School of Science and Engineering

The Graduate School of Science and Engineering plays a role in the development of academia, industry and society by educating and preparing highly specialized professionals (professionals in knowledge and technology) and researchers with advanced expertise and abilities. In the midst of rapid changes in society and industrial structures, there is a need for advanced science and engineering professionals who can support and develop current science and technology, face regional and global issues and contribute to the creation and realization of new value through such concepts as SDGs and Society 5.0. We educate motivated students by offering a highly specialized and flexible curriculum, under a broad and distinctive academic research infrastructure ranging from natural to applied science through our centers in the Premier Institute for Advanced Studies. Our purpose is to contribute to society by developing and preparing advanced science and engineering professionals with high levels of knowledge, skills, personal values, a broad perspective and a new sense of values, who can work creatively and cooperatively on the regional and global stages.

【理工学専攻の組織図】				
Organization of Graduate School of Science and Engineering				
	【博士前期課程】			【博士後期課程】
専攻 Major	教育プログラム Program for Master students		分野 Education Field	教育プログラム Program for Doctor students
理工学専攻 Science and Engineering	基盤プログラム Core Program	産業基盤 Industrial Science and Technology Program	機械工学 Mechanical Engineering	基盤プログラム Core Program
			機能材料工学 Materials Science and Engineering	
			応用化学 Applied Chemistry	
		社会基盤 Public Infrastructure Program	環境建設工学 Civil and Environmental Engineering	
			電気電子工学 Electrical and Electronic Engineering	
			応用情報工学 Applied Information Engineering	
		数理情報 Mathematics and Computer Science Program	数理情報 Mathematics and Computer Science	
		自然科学基盤 Natural Science Program	物理学 Physics	
			地球科学 Earth Sciences	
			化学 Chemistry	
			生物学 Biology	
	特別プログラム Special Program	アジア防災学特別プログラム Special Graduate Program on Disaster Mitigation Study for Asian Students		アジア防災学 特別プログラム Special Graduate Program on Disaster Mitigation Study for Asian Students
		地域エンジニア養成プログラム（博士前期） Regional Engineer Development Program		

II. Major, Programs, Fields at the Graduate School of Science and Engineering

The Graduate School has one major in Science and Engineering. Our Master's Program consists of four core programs: Industrial Science and Technology, Public Infrastructure, Mathematics and Computer Science, and Natural Science, and two special programs: the Special Graduate Program on Disaster Mitigation Study for Asian Students and the Regional Engineer Development Program. We have designed a curriculum, research and education system for each program and provide guidance for the students under these systems. Our Doctoral Program is one system with no division, except for the Special Graduate Program on Disaster Mitigation Study for Asian Students. An outline of each program/field is given below.

1. Industrial Science and Technology Program

<Outline>

The Industrial Science and Technology Program, consisting of the fields of Mechanical Engineering, Functional Materials Science and Engineering, and Applied Chemistry, aims to contribute to the development of academia, industry and society by educating students who will support the modern industrial base and pioneer future knowledge through the development and creation of new machines, new materials with new physical properties and functions, and apply the results of their studies and research activities to life phenomena. This program educates students who are highly interested in the development of industries that enrich humanity and fosters the problem-seeking and problem-solving skills that enable them to conduct research and development activities independently. The purpose of this program is to contribute to society by developing and preparing science and engineering professionals with advanced academic knowledge, skills, personal values, a broad perspective, and a new sense of values, who can work creatively and cooperatively on the regional and global stages.

<Mechanical Engineering>

The mission of the field of Mechanical Engineering is to train leading engineers with high abilities. Research and education are actively pursued in fundamental and applied subjects and their integration in order to develop machinery with new functions and structures. This course is organized into three divisions: Mechanical Systems, Synthesis and Control, Energy Conversion Engineering, and Production Systems and Materials for Machinery. The faculty members work principally on the evaluation and the reliability of the design of material strength and dynamic properties of solids and structures, the creation of new materials, adaptive control and human-interfaces, and the elucidation and management of thermofluid phenomena. Graduate programs are composed of applied subjects corresponding to basic undergraduate subjects and of advanced subjects concerned with up-to-date topics.

<Materials Science and Engineering>

The Materials Science Field and Engineering consists of two research areas: Materials Physics and Engineering (MPE) and Materials Development and Engineering (MDE). One of the major goals is to obtain the basic knowledge of the sophisticated functions of materials. For this purpose, we educate and conduct research on the formation mechanism of material functions in nano, meso- and macro scales, and develop the ability for its applications. In the MPE area, we now focus on the properties, structure, or processing of new advanced glass with new functionality, transparent amorphous materials, metallic biomaterials, base metals, rare metals, insulation materials, organic materials for semiconductors, magnetic nanomaterials, magnetocaloric materials and so on. In the MDE area, we conduct research on the development and application of porous materials and solid oxide catalysts and the development of thermo-mechanics for improving the properties of welding joints in structural metal materials.

<Applied Chemistry>

The Applied Chemistry Field covers the research areas of organic and macromolecular chemistry, physical and inorganic chemistry, biotechnology and chemical engineering. The field deals with basic and applied research with an advanced education, which is indispensable for the development of science and technology. Our research targets cover various kinds of materials, such as metals, inorganic compounds, organic compounds, polymer compounds, genes, and proteins. In reaction chemistry, we develop new material synthetic processes and functional materials based on the understanding and control of chemical reactions at the molecular level. In physical chemistry, we develop new functional materials based on the investigation of nano- and mesostructures, electronic states, electrochemical properties, and photophysical properties of various compounds. In biotechnology, we conduct basic research to elucidate the structure and function of bio-related molecules, as well as applied research such as the creation of functional proteins and the production of proteins for genetically modified plants and infectious disease control.

<Staff / Keyword / Research & Education Field>

	Field	Position	Staff	Keyword / Main Research Subject
	Mechanical Engineering	Professor	○ JaeHoon Lee	Robotics, Mechatronics and AI (Artificial Intelligence) Applications
			○ Yukiharu Iwamoto	Approach to various problems applying fluid engineering
			○ Keiji Ogi	Strength reliability evaluation and sensing of composite materials
			○ Satoru Shibata	Control systems of intelligent machines for coexisting with humans
			○ Manabu Takahashi	Strength and damage evaluation of advanced structural materials
			○ ***Susumu Tanaka	Ship Performance, Ship Equipment
			○ Xia Zhu	Materials Forming and Processing
			○ Hiromichi Toyota	Development of non-conventional machining
			○ Masaya Nakahara	Smart control of combustion for hydrogen and hydrocarbon energy
			○ Shinfuku Nomura	Enhancement of renewable energy and zero emission processes
			○ Masafumi Matsushita	New materials synthesis using extreme condition
			○ Shinobu Mukasa	Discharge in high density media
			○ ***Kazunori Yasuda	Non-Newtonian fluid mechanics and its application, medical fluid mechanics
			○ Tomonori Yamamoto	Robotics for coexisting with humans, Welfare devices, Robots for agriculture, forestry and fisheries
		Associate Professor	○ Takayuki Tamaogi	Evaluation of viscoelastic properties of polymer materials
			○ Shenglin Mu	Control engineering, Welfare devices
		Senior Assistant Professor	Mitsuyoshi Tsutsumi	Estimation of mechanical properties of industrial materials

Industrial Science and Technology	Materials Science and Engineering	Professor	○ Hiromichi Aono	Studies of materials such as nano-sized particles, poly-metallic oxides, porous materials for application of medical care, fuel cell, chemical sensor, catalyst, and decontamination
			○ Yoshiteru Itagaki	Development of solid oxide catalysts and their application for chemical sensors and solid oxide fuel cells
			○ Haruo Ihori	Studies of electrooptical measurement of electric field distribution and electrical treeing phenomena
			○ Sengo Kobayashi	Research on microstructure formation of metallic biomaterials and structural materials
			○ Akira Saitoh	Present research areas covering characterization and structure of transparent amorphous materials.
			○ ***Hiromichi Takebe	Research on processing, properties and structure of new advanced glasses with new functionality
			○ Tomoki Yabutani	Development of technologies for useful utilization of biomass resources and high-performance paper products
		Associate Professor	○ Hideaki Sasaki	Research on production technology and recycling of metallic materials, including base metals (such as iron and copper) and rare metals.
			○ Tatsuya Joutsuka	Structural analysis and exploration of solid catalysts using computational science
			○ Keisuke Matsumoto	Research on magnetocaloric materials, magnetic regenerator materials, and thermoelectric materials.
			○ Takashi Mizuguchi	Development of thermo-mechanical, alloying techniques and welding processes for improvement properties of welding joint in structural metal materials
			○ Saeki Yamamuro	Synthesis and physical properties of magnetic nanomaterials and high-temperature ceramics
	Senior Assistant Professor		Tatsuaki Sakamoto	Research on improvement of strength and ductility of structural materials at room and elevated temperatures by microstructural control through phase transformation
			Hyeon-Gu Jeon	Fabrication of nanoparticle colloids of organic semiconductors by laser ablation method and application to organic electronics.
	Applied Chemistry	Professor	○ Tsuyoshi Asahi	Laser fabrication and spectroscopy of noble organic nano-materials
			○ Eiji Ihara	Development of new method for polymer synthesis
			○ Tatsuya Sawasaki	Functional proteomics using wheat cell-free system
			○ Eizo Takashima	Structural and functional analysis of plasmodial proteins
			○ Kazuyuki Takai	Reconstitution of protein synthesis
			○ Minoru Hayashi	Development of new synthetic methodologies using heteroatoms and transition metals
			○ **Masanobu Matsuguchi	Design of functional polymers and its application to a chemical sensor
			○ *Yohji Misaki	Development of organic molecular materials utilizing redox systems
			○ ***Hidenori Yahiro	Syntheses and applications of meso- and microporous materials
		Associate Professor	○ Hiroaki Shimomoto	Development of novel functional polymers
			○ Takashi Shirahata	Development of new organic conductors and multi-functional materials
			○ Hirotaka Takahashi	Molecular analysis of viral immunity and inflammation
			○ Hiroyuki Takeda	Development of technologies for drug discovery
			○ Akira Nozawa	Development of technology for plant growth regulation using compounds
			○ Syuhei Yamaguchi	Development of environment-friendly catalysts with transition metal complexes
			○ *Hiroshi Yamashita	Study on separation technology of rare metals

Senior Assistant Professor	Yukihide Ishibashi	Ultrafast time-resolved spectroscopy of photo-functional materials
	Tomomichi Itoh	Development of polymer materials with well-controlled nanostructures
	Hidetoshi Ohta	Development of highly active metal catalysts
	○ Chie Tomikawa	Functional analysis of nucleic acids and nucleic acid-related proteins
	Hiroyuki Yamaura	Development of gas sensors and catalysts using metal oxides
	Ryota Yamagami	Functional and structural analyses of RNA

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2. Public Infrastructure Program

<Outline>

The Public Infrastructure Program, consisting of the fields of Civil and Environmental Engineering, Electrical and Electronic Engineering, and Applied Information Engineering, aims to contribute to the development of academia, industry and society by providing those who will support modern technology and pioneer future knowledge through the results of their studies and research activities in electrical energy, electronics, and information and communication engineering, to support future urban and regional social infrastructure. This program educates students who are highly interested in the realization of sustainable social infrastructure in the era of Society 5.0 and fosters their problem-seeking and problem-solving skills that enable them to independently conduct research and development activities. The purpose of this program is to contribute to society by developing and producing advanced science and engineering professionals with advanced academic knowledge, skills, personal values, a broad perspective and a new sense of values, who can work creatively and cooperatively on the regional and global stages

<Civil and Environmental Engineering>

The Civil and Environmental Engineering Field conducts education and research activities with the aim of fostering highly specialized engineers engaged in the development and expansion of social infrastructure while maintaining harmony with the natural environment. The field consists of the three fields of Infrastructure Technology and Design, Urban Planning and Management, and Watershed and Coastal Environmental Engineering, tackling development and conservation from the mountaintop to the seafloor. Infrastructure Technology and Design, deals with civil engineering materials, design and construction methods, and the seismic behavior of civil engineering facilities such as bridges, dams, roads, and underground facilities. Urban Planning and Management deals with the development of living and production environments in urban areas in consideration of transportation systems, disaster prevention, and the maintenance and management of roads and urban infrastructure. Watershed and Coastal Environmental Engineering deals with the physical, chemical, and ecological perspectives needed to understand natural phenomena in the atmosphere, groundwater, rivers, coastal areas, and oceans of watersheds, to achieve sustainable development and harmony with the environment in these areas, and to improve the disaster prevention functions of watersheds and coastal areas. Our goal is not only to train specialists as environmental construction engineers, but also to foster high-level engineers with a comprehensive perspective, creativity, and an international outlook on environmental issues.

<Electrical and Electronic Engineering>

Electrical and electronic engineering has been leading and supporting the technological revolution in various fields of science and technologies. The Electrical and Electronic Engineering Field conducts advanced research in three areas, Electrical Energy Engineering, Electronic Materials and Devices Engineering and Communication Systems Engineering. In these areas, unique research among universities in Japan is being conducted, such as research on technology to introduce genes into cells using discharge plasma and technology to promote the growth of fish, shellfish and plants using plasma treatment, research on the practical application of seed germination acceleration and sterilization treatment using high voltage, and the development of signal processing methods for high-density data storage. Students in this program can acquire a wide range of basic academic skills in electrical and electronic engineering as well as specialized knowledge of the research area and research and development methods.

<Applied Information Engineering>

In the field of Applied Information Engineering, we contribute to society by educating professionals who can identify issues in our society and solve such issues using professional knowledge and skills based on information and communication engineering. We train advanced information engineers who can observe people's living and industries in various societies, who can set goals and plans for solving issues by using professional knowledge and skills in information and communication engineering, who can propose sustainable and feasible approaches, who can carry out projects, and who can work collaboratively with diverse people. We supervise research and development work in the areas of Computer System Engineering, Intelligent System Engineering and Applied Information Engineering, with the purpose of applying these technologies in information and communication engineering, solving social issues and creating new values.

<Staff / Keyword / Research & Education Field>

	Field	Position	Staff	Keyword / Main Research Subject
	Civil and Environmental Engineering	Professor	○ Keiyu Kawaai	Electro-chemical techniques for assessing durability performances, structural integrity of reinforced concrete and effect of repair including self-healing for cracking in concrete
			○ Naoki Kinoshita	Thermally induced mechanical and hydraulic properties of rocks and behavior of openings in rock mass, Utilization of industrial by-products for construction-related materials, Landslide Monitoring System, Soil improvement methods with reduced environmental impact
			○ Kazuyuki Nakahata	Non-destructive imaging technology using laser, ultrasound, vibration, and heat, as well as data assimilation using 3D digital models
			○ Netra Prakash Bhandary	Geo-disaster mitigation and hazard assessment, landslide creep mechanism, and residual strength characteristics of clayey soils
			○ Tsuyoshi Hatori	Consensus formation around a public project, Social dilemmas, Regional governance
			○ Hirofumi Hinata	Development of tsunami disaster mitigation technique based on oceanographic radar and numerical simulation. Research on marine pollution caused by plastics in terms of physical oceanography.
			○ Nobuhiko Matsumura	Regional resource management, Social network analysis
			○ Yo Miyake	Impacts of human activity on stream organisms, Conservation of stream ecosystem, Evaluation of stream environmental condition by stream organisms.
			○ Ryo Moriwaki	Urban climate formation process, Water circulation in the basin, Utilization technology of renewable energy.
		Associate Professor	○ Kohei Ono	Seismic behavior of earth structure, liquefaction countermeasure, buried pipeline, slope stability
			○ Tomoya Kataoka	Assessment of environmental loads from land to oceans and development of remote sensing technique in aquatic environment
			○ Shinya Kurauchi	Analysis and modeling on travel decision-making processes, Travel demand forecasting and evaluation of transport policies
			○ Hirotoishi Shirayanagi	Perception and evaluation of buildings and natural landscape, Urban and regional planning
			○ Yutaka Tada	Housing inspection and renovation, Pre-disaster prevention city design
			○ Takahiro Tsubota	Deep learning application to traffic flow forecasting, Safety performance evaluation of road and traffic flow, Traffic flow monitoring
			○ ***Toru Futagami	Urban disaster preventive planning under a great earthquake and development of urban information system
			○ Rupprecht Christoph D. D.	Sustainability, green space, food systems, multispecies, futures, degrowth
			○ Tomoki Inoue	Ergodic theory on dynamical systems with chaos, Mathematical foundations towards application of chaos and fractals
			○ *Yoshihiro Okamoto	Research on channel coding and signal processing techniques to achieve high density recording in digital information storage systems

Public Infrastructure	Electrical and Electronic Engineering	
	Professor	○ Ryotaro Ozaki Research on optical properties of nano-structured liquid crystals or polymers. Numerical simulation of light propagation in nanstructured materials ○ Kazunori Kadowaki Studies on high field conduction of polymer materials and highvoltage pulsed-power application ○ Masafumi Jinno Plasma electronics. Plasma gene transfection, bio-medical application and environmental preservation. Numerical modelling of plasma. Lighting ○ *Shinji Tsuzuki Research on IoT communication systems such as power line communication and LPWA wireless based on spread spectrum communication technology ○ Tomoaki Terasako Growth and characterization of metal oxide films and nanostructures for opto-electronic devices.
	Associate Professor	○ Yoshihisa Ikeda Lighting and visual effect, Visibility enhancement, effective luminance enhancement, color rendering property enhancement, and glare reduction ○ Takashi Saitou Development of optical elements and microscopy utilizing information technology, and their application to bio-imaging ○ Yasuaki Nakamura Research on error correction coding and iterative decoding systems for information storage ○ Madoka Nishikawa Research on signal processing techniques to achieve high density recording using neural network in digital information storage systems ○ Hideki Motomura Generation and control of plasmas and their diagnostics for industrial applications / numerical simulation
Applied Information Engineering		○ Hirohisa Aman Software Engineering, Software Quality Management ○ Kazunori Ando Mathematical Physics, Scattering Theory, Inverse Problem ○ ***Minoru Kawahara Information and Communication Systems ○ Isao Goto Deep Learning, Natural Language Processing, Large Language Model, Machine Translation ○ Hiroshi Takahashi Computer Systems, Dependable Computing, Testing for VLSI ○ Takashi Ninomiya Natural Language Processing, Machine Learning ○ **Kazuto Noguchi Optical Communication Systems, Optical Modulator, Optical Waveguide, Information Network ○ Yoshinobu Higami Dependable Systems, Fault Testing, Fault Diagnosis, Design for Testability
		○ Toshiyuki Uto Multimedia Signal Processing, Information Hiding ○ Keiichi Endo Information System, Educational Technology, Information Network ○ Dai Okano Numerical Analysis, Computational Science, Complex Function Theory ○ Hiroshi Kai Computer Algebra System, Information Security ○ Tomoyuki Kajiwara Natural Language Processing, Deep Learning ○ Shinji Norimatsu Ontology, Information Systems ○ Hisashi Morioka Mathematical Physics, Scattering Theory, Inverse Problem, Quantum Walk
		○ Masaharu Isshiki Image Processing, Deep Learning, Virtual Reality ○ Shun Ido Virtual Reality, Image Processing ○ Tsutomu Inamoto Mathematical Programming, System Optimization, Machine Learning, Rule-base ○ Senling WANG Dependable Computing, Design for Testing of LSI, Fault Detecting, Low-Power Testing ○ Koji Kinoshita Image Processing, Object Tracking, Deep Learning

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3. Mathematics and Computer Science Program

<Outline>

The Mathematics and Computer Science Program, from Mathematics/Data Science to Computer Science, aims to contribute to the development of academia, industry and society by educating professionals who will support modern technology and pioneer future knowledge through their studies and research activities that theoretically explore the phenomena inherent in mathematics/computer science. They will explore these fields as a basic science that provides a foundation for other fields, or as an advanced tool for application. This program educates motivated students with a spirit of scientific inquiry through a well-balanced curriculum ranging from advanced theory in various fields of mathematics to applied mathematics, data science and computer science. It fosters problem-seeking and problem-solving skills that enable them to conduct research and development activities independently. The purpose of this program is to contribute to society by developing and preparing science and engineering professionals with advanced knowledge, skills, personal values, a broad perspective and a new sense of values who can work creatively and cooperatively on the regional and global stages.

<Staff / Keyword / Research & Education Field>

	Field	Position	Staff	Keyword / Main Research Subject
Mathematics and Computer Science	Mathematics and Computer Science	Professor	○ Hirohisa Aman	Software Engineering, Software Quality Management
			○ Kazunori Ando	Mathematical Physics, Scattering Theory, Inverse Problem
			○ Shin-ichi Oguni	Noncommutative Geometry, Geometric Group Theory
			○ ***Minoru Kawahara	Information and Communication Systems
			○ Isao Goto	Deep Learning, Natural Language Processing, Large Language Model, Machine Translation
			○ **Dmitri B. Shakhmatov	Investigation of topological structure of topological groups and fields.
			○ Hiroshi Takahashi	Computer Systems, Dependable Computing, Testing for VLSI
			○ Takashi Ninomiya	Natural Language Processing, Machine Learning
			○ **Kazuto Noguchi	Optical Communication Systems, Optical Modulator, Optical Waveguide, Information Network
			○ Hiroshi Haramoto	Pseudorandom numbers, Monte Carlo methods
			○ Yoshinobu Higami	Dependable Systems, Fault Testing, Fault Diagnosis, Design for Testability
			○ Miki Hirano	Number Theory (Automorphic Forms, Automorphic Representations, and their L-functions)
			○ Masaya Matsuura	Time Series Analysis
			○ Takamitsu Yamauchi	General Topology
			○ Yoshinori Yamasaki	Analytic Number Theory
		Associate Professor	○ Toshiyuki Uto	Multimedia Signal Processing, Information Hiding
			○ Keiichi Endo	Information System, Educational Technology, Information Network
			***Hiroshi Ohtsuka	Algebraic approach to parallel processes and their communications.
			Motoya Ohnishi	Intersection of Learning Theory and Dynamical Systems with Applications to Robotics and Control
			○ Dai Okano	Numerical Analysis, Computational Science, Complex Function Theory
			○ Hiroshi Kai	Computer Algebra System, Information Security
			○ Tomoyuki Kajiwar	Natural Language Processing, Deep Learning

		A	Shinji Norimatsu	Ontology, Information Systems
			○ Hisashi Morioka	Mathematical Physics, Scattering Theory, Inverse Problem, Quantum Walk
			Shigenori Yanagi	Studies on nonlinear partial differential equations and its application to compressible Navier-Stokes equations.
		Senior Assistant Professor	Shun Ido	Virtual Reality, Image Processing
			Koji Kinoshita	Image Processing, Object Tracking, Deep Learning
			Masaharu Isshiki	Image Processing, Deep Learning, Virtual Reality
			Tsutomu Inamoto	Mathematical Programming, System Optimization, Machine Learning, Rule-base
			○ Senling Wang	Dependable Computing, Design for Testing of LSI, Fault Detecting, Low-Power Testing
			Yuka Teramoto	Mathematical analysis (Analysis of compressible Navier-Stokes equations)
			Hiroshi Fujita	Descriptive Set Theory

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4. Natural Science Program

<Outline>

The Natural Science Program, consisting of the fields of Physics, Earth Sciences, Chemistry, Biology and their combined fields, aims to contribute to the development of academia, industry and society by educating professionals who support modern technology and explore future knowledge through their studies and research activities on a wide range of topics related to nature and its surroundings, such as scientific laws and various phenomena in this world, the formation of the universe and the earth, the ecology and mechanism of animals and plants, and the structures and new uses of materials. This program educates motivated students with a spirit of scientific inquiry by offering a highly specialized and flexible curriculum, under the broad and distinctive academic research infrastructure of the Graduate School of Science and Engineering and the centers of the Premier Institute for Advanced Studies of Ehime University. It fosters problem-seeking and problem-solving skills to enable independent research and development activities. The purpose of this program is to contribute to society by developing and preparing science and engineering professionals with advanced knowledge, skills, personal values, a broad perspective and a new sense of values who can work creatively and cooperatively on the regional and global stages

<Physics>

Physics is a branch of science that studies the mechanisms of natural phenomena and elucidates the basic laws of nature, which is based on facts established by experiments and observations. The findings are used to understand the diversity of the world and applied in many areas of technology and industry. The field of Physics carries out research and education that covers a wide scale of phenomena ranging from subatomic particles to the universe. Specifically, in theoretical physics, we aim to understand various properties of matter and phenomena with the fundamental laws of physics on a micro and/or macro scale. In experimental physics, we study materials with special magnetic properties, plasma phenomena, optical physics, and their applications. In the astrophysics, we investigate phenomena and objects in the universe such as solar flares, black holes, galaxies with observations using various wavelengths and computer simulations.

<Earth Sciences>

The field of Earth Sciences conducts fundamental and advanced research and education on geology, paleontology, petrology, mineralogy, solid-earth geophysics, oceanography, and geo-environmental science. In particular, we now focus on comparative and descriptive studies of fossil and living vertebrates, the biostratigraphy and evolution of radiolarians, the functional and theoretical morphologies of ammonoids and other mollusks, field geological survey, the descriptive and experimental studies of rocks (granite, etc.) and minerals, archaeological materials, the technology of high-pressure experiments, earth and planetary tectonics, the properties of rock-forming minerals, simulation of the inside of the earth and planets, theoretical mineral physics, paleoceanography, physical and chemical oceanography, and environmental pollution.

<Chemistry>

The field of Chemistry conducts fundamental and advanced research and education that covers the basics to the cutting edge of material science, such as material creation, chemical analysis, reaction control, the physical property control of materials, and the utilization of genes or biological substances. In solid-state physical chemistry/reaction physical chemistry, we conduct research on the molecular mechanism elucidation of macroscopic properties (catalytic action, electrical/magnetic properties, etc.) of solid materials, structural analysis, creation of new materials, and we conduct research on the elementary processes of chemical reactions, the elucidation of semiconductor surface structures and physical properties using advanced spectroscopic technology. In organic synthesis/material creation chemistry, we conduct research on the synthetic creation and structural analysis of functional molecular materials, and the exploration and synthesis of natural physiologically active substances contained in marine creatures. In analytical chemistry/biological chemistry, we conduct research on the development of new bioanalytical methods, creation of new functional biomolecules and artificial life systems, and elucidation of the molecular mechanism of highly efficient energy conversion in photosynthesis by using genetic-engineered mutants. We also investigate environmental pollution of chemical substances that adversely affect the health of humans and wildlife, such as endocrine disruptors from a regional and global perspective.

<Biology>

The field of Biology consists of three areas: morphogenesis, physiology/adaptation, and ecology/environment. We investigate a variety of biological processes in microorganisms, plants, and animals at different levels: from molecules and cells to populations, communities and ecosystems. In the area of morphogenesis, we study phenomena related to morphogenesis of animals and plants using biochemistry, molecular biology, histology, morphological methods, etc. on themes such as animal development, evolutionary morphology, and plant morphology. In the area of physiology/adaptation, we study the environmental response of animals and plants using the methods of physiology, biochemistry, molecular biology, on topics such as plant physiology, fish environmental physiology, and aquatic toxicology. In the area of ecology/environment, research on topics such as ecology and evolution, and ecotoxicology is undertaken by field studies, molecular biology, biochemical methods, and bioinformatics to clarify the relationship between organisms and the environment, the relationship between species in evolution, and the toxic effects of environmental pollutants and their molecular mechanisms. These studies aim to provide a comprehensive understanding of the function and evolution of organisms and the interrelationship between organisms and the global environment.

<Staff / Keyword / Research & Education Field>

	Field	Position	Staff	Keyword / Main Research Subjects
		Professor	○ Hisamitsu Awaki	Study of structure and evolution of the Universe. In particular, study of active Universe through cosmic X-ray emission, and development of instruments for X-ray observatory.
			○ Masaru Kajisawa	Observational studies of galaxy formation and evolution. History of star formation and mass assembly of galaxies.
			○ Yuichi Terashima	Study of high energy phenomena in the Universe. In particular, observational study of black holes and the structure and evolution of the Universe.
			○ Tohru Nagao	Observational studies on the formation and evolution of galaxies and supermassive black holes. Studies on the chemical evolution of the Universe.
			○ * Kazuhiro Fuchizaki	Theoretical treatment on chemical physics of phase equilibria and relaxation kinetics.

Physics	Associate Professor	○ Tsunehiro Maehara	Experimental study of plasma in liquid.
		Takeshi Iizuka	Theoretical studies on nonlinear waves. Gap solitons in optical fiber. Coupled mode theory in photonic crystal.
		○ Satoshi Ohmura	Quantum molecular dynamics simulation for disordered systems • Development of computational methods
		Kensuke Konishi	Low temperature physics and statistical mechanics on magnetic materials. Experimental studies of magnetism; Fundamentals and Applications.
		○ Megumi Shidatsu	X-ray and multi-wavelength studies of high energy phenomena around compact objects, especially black holes.
		○ ***Tohru Shimizu	Space plasma physics, fast magnetic reconnection based on MHD and kinetic theory and numerical studies.
		○ Masaaki Nakamura	Theoretical study for strongly correlated quantum systems and topological materials, such as Tomonaga-Luttinger liquid, low-dimensional magnet, quantum Hall effect, graphene, and topological insulator.
		○ Yoshiki Matsuoka	Observational research on the evolution of galaxies, supermassive black holes, and the Universe.
		○ Tatsuhiko Miyata	Liquid state theory on structure and thermodynamics; Theoretical study of self-assemblies in solution such as micelle and protein.
	Senior Assistant Professor	Koji Kondoh	Study of magnetic reconnection in space plasma using magnetohydrodynamic simulation and spacecraft observation.
		Hisao Kondo	Study of physics on photo-excited states of solids. In particular, experimental studies of cavity-polaritons in microcavities.
Earth Science	Professor	○ Naoki Ishimatsu	Structure and Electronic Properties of Metal, Alloys, and Metallic compounds Investigated by synchrotron radiation and high pressure application
		○ Xinyu Guo	Simulation of the Kuroshio, Interaction of the Kuroshio and coastal water, Marine environmental prediction of Seto Inland Sea.
		○ Masanori Kameyama	Mantle Dynamics; Studies on flows, deformations, and evolutions of the Earth's interior based on the computational fluid dynamics.
		○ Michinobu Kuwae	Paleoceanographic and paleolimnological studies on long-term dynamics of marine and lake ecosystems in response to climate changes and human impacts.
		○ Taku Tsuchiya	Theoretical and computational study of minerals and modeling the Earth and planetary interiors.
		○ Takehisa Tsubamoto	Evolution, paleobiogeography, and paleoecology of land mammals during the Cenozoic. Excavation, description, and paleontological study of vertebrate fossils.
		○ Yu Nishihara	Experimental study on transport properties, including rheology, of deep Earth materials.
		○ ** Rie S. Hori	Geological and paleontological studies on deep-sea sediments and paleoenvironment.
		△ ***Yasuyuki Murakami	Remains, Relic, Regional culture
		○ Akihiko Morimoto	Study on material cycle in coastal seas by means of field observation and numerical simulation.
	Associate Professor	○ Tomohiro Ohuchi	Rheological properties of rocks under high pressures (e.g., creep and fracture strength, seismological properties) and processes of microstructure formation.
		* Takashi Okamoto	Evolution and paleoecology of fossil mollusks, especially in the theoretical modeling of ammonoid shell morphology and morphogenesis during the Cretaceous period.
		○ Nao Kusuhashi	Vertebrate paleontology focusing on the evolution and early history of mammals during the Mesozoic, and lithostratigraphy and sedimentary geology based on field research.
		○ Satoshi Saito	Petrology and geochemistry. Granite petrogenesis. Evolution of arc and continental crust in convergent margin.
		○ Takeshi Sakai	Study of equations of state of terrestrial planet materials using laser heated diamond anvil cell.

Natural Science			○ Steeve Georgi Greaux	Elastic and thermal properties of rocks and minerals applied to the study of the Earth and planetary interiors. Chemical and physical transformations of materials under high pressures and temperatures. Sound wave propagation velocity measurements. Physical property analyses by synchrotron radiation X-rays.
		Senior Assistant Professor	Satomi Enju	Study on minerals formed by hydrothermal alteration. Formation and evolution of materials in the early solar system
			○ Hideharu Kuwahara	Elucidation of chemical differentiation of terrestrial planets by high-pressure experiments, Elucidation of the role of core and mantle on the formation of surface environment of terrestrial planets.
			Yohei Shirose	Mineralogical study of pegmatite by observation of the microtexture, and descriptive study of rare minerals.
			○ Haruhiko Dekura	Theoretical condensed-matter and computational physics on electronic-structural, dynamical, and transport properties of deep Earth and planetary materials.
		Assistant Professor	Sayako Inoue	Elucidation of nanomineral formation and transformation mechanisms at the atomic scale using high resolution transmission electron microscopy.
	Chemistry	Professor	○ Keishi Ohara	Properties, reaction processes, and spin-dynamics of excited state molecules and short-lived radicals.
			○ Tatsuya Kunisue	Development of analytical methods for novel environmental contaminants with hormone-like activity and its application to ecotoxicology.
			○ Tamotsu Zako	Nano-bioanalysis and studies on disease-related proteins.
			○ Masayoshi Takase	Synthesis and characterization of novel π -electron systems.
			○ Ryoji Takahashi	Synthesis of novel porous metal oxides and design of their functionalities in adsorption and catalysis.
			○ Toshio Naito	Physical properties of low-dimensional solids and their novel functions.
		Associate Professor	○ Atsushi Ogawa	Development of new biotechnologies based on cell-free systems.
			○ Tetsuo Okujima	Synthesis of novel aromatic compounds aimed for the creation of functional materials.
			○ Takuhiro Kakiuchi	Studies of chemical reaction dynamics at interface between gas and solid by supersonic molecular beam method and X-ray photoelectron spectroscopy.
			○ Makoto Kuramoto	Isolation and structural elucidation of bioactive compounds from marine organisms.
			○ Yoji Shimazaki	Separation analysis, Protein, Electrophoresis / Construction of methods for separating and analyzing biological proteins in the natural states.
			○ Miwa Sugiura	Elucidation of molecular mechanism of highly efficient energy conversion in photosynthesis. / Development of bioremediation by using photosynthetic microorganism.
			* Hiroyuki Tani	Investigation of novel functionalized organic compounds concerned with their syntheses, structures and physical properties.
			○ Rumi Tanoue	Evaluation of the bioaccumulation potential and ecological risk of unregulated synthetic chemicals in the aquatic environment.
			○ Kei Nomiyama	Studies on the impact assessments of ionic environmental pollutants in wildlife.
			○ Takashi Yamamoto	Studies on the interactions and physical properties of molecular functional solids.
		Senior Assistant Professor	Fumiya Sato	Morphology-controlled synthesis of metal oxides and its application to heterogeneous catalytic reaction.
			Shigeki Mori	Synthesis and properties of unique metal complexes utilizing conjugation compounds.
			○ Mikio Inoue	Analysis of habitat structure and biotic interactions in stream communities.
			○ Hisato Iwata	Ecotoxicology of wildlife and species-diversity of disruption of cellular signaling pathway by environmental chemicals.

Biology	Professor	○ Yasushi Sato	Cell differentiation, morphogenesis, and environmental responses in higher plants.
		○ Hiroki Hata	Ecology of marine organisms, especially on species interaction and coevolution.
		○ Yasunori Murakami	Evolution of the vertebrate brain: comparative and developmental analysis.
		○ Kozo Watanabe	Environmental epidemiology to ecologically control mosquito-borne infectious diseases, Development of high-throughput biodiversity assessment techniques, Study of antimicrobial-resistant bacteria in water environment
	Associate Professor	○ Yumeki Oto	Population ecology and evolutionary biology of aquatic animals focusing on migratory behavior
		○ Hirotaka Kato	Molecular mechanisms for land plant development and their evolution.
		○ Yoh Sakuma	Molecular response of higher plant to water and temperature stress.
		○ Hiromi Takata	Morphogenesis and organogenesis of <i>Xenopus laevis</i> during metamorphosis.
		○ Makiko Fukui	Comparative embryological studies of arthropods, with special reference to the insects.
	Senior Assistant Professor	Tsuyoshi Kaneta	Functions of cytoskeletons in plant cells, Mechanisms of plant growth regulation by phytohormones.
		Kei Nakayama	Environmental toxicology in fish and invertebrates.

○ : a member of faculty for Master's and Doctoral programs,

△: a member of faculty for Doctoral program,

blank: a member of faculty for Master's program

* : a staff of scheduled to retire on March 31, 2026

** : a staff of scheduled to retire on March 31, 2027

*** : a staff of scheduled to retire on March 31, 2028

5. Special Graduate Program on Disaster Mitigation Study for Asian Students

<Outline>

Many countries in Asia and Africa suffer from natural disasters including earthquake and meteorological disasters. Engineers working in the fields of disaster prevention and mitigation not only need the knowledge of civil engineering but also of a wide range of social sciences. The Special Graduate Program on Disaster Mitigation Study for Asian Students aims at preparing highly trained researchers and engineers with advanced research capabilities in the field of disaster prevention and mitigation measures and the features of natural disasters in Asian and African Regions. To make societies in the regions safer and more resilient against natural disasters, the program has been designed to train Asian and African students in the fields of earthquake and meteorological hazards, their mechanisms of occurrence, damage mitigation, hazard prevention, disaster management, disaster informatics, and other related topics.

<Staff / Keyword / Research & Education Field>

Position	Staff	Keyword / Main Research Subjects
Professor	○ Keiji Ogi	Strength reliability evaluation and sensing of composite materials
	○ Keiyu Kawaai	Electro-chemical techniques for assessing durability performances, structural integrity of reinforced concrete and effect of repair including self-healing of concrete
	○ Naoki Kinoshita	Thermally induced mechanical and hydraulic properties of rocks and behavior of openings in rock mass, Utilization of industrial waste for construction materials, Development of design method and performance evaluation of rock net
	○ Satoru Shibata	Control systems of intelligent machines for coexisting with humans
	○ Masaya Nakahara	Advanced combustors of hydrogen fuel and the prevention of potential risks in a future hydrogen society from both aspects of the clarification of basic phenomena and technical developments
	○ Netra Prakash Bhandary	Geo-disaster mitigation and hazard assessment, landslide creep mechanism, and residual strength characteristics of clayey soils
	○ Hirofumi Hinata	Development of tsunami disaster mitigation technique based on oceanographic radar and numerical simulation. Research on marine pollution caused by plastics in terms of physical oceanography
	○ Ryo Moriwaki	Urban climate formation process, Water circulation in the basin, Utilization technology of renewable energy
Associate Professor	○ Tomoya Kataoka	Deep learning application to traffic flow forecasting, Safety performance evaluation of road and traffic flow, Traffic flow monitoring
	○ Takahiro Tsubota	Deep learning application to traffic flow forecasting, Safety performance evaluation of road and traffic flow, Traffic flow monitoring

○ : a member of faculty for Master's and Doctoral programs

6. Regional Engineer Development Program

<Outline>

The Regional Engineer Development Program aims to contribute to the sustainable development of regional industries by fostering highly skilled engineers who possess a broad perspective that combines advanced engineering expertise in regional technology-based industries with knowledge related to technology management/administration, and a diverse range of on-the-job know-how (practical knowledge). This program offers education in multiple specialized fields required by regional technology-related industries, with subjects related to management and administration, and research projects related to regional industries. It fosters practical skills in communication and in working with people in different specialized fields and backgrounds for solving problems in collaboration with regional stakeholders. The purpose of this program is to contribute to society by developing and preparing science and engineering professionals with advanced knowledge, skills, personal values, a broad perspective and a new sense of values who can work creatively and cooperatively on the regional and global stages.

<Staff / Keyword / Research & Education Field>

Position	Staff	Keyword / Main Research Subjects
Professor	○ Sengo Kobayashi	Research on microstructure formation of metallic biomaterials and structural materials
	○ Manabu Takahashi	Strength and damage evaluation of advanced structural materials
	○ Susumu Tanaka	Ship Performance, Ship Equipment
	○ Kazuyuki Nakahata	Nondestructive testing, imaging using vibration and elastodynamic / electromagnetic wave, and large scale simulation for wave using high performance computing.
	○ Masaya Nakahara	Smart control of combustion for hydrogen and hydrocarbon energy
	○ Tomonori Yamamoto	Robotics for Coexisting with Humans, Welfare Devices

○ : a member of faculty for Master's and Doctoral programs