# Flow of Engineering Education

Currently, the ratio of engineering students who go on to the graduate school has been increasing. Thus, university entrance examination with a view of the graduate school education has become more and more important. The special feature of education and research in the Faculty and Graduate School of Engineering of Mie University is to have established seven research areas in master course of graduate school. These research areas cover most of industrial fields to meet the request and demand from society, enabling the development of advanced professional engineers acquiring systematic knowledge and skills and capable of rapid and flexible response to each problem. Also, as a distinct attempt by the Division and Department of Engineering, the International Industry-Government-Academia Division and the Public Collaboration Research Division have been established for the advancement of internationalization and cooperation with society.

## National University Corporation Mie University

**Guide Book to Faculty of Engineering and Graduate School of Engineering**

- Division and Department of Mechanical Engineering
- Division and Department of Electrical and Electronic Engineering
- Division and Department of Chemistry for Materials
- Division and Department of Architecture
- Division and Department of Information Engineering
- Division and Department of Physics Engineering
- Course of Graduate School/Project Laboratories

### Annual Events

- **April**
  - Entrance Ceremony
  - Graduation for Incoming Freshman
  - Start of First Semester

- **October**
  - Start of Second Semester
  - Distribution of Entrance Examination Guidelines of Foreign International Student on Private Examinations

- **November**
  - Distribution of Individual Achievement Test Guidelines
  - University Festival

- **June**
  - Distribution of Admission Office Guidelines

- **December**
  - Schooling for Admission Office
  - Acceptance for Application of Entrance Examination of Foreign International Student on Private Examinations
  - Mie University Exam of Total Regional Cultural Festival
  - Winter vacation

- **July**
  - National University of Total Regional Athletic Meet
  - First Semester Examination

- **August**
  - Open Campus
  - Schooling for Admission Office
  - Summer Vacation

- **September**
  - Entrance Examination by Admission Office (September)

### Location

![Location Map](image)

- **Access**
  - Shortest required time from major cities to Mie University
  - Tokyo: 120 minutes
  - Osaka: 90 minutes
  - Naha: 40 minutes
  - Okinawa: 40 minutes

- **Address**
  - National University Corporation Mie University Graduate School of Engineering Team
  - 1577 Kurihamachiyacho, Tsu City, Mie Prefecture 514-8507
  - TEL 059-231-3469, FAX 059-231-3471
  - http://www.eng.mie-u.ac.jp

- **2016.4**
Division and Department of Mechanical Engineering

Course of Quantum Engineering and Electromechanics

Quantum Material Engineering
We study surface and interface properties of materials and nano processing, synthesis of DLC and c-BN thin films, non-equilibrium phenomena of fracture mechanics and solidification, application of magnetic properties, non-equilibrium phase synthesis by ion implantation, theoretical calculation of material strength, design of wave algorithm for the application of optics and vibration, and crystal growth simulation by molecular dynamics.

Mechatronics
We aim to develop robot control technology to realize human-machine coexistence, and create intelligent robot to contribute to the society. Particularly we focus on development of the humanoid robot in the field of life, medical service and welfare and the product-making robot available for precision work.

System Design
We are doing a design of individually-customized device and a development of control method based on human property. Examples are the industrial power assist device to carry heavy loads in factory and the autonomous robot vehicle.

Biological System Engineering
We are studying deformation and dynamic of materials (material mechanics). Deformation caused by force in a basis for creating a safe and new machine. And we are also paying much attention from medical field as a study capable of dealing with the motion of human body and organ.

Course of Advanced Materials and Processing

Materials and Processing Engineering
We are making research on joining and cutting for machinery manufacturing by using the devices, such as high-frequency induction heating apparatus which can simulate weld thermal cycles, high-power CO2 laser and resistance welder which are applied to the assembly of automobile body.

Integrated Processing System
We study high functional processing system in the fields of manufacturing and material development. It is aimed that environmental-friendly metrics are improved and established in metal machining process. New carbon materials are paid attention because of their small environmental burden.

Process Analysis
We are studying intelligent systems such as the sensing, the pattern recognition, the human interface device, and the human function alternative device. The photographs show the google-style stereoscopic display and a man wearing the motion capture suit.

Course of Environmental Energies

Fluid Engineering Laboratory for Energy and Environment
We are studying the flow of various materials including air and water. We are also doing research and development of the fluid machinery relating renewable energy such as aeroljiel, wind-power generation and micro-hydro power generation.

Design of Energy System
Photograph on the left shows the experiment device of photocatalytic CO2 reforming for generating the fuel (CO, CH4, etc.) from CO2, the main cause of global warming. The progress of this research may lead to the transformation of carbon cycle which could be one of the solutions for global warming.

Fluid and Thermo Engineering
To improve the performance of energy and environmental applications, we are conducting the analysis of complex flow phenomena such as turbulence, multiphase flow, phase change, and fluid-structure interaction, while we are developing both numerical simulation methods and flow-control scheme.
Division and Department of Electrical and Electronic Engineering

http://www.elec.mie-u.ac.jp/

Electrical and electronic engineering is an academic field to pursue how to utilize electricity both as electric energy and as medium of communication and information processing. It covers a wide range of technologies such as effective generation, conversion and transformation of electric energy, advanced communication and information processing, and the electronic material including semiconductor and superconductor for supporting the above-mentioned technologies. This academic field is a basis of various intellectual activities. Students in this division can also learn advanced IT technologies and communication skill required from the information and internationalized society. We aim to develop such human resources that master practical science to apply to various industries and can contribute to the society.

Course of Electrical System Engineering

Electrical System
Research and development for realization of high-performance motion control and next-generation robot by applying power electronics and actuator technologies is conducted. Photovoltaic shows the device to demonstrate the research outcomes on how robot hand manipulates its fingers to hold a thing (to determine the finger position for a stable grip and maneuverable operation).

Control System
We are doing research and development on application of the latest control theory to power conversion and motor control technology. These are the basic technology for electric vehicle and power generation by natural energy. Photovoltaic shows the circuit of verification test on the frequency conversion device (matrix converter) which can pull out fixed voltage and fixed frequency from alternating current of variable voltage and variable frequency.

Energy System
In this research field, the study to prevent global warming and to reduce greenhouse gas is being made through the high output and high-efficiency of power generation system utilizing the natural energy generated from wind turbine (shown in the photo) and solar battery, and the development of electric power conversion system for a stable power supply to the power line.

Course of Electrical Material Science and Technology

Opto-electronics
Aiming at the next-generation high-tech semiconductor device enabling energy-efficient, environmentally-resistant, high-speed processing, and highly-efficient light generation, we are putting a focus on the leading-edge material of nitride semiconductor, and making research on its crystal growth, characterization, and device application. Also research on light control technology and application to LED lighting is being conducted.

Organic Electronics
Various organic materials are used in machines such as electric generator or electric vehicle depending on their functions. Organic Electronics laboratory is developing the high-temperature and high-voltage resistant material, the thermally-conducting material allowing no current to pass, and the vibration-resistant material.

Quantum Electronics
We are doing the local analysis of high resolution, the development of high-intensity charged particle (electron beam) as a resource for the probe of microfabrication technology, and the research on related physical phenomena. In addition, we are developing novel processes for synthesizing nanocarbon materials such as carbon nanotubes and graphene for application in electronics.

Course of Information and Communication Systems

Information Processing
Understanding and utilization of information media by computer is our research area. For example, we are considering some new algorithms on the image understanding, document analysis, neural network, data-mining strategy, natural language understanding for next-generation learning system, medical computer aided system, mobile robot, and electronic medical record system.

Communication Engineering
We are working on a wide range of research all related to wireless communications systems. Our interested research fields include high efficient modulation / demodulation techniques, multiple access techniques and network control techniques for realizing the next-generation wireless LAN, terrestrial mobile phone, fixed and mobile satellite communication, television broadcasting, and intelligent transport systems (ITS).

Computer Engineering
We are conducting research and development on the key technologies of ICT (Information and Communication Technology) and their application systems, such as the system design technique for information networks including computer network and the learning and education system to support programming exercise and design exercise of software/hardware.
Division and Department of Chemistry for Materials

http://www.chem.mie-u.ac.jp

Course of Molecular Design

Polymer Chemistry — Research on the development of high performance organic polymer materials (proton-conducting membranes for fuel cells, ion-conductive solid polymer electrolyte materials for lithium cells, soft materials, contact lens materials, Organic-Inorganic Hybrid Optical Materials, etc.) are conducted.

Organic Functional Chemistry for Materials — Our research aims to create organic materials that have electrically, magnetically, and optically useful features. We are working on the synthesis of new organic molecules designed based on the theory and on the evaluation of their physical properties/reactivity by the advanced instrumental analysis.

Organic Functional Synthesis — Modern life is made-based on various organic compounds such as functional materials or medicines. We are studying "organic manufacturing," in other words, efficient organic synthesis, aiming the development of environmentally benign organic synthesis process to compound human-friendly fine chemicals, new bioactive compounds, and functional materials.

Theoretical Study on Chemical Reaction — We make a prediction by simulating physical properties and chemical reactions of compounds by the quantum chemical calculation. Mainly focusing on molecules that have two or more cores, theoretical investigation of their catalytic mechanism (reaction mechanism) and theoretical research of reactivity of ion channel are conducted.

Course of Biological and Functional Chemistry

Energy Conversion Chemistry — Energy Conversion Chemistry Laboratory researches into lithium battery and fuel cell development. These researches are based on Inorganic solid state chemistry including materials synthesis, structural analysis and physical property measurements. Our major goal is to produce new functional materials to facilitate development of energy storage and conversion systems for automotive applications.

Inorganic Materials Science — We are developing a research on chemistry with good use of inorganic materials. Specifically, research of manufacture and reactivity of each solid catalyst such as petroleum reforming catalyst or environmental catalyst, manufacture of new inorganic-organic hybrid materials or eco-glass, elucidation of nonlinear optical effect of glass are conducted.

Biomaterial Science — We are researching on the mechanism of regeneration/restoration of biological tissue by using the analysis of combination of images of cells or tissues and molecular information. Moreover, based on the knowledge we have obtained, the development of artificial structures imitating biomembrane/vascular, the research of inter-organizational material transmission and the development of regenerative medical materials/bio-artificial organs that induce the tissue regeneration are conducted.

Course of Materials Science

Organic Materials Science — Structure and physical property including design and application as new functional materials are being studied for a complex system composed of different kinds of materials utilizing self-assembled and interfacial properties of soft matters such as polymers, surfactants, and colloids.

Analytical & Environmental Chemistry — We are researching on the technology for a sustainable society. Technologies for reducing environmental impacts such as the techniques to measure the environmental pollutant, to purify water, to transform carbon dioxide (CO₂) to generate hydrogen and so on are mainly being developed.

Molecular Bioengineering — Based on molecular bioengineering, cell and gene biotechnology, and biochemistry, we are mainly developing new technologies for the next generation of monoclonal antibody and the construction of artificial cell model. Extensive life science research from basic to application focusing on biotechnology is carried out.

Laser Photochemistry — We are working on the growth and application of nanocrystalline materials and related composites including metals, which are important substances/materials for nanotechnology to support our future society, with the high-tech use of energies such as laser, plasma and heat.

Evaporator

Electronic states in molecule

Organic solid state distillation apparatus

Visualization measuring instrument (Fluorometer)

Observation of cells on the material
Division and Department of Architecture

Architecture is a study exploring design, building, management, and history of architecture. Artistic capabilities are necessary to study it even in the field of engineering. Today, holistic perspective is needed for the architecture because buildings should be suitable for today’s advanced lifestyle and culture and to meet sophisticated technology to protect lives and properties against natural disasters. This department is aiming to bring up creative human resources who can capture the change of society dynamically and act from wide and comprehensive viewpoint.

Course of Architectural Design
(Architectural Design and Regional Design / Architectural Environment and Equipment Design / Structural Design)

Field of Architectural Planning
Various researches on architectural planning and design are conducted, such as the researches on functions and management methods of a large variety of buildings, planning of cities or regions and their landscape preservation, history and culture of buildings we have inherited, and the method of consideration when plotting architectural form.

Course of Architectural Management
(Architectural and Regional Management / Architectural Environment and Equipment Management / Structural Management)

Field of Architectural Environment and Equipment
In the Course of Architectural Environment and Equipment Design, researches on the optimum control of the heat, air, sound / light environment of not only inside the architectural structure but also surrounding of the structure to materialize more desirable environment for human and architectural space, and global environment are conducted.

Field of Architectural Structure
We take charge of the education about the structural design method of buildings, evaluation of quality and durability of building materials, and construction technology. Our research themes are about the seismic performance and the material properties of the structure of steel, reinforced concrete and wood, or about the regional disaster prevention against natural disasters such as earthquake and so on.
Information is essential to modern life and key of success for almost all companies. Information engineering is the study of engineering techniques and systems to deal with information, and is expected for further development. Specifically, it includes information process such as occurrence/transmission/conversion/output of information, and diverse fields of computer architecture and software for their actual use. In this department, it enables students to comprehend Information Engineering fully and to view it with a wider perspective, from basic information technologies for computing to advanced information technologies, even to application to various problems. Advanced and attractive researches are being conducted.

**Computer Science Course**

**Computer Software** — In this field, the research of computer software is carried out from the both aspects of its theory and practice. With the theoretical aspect, researches on verification of correctness of software and computation model are carried out. With the practical aspect, researches on design and implementation of parallel programming languages for high-performance computing are carried out.

**Computer Architecture** — For design and implementation of a large scale distributed parallel processing system, ultra low power processors for mobile devices, UHDTV Codec LSI, such researches as parallel programming environment, low power VLSI architecture, and high efficiency coding hardware are carried out in this field.

**Computer Network** — In this field, based on network technology and image processing technology, researches on their cooperation are carried out. Especially, researches on overlay/ad hoc networks, security, medical image diagnosis support, and robotic vision image processing take a leading part.

![FPGA parallel processing board equipped with a noise restoration circuit](image)

![Computer Architecture](image)

![Computer Network](image)

**Intelligent Computing Course**

**Pattern Analysis** — As a contribution to a safer living environment, we have been researching sensing systems that employ optical fibers as a sensor, and developing monitoring systems in which they are applied. Analysis of the light spectrum from the optical fiber sensor provides information on the strain and deformation of structures. Furthermore, through the researches on audio signal processing such as spatial audio, sound image control, and sound analysis of musical instrument, we aim to realize highly realistic communication system.

![Analysis of instrument signal](image)

![Tunnel deformation sensing](image)

**Human Informatics** — Human Informatics focusing on virtual/visual sensation and perception is studied mainly focusing on motion/ cyber sickness. Sickness-free 3D driving simulator and movie showing methods at sea are being developed. Moreover, research on natural language processing such as computer aided language learning system for kids is carried out.

![Virtual reality system](image)

![Device for Cortical Stimulator](image)

**Human Interface** — Human Interface laboratory involves pattern recognition and its application. Examples of our research contributions are on an address and place name recognition for mail sorting machine and license plate recognition for a vehicle, and the research on personal identification based on a signature and face recognition. The researches on quantitative evaluation of the performance of human heart by computer processing using ultrasonic imaging device and MRI are also involved. These are applicable for early detection of a heart disease.

![Mail sorting machine which recognizes an address](image)

![Personal Identification by face recognition](image)

![Ultrasonic diagnostic equipment and the human heart](image)
**Course of Quantum Mechanical Engineering**

**Quantum Physics**

The research activities are performed on fundamental problems of quantum theory, high energy physics, nonequilibrium statistical mechanics, and complex systems. Quantum thermodynamics is also one of the main subjects in connection with nanoscience.

**Condensed Matter Physics**

In this field, the research on electronic state of metals such as superconductivity, phase transitions of liquid crystals and physics of nanостructures are carried out. Fig. 1 shows temperature dependence of electrical resistance observed in typical superconductors and persistent current flowing in the superconducting ring. Fig. 2 is a schematic picture of a single-molecule spintronic device

**Course of Nanotechnology**

**Nano-design**

Among science and technology in the 21st century, nanotechnology raises high expectations. Nano-design laboratory develops a leading edge nanosimulation technique in terms of computational materials science, and leads the nanotechnology research in cooperation with domestic and overseas research institutes.

**Nano-sensing**

In this field, researches on various measurement techniques using a wave motion of sound and light (electromagnetic wave) and relevant signal processing technology are carried out. Examples of concrete subjects of research are measurement/analytic technology of biological weak signal, and fine measurement technology using optical fiber. Not only nano scale, extensive measurement researches are being advanced in cooperation with companies.

**Nano-processing**

The researches on bio/nano-processing, and high-pressure properties of newly developed power transmission oil as a nano-scale molecular machine are carried out in this field. (Research facilities: Atomic force microscope, universal testing machine, electron microscope, photon correlator of oil and ultrahigh-pressure properties measuring device etc.)

**Nano-electronics**

The research on the resource-and-energy-efficient information recording is carried out in this field. Main subjects include the magnetic recording which records one bit in the nanometer size and the new electronics using a spin, which is a unique nature of electron.

Nanotechnology which is the technology to produce the nanometer-sized materials and parts has been attracting attentions as a key technology for the 21st century. Nanotechnology has been expected to contribute to advancement of science and technology, and to solve the various problems such as global environment, energy and medical care. Our department has an education and research system which combines physics, mechanical engineering and electronic engineering tightly connected with nanotechnology. Thus our students are educated to become competent engineers and research workers having comprehension of physics and mastering mechanical and electronic engineering at the same time.
**Course of Graduate School**

**Division of Recycling System Design**
We human beings have consumed various resources and energy such as fossil fuel since the Industrial Revolution and therefore it has been concerned that they might be depleted. Also, mass production and consumption activities have rapidly expanded environmental pollution and destruction and caused serious human and material damages one after another. Under such situation, these days, it is urgently needed to research on effective utilization of resources and energy and to construct technologies for saving energy, recycling, and environmental conservation. This course provides education and research on effective utilization of resources and energy, and on the recycling-oriented system related to saving energy, recycling, and environmental conservation. Specifically, we aim at the education and research on environmental thermal fluid engineering, flow / heat transfer control, and durability / recycle of structures. Moreover, this course also aims at social contribution as the course of education and research for working adults to brush up their skills or upgrade their career.

**Project Laboratories**

**Laboratory of Vehicle Network Technology**
A connector is one of the indispensable parts of electrical and electronic equipments. As the connectors mounted on automobiles are in severe usage environments, we are attempting to realize the highly reliable connectors by working on the basic research of conduction and insulation.

**Eco-Products Laboratory**
Mie University and Fuji Electric Retail Systems Co., Ltd. are jointly researching on energy-saving, automation control function and safety especially for vending machine development. We are developing the technology for measuring energy consumption of vending machines under the field test.

**Facilities for Education and Research**

**Cooperation Research Center**
The center is founded in the aim of promoting high-level science and technology and contributing to the development of regional industry. These developments are carried out through cooperative research or delegated research by the university together with enterprises, local governments or public research and development institutes and through technological assistance and technological consultation.

**Industrial Technology Innovations Institute**
This institute advances innovative and internationally-evaluated research and development, centering on cooperative research with enterprises. We aim at the creation of new industrial field through the university-industry cooperation along with the human resource development of young and competent researchers.

**Creative Research and Development Institute**
**Instrumental Analysis Facilities**
We have large-sized and newly produced analytical instruments to measure physical properties and chemical properties of substances and materials. All staff and students have useful and adequate access to the facilities.

**Life Science Research Center**
**Ultrastructural Research Facilities**
The facilities are for the most advanced researches or experiments such as experiments of genetic modification. Division of Chemistry for Materials in Faculty of Engineering uses the facilities to conduct their researches related to genetic engineering.

**Electron Microscope Facilities**
The facilities contribute to develop the medical, biological, and engineering researches, equipped with transmission electron microscopes, and scanning electron microscopes. Department of Engineering uses the highly efficient facilities to observe the microstructure of semiconductors, metals and glass.

**Center for Information Technologies and Networks**
This is a center of the campus network of Mie University. All students can access the mail server operated by the center and also upload their own hompages. It is used for web search and report writing.

**Environmental Preservation Center**
A proper administration of all of the waste matters in the university is conducted in this center. Processing units for waste liquid detoxify the harmful waste liquid and prevent environmental pollutant from flowing out. What is more, we carry out the researches about energy and resource saving and waste recycling, and attempt to make the university a model area for reducing environmental loading.

**Auditorium (Sansui Hall)**
The auditorium includes the main hall with 1,650 seats, the small hall with 300 seats, and a stage of 20-meter open width. School ceremonies and events, as well as national conferences and lecture meetings are held in it.

**University Library**
The library supports the study of students living in an advanced information-oriented society. A reference room, a collaborative learning room, an audiovisual room and the most advanced high technological equipments are provided. It can be used as an extension of a classroom since it is opened from 8:45 to as late as 21:45 on weekdays.