*This document is an English translation of the 2026 Guide to Entrance Examination in Japanese. The Japanese version shall be the authorized version; the English translation for reference only and includes the additional information for international students.

2026 Guide to Entrance Examination

Graduate School of Engineering,
The University of Tokyo

Department of Nuclear Engineering and Management

Master's Program, Doctoral Program

Contact address:

Department of Nuclear Engineering and Management
Graduate School of Engineering, the University of Tokyo
7-3-1, Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

Email: nyushijimu@n.t.u-tokyo.ac.jp
Website: http://www.n.t.u-tokyo.ac.jp

(Notice) When the “Guide to Applicants” and “Guide to Entrance Examination” changes, the department will inform the possible applicants in the Graduate School website and the department website. Please be sure to regularly check it when making the application.

Graduate School of Engineering:
https://www.t.u-tokyo.ac.jp/soe/admission/general-guideline
Department of Nuclear Engineering and Management:
http://www.n.t.u-tokyo.ac.jp/

1. Department of Nuclear Engineering and Management

The guide to entrance examination contains the important information for those who are going to take an entrance examination of the Department of Nuclear Engineering and Management. This is a supplementary document to the “Guidelines for Applicants to the 2026 Master’s / Doctoral Program Graduate School of Engineering, the University of Tokyo.” This provides the information about subjects, schedules and other related materials. Please read both this brochure and the Guidelines carefully before submitting your application.

Detailed information of the Department of Nuclear Engineering and Management can be found on the department’s website. The School of Engineering started Transdisciplinary Education Program on Resilience Engineering, which is the first trans-department education program, in April 2013, and the Department collaborates with this program for research and education. Our curriculum is certified by the International Atomic Energy Agency (IAEA), and those who meet the requirements for completion will receive the completion certificate of “IAEA Nuclear Technology Management Program”.

After entering the Master’s or Doctoral Program, students will be affiliated with your academic supervisor’s research laboratory. You can find the brief introduction of faculty members in the section four.

The schedule of the guidance to applicants for the Department of Nuclear Engineering and Management is below. The contents of all meetings are the same.

1) Saturday, April 19, 2025, from 15:00 @Engineering Building 3, Lecture room 32 + online (Guidance) & from 15:30@Engineering Building 2, Exhibition room (Poster Session by Laboratories, on-site only). Please check the details on the website (http://www.n.t.u-tokyo.ac.jp)
2) Wednesday, April 23, 2025, from 17:30 @Engineering Building 3, Lecture room 32 + online (Guidance) & from 18:00@Engineering Building 3, Meeting room 423, 424 (Poster Session by Laboratories, on-site only). Please check the details on the website (http://www.n.t.u-tokyo.ac.jp)

We will present an overview of the entrance examination and laboratories of the Department of Nuclear Engineering and Management at each meeting. Q&A sessions and individual consultations will be also held.

(Notice) Concerning the above schedule of the guidance, the dates, locations and implementation methods are subject to be changed. Before participation, please be sure to check the website of the department (http: //www.n.t.u-tokyo.ac.jp/).

If you have any questions or need further information about the examination, please contact us via e-mail at: nyushijimu@n.t.u-tokyo.ac.jp

Note:
All private information (including entries in the required documents for application and examination results) are used only for the purpose of screening and examining the educational systems and entrance exams of the University of Tokyo, and are not used for any other purpose.

The period of application: All application data should be uploaded to the designated upload site. Upload period of application documents in online submission is from Fri, May 30 to Thu, June 5, 15:00 (Japan time).

Written examination will be conducted on campus.

If the number of applicants exceeds a certain number, the department will implement applicant screening based on the submitted documents. When implementing the applicant screening, only those who pass the applicant screening can take written and oral examinations. In the case of the applicant screening, the department will notify applicants by the website (http://www.n.t.u-tokyo.ac.jp/).

The Department of Nuclear Engineering and Management will conduct a special oral examination for master's course applicants. This examination will be conducted who would like to take it. The applicants who are selected though special oral examination will be exempt from written examination in regular admission.

If you wish to take the special oral exam, be sure to select to taking it in the item "Taking the special oral examination" of master's program application form.

2. Master's Program

2-1. Examination subjects

Foreign language - English

Please submit the official score of TOEFL (TOEFL iBT, or TOEFL iBT Home Edition).
The due deadline for submission is Thursday, June 5.
For details regarding the submission of TOEFL official score, please refer to "Notice regarding Foreign-language (English) Examinations in 2026 Graduate School of Engineering, The University of Tokyo Entrance Examinations (TOEFL score submission).
The deadline for submitting TOEFL scores is strictly enforced. Not only the appointment number but also the **score itself must be required**. Please take the exam as early as possible.
Submitted score cannot be replaced after the deadline.

Written examination

Written examination will be conducted on campus (The University of Tokyo, Hongo Campus).

Specialized subjects: Mathematical problems designed to test ability to think logically and a reading comprehension examination

※Mathematical problems designed to test ability to think logically: The problems prepared for mathematics of the regular education subject by the School of Engineering are used as the problems. Examinees are requested to select and answer three of the six problems from six fields: "Primarily from the fields of Differential and Integral Calculus, Differential Equations", "Series, Fourier Analysis, Integral Transform", "Vector, Matrix, Eigen Value (Linear Algebra)", "Curve and Surface", "Function Theory and Complex Number" and "Probability and Statistics, Information Mathematics, etc."

Oral examination

Applicants will be given about 20 minutes for an interview about their basic knowledge and motivation for research, and so on.

2-2 Special oral examination

The special oral examination will be given to master's course applicants who have been judged to have extremely excellent academic ability through applicant screening and whose first choice is this department. This examination will be conducted only to those who wish to take it. The applicants who are selected in this examination will be exempted from written examination of regular admission. The special oral examination will be conducted face-to-face on Hongo Campus of The University of Tokyo.

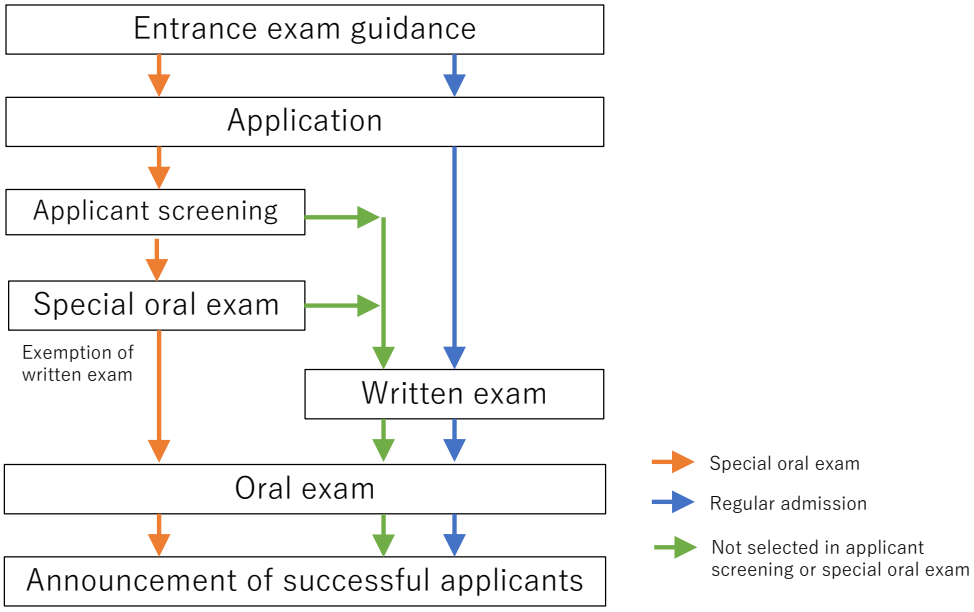
※In the special oral examination, an oral examination will be conducted to evaluate mathematical ability, etc.

※Please note that applicants selected through the special oral examination must take the oral examination in the same manner as applicants of regular admission.

※Applicants who are not selected through the special oral examination and its screening can take the written examination and the oral examination in regular admission.

※Applicants who wish to take the special oral examination must submit, in electronic form, a short thesis regarding the motivation for applying to the department together with the research content in the master's course and a designated sheet reporting the academic grade of undergraduate

course based on academic transcript **by Thursday, June 5**, as well as the TOEFL score. Detailed information will be announced on the Department website.



Schedule of entrance examination (planned)

2-3. Examination schedule

<table>
<tr><th colspan="2">Subject</th><th>Date & time</th><th>Location</th><th>Items to Bring</th></tr>
<tr><td colspan="2">Foreign language</td><td>English
(TOEFL score submission, Submission Deadline: June 5th Thu)</td><td>—</td><td>Individual online exam location</td><td>Follow TOEFL exam guidelines</td></tr>
<tr><td colspan="2" rowspan="2">Special Oral Examination</td><td>Applicant screening</td><td>—</td><td>Individual online exam location</td><td>—</td></tr>
<tr><td>Special Oral Examination</td><td>July 26 (Sat) (tentative)</td><td>It will be indicated on the exam admission card which will be sent after you have applied.</td><td>Exam admission card</td></tr>
<tr><td rowspan="3">Written exam</td><td rowspan="2">Specialized subjects</td><td>Reading comprehension Examination</td><td>August 25 (Mon), 9:30 to 11:00 (tentative)</td><td>It will be indicated on the exam admission card which will be sent after you have applied.</td><td rowspan="3">Black pencils (or black mechanical pencils), an eraser, a pencil sharpener (a desktop type is not allowed), mechanical pencil leads, a watch (watches with functions other than time measurement are not allowed)
*The bringing of ballpoint pens is not permitted.</td></tr>
<tr><td>Mathematical problems designed to test ability to think logically</td><td>August 25 (Mon), 13:00 to 15:30 (tentative)</td><td>Same as above</td></tr>
<tr><td colspan="2">Survey of preferred research laboratory, guidance for oral examination</td><td>August 25 (Mon) 15:40 to 16:00 (tentative)</td><td>Same as above</td><td>Writing tools</td></tr>
<tr><td colspan="3">Oral examination</td><td>August 26 (Tue) to August 27 (Wed)</td><td>Noticed in the guidance for oral examination</td><td>Exam admission card</td></tr>
</table>

Examination dates, times, or locations are just tentative and might be changed. Please be sure to check our website (http://www.n.t.u-tokyo.ac.jp).

2-4. Others

(1) October enrollment:
The successful applicants can enroll the Master's Program from October 2025, if they can meet the requirements. However, it usually takes about three months for a foreign national takes a new status of residence, which would be too late for "October admission". For foreign nationals who need to apply for a new status of residence, please consider selecting "April admission".

(2) Consultations with faculty:
If you need to ask about research fields of the Master's Program, you can ask faculty before you apply. You can find a contact address on the faculty member page in our web site.

(3) Research laboratory affiliation:
After being accepted, students will be affiliated with one of the research laboratory according to their preference and entrance examination scores. The results of the assignment will be notified in writing or by e-mail after the announcement of acceptance, and we will not respond to inquiries regarding assignment results.

(4) Past written examination:

Mathematical problems designed to test ability to think logically: You can find them website at https://www.t.u-tokyo.ac.jp/soe/admission/general-past

Reading comprehension examination: You can pick it up at the office of Department of Nuclear Engineering and Management or we'll send it to you if you order via the following web form: https://forms.gle/eFS2wtCMcckT2di59.

(5) Scholarships:
There are several scholarship programs and international study programs available at the School of Engineering. You can also find further information on the website of OIS (Office of International Students of School of Engineering).
OIS: http://ois.t.u-tokyo.ac.jp/index.html

(6) Other:
If you have any further questions or concerns about the entrance examination, please contact the office of the Department of Nuclear Engineering and Management by email (nyushijimu@n.t.u-tokyo.ac.jp).

3. Doctoral Program (Application Schedule A)

3-1. Examination subjects
Primary examination

Foreign language - English

Applicants who have completed or are expected to complete a master's program of the University of Tokyo do not have to take this examination.

Please submit the official score of TOEFL (TOEFL iBT, or TOEFL iBT Home Edition).
The deadline for submission is Thursday, June 5th.
For details regarding the submission of TOEFL official score, please refer to “Notice regarding Foreign-language (English) Examinations in 2026 Graduate School of Engineering, The University of Tokyo Entrance Examinations (TOEFL score submission).
The deadline for submitting TOEFL scores is strictly enforced. Not only the appointment number but also the **score itself must be required**. Please take the exam as early as possible.
Submitted score cannot be replaced after the deadline.

Written examination

Applicants who have completed or are expected to complete a master's program of the School of Engineering, the University of Tokyo, do not have to take this examination.

Written examination will be conducted on campus (The University of Tokyo, Hongo Campus).

Specialized subjects: Mathematical problems designed to test ability to think logically and a reading comprehension examination

※Mathematical problems designed to test ability to think logically: The problems prepared for mathematics of the regular education subject by the School of Engineering are used as the problems. Examinees are requested to select and answer three of the six problems from six fields: “Primarily from the fields of Differential and Integral Calculus, Differential Equations”, “Series, Fourier Analysis, Integral Transform”, “Vector, Matrix, Eigen Value (Linear Algebra)”, “Curve and Surface”, “Function Theory and Complex Number” and “Probability and Statistics, Information Mathematics, etc.”

Oral examination

Applicants will be given about 25 minutes (15 minutes of presentation + 10 minutes of an interview) for an oral examination. In the presentation, you have to explain your master’s thesis, or research achievement that can be alternative of your master’s thesis. You are also supposed to describe your research plan after entering the Doctoral Program.

Note:

Applicants who have graduated or are expected to graduate and awarded a master’s degree or its equivalent by September 2025, or who have been recognized as having academic abilities equal to or greater than a person who has received Master’s degree, based on individual screening of Admission Qualifications by the School of Engineering the University of Tokyo, should have about 35 minutes (20 minutes of presentation + 15 minutes of an interview) for the oral examination. This means that this oral examination is counted as both the primary oral examination and the secondary examination described below.

Secondary examination

Oral examination

Applicants will be given about 35 minutes (20 minutes of presentation + 15 minutes of an interview) for an oral examination. In this presentation, you have to explain your master's thesis, or research achievement that can be alternative of your master's thesis. You are also supposed to describe your research plan after entering the Doctoral Program.

3-2. Examination schedule

Primary examination

<table>
<tr><th colspan="3">Subject</th><th>Date & time</th><th>Location</th><th>Items to Bring</th></tr>
<tr><td colspan="2">Foreign language</td><td>English
(TOEFL score submission, Submission Deadline: June 5th Thu)</td><td>—</td><td>Individual online exam location</td><td>Follow TOEFL exam guidelines</td></tr>
<tr><td rowspan="2">Written exam</td><td>Specialized subjects</td><td>Reading comprehension Examination</td><td>August 25 (Mon), 9:30 to 11:00 (tentative)</td><td>It will be indicated on the exam admission card which will be sent after you have applied.</td><td rowspan="2">Black pencils (or black mechanical pencils), an eraser, a pencil sharpener (a desktop type is not allowed), mechanical pencil leads, a watch (watches with functions other than time measurement are not allowed)
*The bringing of ballpoint pens is not permitted.</td></tr>
<tr><td></td><td>Mathematical problems designed to test ability to think logically</td><td>August 25 (Mon), 13:00 to 15:30 (tentative)</td><td>Same as above</td></tr>
<tr><td colspan="3">Oral examination
*See Note</td><td>August 26 (Tue) to August 27 (Wed)</td><td>Announced after written exam</td><td>PC etc. and presentation materials for Oral exam, and admission card</td></tr>
</table>

Examination dates, times, or locations are just tentative and might be changed. Please be sure to check our website (http://www.n.t.u-tokyo.ac.jp).

*Note :

1) All applicants have to submit the document (a) before the exam:

(a) One copy of a summary of your master's thesis or alternative research achievement

・It should not exceed 4 pages of single-side A4 printing including figures and diagrams.

・Applicants ,who are expected to obtain a master's degree by March 31, 2026, should present a summary of a midterm report of your research progress.

2) Applicants who will take the extended oral examination which serves as both the primary oral examination and the secondary examination must submit the document (b) in addition to the document (a) before the exam:

(b) One copy of master's thesis or documents which expressly provide alternative research achievement to the master's thesis. In the case of working adult, a copy of research paper may be used, but note that fragmentary work introductions and team achievements deviate from the perspective of examination.

You have to upload the electronic files (PDF file) of the document (a) and document (b) (only for those who need to do) no later than ***August 1 (Fri)***. The upload destination will be notified later on our web site (http://www.n.t.u-tokyo.ac.jp/prospective/examination/).

For the presentation, you can use presentation materials created with Microsoft PowerPoint etc. If you do not use the presentation materials created with Microsoft PowerPoint etc., you can use another material for your presentation. In that case, please let us know at the department office by email until ***August 1 (Fri)***.

If you have any further questions regarding the above, please contact the office of the Department of Nuclear Engineering and Management by email (nyushijimu@n.t.u-tokyo.ac.jp).

Secondary examination

Secondary examination is only for those who have passed the primary examination, and it is scheduled for January 2026. The detailed information will be informed to the applicants later.

3-3. Others

(1) October enrollment:
The successful applicants can enroll the Master's Program from October 2025, if they can meet the requirements. However, it usually takes about three months for a foreign national takes a new status of residence, which would be too late for "October admission". **For foreign nationals who need to apply for a new status of residence, please consider selecting "April admission"**.

(2) Consultations with faculty:
Before applying, every applicant for the Doctoral Program **has to discuss** your research field with your prospective academic supervisor before you apply.

(3) Admitting students with full-time jobs:
Those who wish to enter the university while still being employed are required to submit upon entry to the university, a Letter of Approval (in any format) from their employer (as long as the one who approves you holds a higher position than you, then the exact position does not matter) certifying that their "in office status" does not in any way interfere with them entering the university.

(4) Past written examination:

Mathematical problems designed to test ability to think logically: You can find them website at http://www.t.u-tokyo.ac.jp/soee/admission/general_past.html

Reading comprehension examination: You can pick it up at the office of Department of Nuclear Engineering and Management or we'll send it to you if you order via the following web form: https://forms.gle/eFS2wtCMcckT2di59

(5) Scholarships:
There are several scholarship programs and international study programs available at school of Engineering, including Graduate School of Engineering, The University of Tokyo Doctoral Student Special Incentives Program (SEUT-RA) and Doctoral Student Support: "Fostering Advanced Human Resources to Lead Green Transformation (GX)" (SPRING GX). You can also find further information on the website of OIS (Office of International Students of School of Engineering.)
OIS: http://ois.t.u-tokyo.ac.jp/index.html

(6) Transcripts for undergraduate courses or equivalents
Applicants who have graduated or will graduate from the School of Engineering, the University of Tokyo, must provide the transcripts for undergraduate courses or equivalents, if he or she has not graduated from the Faculty of Engineering, the University of Tokyo.

(7) Other:
If you have any further questions or concerns about the entrance examination, please contact the office of the Department of Nuclear Engineering and Management by email (nyushijimu@n.t.u-tokyo.ac.jp).
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4. Introduction of the faculty members and their research

The following is a list of faculty members and outline of their research. Please visit the department's website and check also their laboratory's website, faculty's theses etc. Post-graduate students of our department will be supervised by one of the faculty members below.

Hiroaki ABE (Professor)

Nuclear Materials, Fuels and Related Discipline

Development of materials and related analysis techniques are indispensable for the expected solutions for the safe design and operation of nuclear power plants. We deal with the research and development of materials for fusion reactors, advanced fission reactors (Generation IV), and light water reactors (LWRs) including Accident Tolerant Fuels (ATFs). Our main targets are to reveal the fundamental mechanism of the degradation process under extreme environments, such as irradiation, corrosion, and hydrogenation, in Fe-based and Zr-based alloys. Developments in high-performance materials and new testing methods are also of our interest. The following techniques are currently applied. (a) Microscopy like TEM, HVEM, TEM-accelerator, SEM/EBSD, etc.; (b) mechanical tests like advanced expansion-due-to-compression (A-EDC) test, tensile, creep, and nano-hardness, etc.; and (c) computer simulations like FEM and MD.
[Fission, Fusion, Nuclear materials, Nuclear fuels, Extreme environment, Degradation mechanism, Radiation effects]

Kazuyuki DEMACHI (Associate Professor)

Anomaly detection and identification for nuclear security, maintenance and safety

Since the accident at the Fukushima Daiichi Nuclear Power Plant in March 2011, nuclear power plants have been recognized as an attractive target for terrorists, and the strengthening of nuclear security has been advocated all over the world. In recent years, in addition to the conventional nuclear security threats, new threats such as insiders, cyber-attacks, and stand-off attacks have emerged, and there is an urgent need to strengthen nuclear security. In order to solve this problem, it is necessary to develop human resources who have a high degree of expertise in AI and other knowledge, and to develop human resources who have flexibility and adaptability to the ever-changing social situation. Especially in nuclear security at nuclear power plants, flexible cooperation with nuclear safety is essential. Our laboratory aims to strengthen the nuclear security and safety of nuclear plants. In particular, we are developing technology for "anomaly detection & identification" by applying deep learning. The main research themes of recent years are the followings, but we will also flexibly develop other technologies.

(1) A technology that combines image AI, natural language processing AI, and generative AI to detect abnormal behavior in real time, such as acts of sabotage or theft of nuclear materials that could lead to accidents at nuclear power plants.
(2) A technology that applies regression AI models to plant data from nuclear power plants and operational monitoring data from active equipment to detect the occurrence of failures early and has reinforcement learning AI suggest appropriate responses for recovery.
(3) A technology that uses AI to determine appropriate content, such as videos of skilled workers and work instructions, and displays them on AR glasses worn by workers.
(4) A technology to find Beyond DBT (unpredictable nuclear security threats) scenarios using multi-agent models and reinforcement learning.

[Deep learning, nuclear security, nuclear safety, anomaly detection & identification, work support]

Yasumasa FUJII (Professor)

Energy systems analysis for policy and technology assessment

Fujii laboratory has been working on the research topics of the feasibility analysis of various alternative energy supply technologies, and policy evaluation for international energy security and environmental issues using a global energy system model built with large-scale mathematical programming on the computers. Moreover, research topics of energy management, such as institutional design of deregulated electricity markets and optimal strategy planning of energy procurement under uncertainty, have also been investigated using variety of analytical techniques of stochastic dynamic programming, financial engineering, and multi-agent simulation with reinforcement learning.

In Fujii laboratory, since we try to find the solutions for the energy problems of 100 years and for the social system which is not realized yet, we welcome students who have the interest to learn various fields, and those who have strong imagination to consider the future of foreign countries.

[Energy economic systems, Technology and policy assessment, Optimization, Stochastic programming]

Shuichi HASEGAWA (Professor)

Nuclear Engineering using the interaction between photons and matters

Technologies based on the interaction of photons with matter have made remarkable progress and are now capable of detecting and even manipulating motion at the single atom level.

By utilizing the technologies, a quantum computer using ion traps has been realized by controlling the internal state of ions as well. Currently, the expansion of the number of ions (the number of qubits) is a major subject, and research is being conducted on technology to capture and manipulate ions with electrodes using microfabrication technology.

We are also conducting research on the detection of so-called difficult-to-measure nuclides, such as long-lived radionuclides in the environment, in radioactive waste disposal, and in the nuclear fuel cycle, with ultra-high precision.

In addition, by using high-energy X-rays generated by bremsstrahlung from an electron accelerator, we are aiming for social implementation of X-ray non-destructive inspection of social infrastructure and application of nuclear reactions to produce radionuclides for medical use.

These advanced technologies are expected to be used in a wide range of fields, including nuclear engineering, quantum information processing, radioactive medicine, tracer applications, environment, and nuclear security.

Since there are no apparatus in the world to achieve these goals, many devices are designed and manufactured in our laboratory, starting from simulations. There is something of interest for everyone, so please join us in our research.

[Quantum computer, ultra trace nuclide analysis, X-ray non-destructive analysis, isotope process engineering, nuclear fuel cycle engineering, atomic and molecular photochemical physics]

Kenichi ISHIKAWA (Professor)

Theory of attosecond science and ultrafast intense laser-matter interaction

We investigate the interactions between intense laser pulses and matter - including atoms, molecules, and solids - through quantum-mechanical first-principles calculations. Our research focuses on the attosecond-scale quantum dynamics of electrons induced by ultrashort laser pulses and the subsequent nuclear dynamics. These ultrafast processes play essential roles across various fields, such as understanding radiation effects in biological systems, precise control of chemical reactions, advancing petahertz electronics, and developing smart laser material processing techniques. Our laboratory actively collaborates with internationally renowned institutions, including Vienna University of Technology, LMU Munich, Max Planck Institute of Quantum Optics, Max Born Institute, FERMI free-electron laser facility, and RIKEN, fostering cutting-edge interdisciplinary research.

[Laser, Attosecond science, Quantum technology, Quantum optics, Ab initio simulations, Laser material processing, Digital photonic production]

Jinya KATSUYAMA (Project Associate Professor)

The safety associated with long-term operated nuclear reactors

Materials and welding are important for manufacturing, and appropriate maintenance and management to ensure the safety of nuclear facilities and components.

In order to ensure the safety of light water reactors which has been operated for long term, we are researching methods for predicting the material degradation of reactor pressure vessels and nuclear piping, which are the most important safety-related components composed of the pressure boundary, through deeper understanding the degradation mechanisms and so on. Additionally, we are conducting research and development to accurately evaluate weld residual stress, which is important for assessing the structural integrity of nuclear components, taking material variations caused by welding into account. Moreover, we are developing a probabilistic evaluation method that integrates the above technologies with the aim of risk-based decision-making related to maintenance and management, and proceeding practical applications of the probabilistic evaluation method.

The accident of Fukushima Daiichi Nuclear Power Plants provided an opportunity to refocus the importance to assess failure behavior of reactor components with complicated geometry due to relocation of fuel materials, and to assess the safety of reactor system considering their failure behavior.

We are proceeding research and development on evaluation methods related to above topics in collaboration with the Japan Atomic Energy Agency.

[Material, Welding, Ageing degradation, Probabilistic structural integrity assessment, Nuclear safety]

Ryoichi KOMIYAMA (Professor)

Quantitative analysis of energy security

Energy security is a key agenda to address for sustaining socioeconomic activities under various structural and contingency risks such as the depletion of fossil fuel and energy supply disruption. In order to formulate effective technical and political measures for enhancing energy security under those risks and constraints, we need to comprehensively understand economics and international energy market as well as the engineering aspect of energy technology. The research theme in our group is to develop a mathematical and computational energy-economic model to analyze the optimal strategy for the deployment of energy technologies and to discuss energy policy firmly based on the simulated results derived from the model.

[Energy security, Energy-economic model, Mathematical optimization, Econometrics]

Hiroyuki MATSUZAKI (Professor) (The University Museum)

AMS, isotope system, Earth environmental system

Development of Accelerator Mass Spectrometry (AMS) and other ion beam analysis systems, and their application studies are conducted in our laboratory.

Several special but extremely rare isotopes produced by the cosmic-ray interaction or the artificial fission reaction hold significant information about past climate variation and materials dynamics on the earth. We are reading and understanding this information by means of Accelerator Mass Spectrometry (AMS). For example, analysis of Iodine-129 in natural archive such as ice core, coral and sediments elucidates space-time variation of iodine isotope system. Radiocarbon dating (C-14 dating) is also one of AMS applications.

We are also developing novel techniques for the analysis of new nuclides yet detected ever., e.g., Laser Photo Detachment (LPD) system. This is entirely new technique of the isobar suppression which could enable detection of Ni-59, Sr-90, Cs-135. Recently we developed U-236 detection system using Time Of Flight (TOF). Since U-236 is a good indicator of the fission of U-235, it is important for the environmental assessment of nuclear facilities or nuclear accidents. It is also expected to be applied to the identification of nuclear source/activity.

Because we have a 5MV tandem accelerator and beam line system, various experimental studies using ion beam based on creative ideas are possible. Let's enjoy the development of new method with the accelerator/ion beam engineering and exploration of new research field.

[Accelerator Mass Spectrometry, Ion beam, Isobar separation, nuclide analysis, earth environment, Iodine isotopes, Uranium isotopes]

Shuichiro MIWA (Associate Professor)

Engineering Innovation through Multiphase flow

Multiphase flow, defined as a simultaneous flow of several phases, is observed in various disciplines, including engineering devices, nature, and even in human bodies. The phenomenon is highly complex and takes place in different spatial and temporal scales with deformable interfacial boundaries. One of the forms of multiphase flow, known as gas-liquid two-phase flow, is particularly important for the design and operation of energy/ chemical systems, including nuclear reactors.

Our laboratory aims to develop models applicable for various two-phase flow systems, including next gen. reactors, through experimental, computational, and theoretical approaches. Joint research with industries and collaborative works with research groups across the globe are currently ongoing. Research projects in our group are subdivided into three folds:

(1) Experimental approach: Understanding two-phase flow dynamics in tight-lattice rod-bundle geometry, passive safety system, flow-induced vibration, and air entrainment system through fundamental experiments.
(2) Data-driven approach: Development of two-phase flow fields analysis using AI techniques (pattern recognition, object detection, GAN), accidental analysis using RNNs.
(3) Numerical approach: Development of constitutive equations utilized in system analysis codes, blood flow simulation using multi-dimensional CFD through collaboration with medical experts.

Our focus is to strengthen the traditional model development approach through fundamental experiments while adopting state-of-the-art techniques such as AI and numerical simulations to deepen the understanding of multiphase flow.

We are looking forward to having zealous and passionate students eager to learn and grow professionally through multiphase flow research!

[Two-phase flow, Nuclear thermal-hydraulics, Machine Learning, Next Gen. Reactors, Reactor Safety]

Yuya MORIMOTO (Visiting Associate Professor)

Note: No new student will be accepted.

Attosecond Electron-beam Imaging

We are developing novel imaging techniques to visualize ultrafast phenomena occurring on the atomic scale. We use ultrashort electron beams and ultrashort pulsed lasers. By developing an attosecond electron microscope, we will visualize ultrafast phenomena with Angstrom resolution, for example, the ultrafast motion of electrons in an initial step of a chemical reaction. Our research activities range from theoretical studies on electron beam generation and its scattering, design of electron guns, electrodes, and electromagnetic lenses using simulation software, design and development of ultra-high vacuum devices, observation of ultrafast phenomena using ultrashort electron beams, development of novel light sources with various wavelengths using intense femtosecond lasers, and manipulation of electron beams by light waves. Our research is conducted at RIKEN in Wako, Saitama.

[Electron Microscopy, Ultrashort laser, Physical chemistry, Light-matter interaction]

Kenta MURAKAMI (Associate Professor)

Management of Plant Life thought Multiscale Physics

Research themes are modeling of material behaviors in nuclear systems and its interaction with humans and organization, and development of advance nuclear materials.

Our research is being used to formulate standards for the long-term operation of existing nuclear power plants and to assess the impact of nuclear accidents. We welcome master students who wish to work in the nuclear industry in Japan or overseas.

Students of doctoral programs will be assigned one of the following themes and will be asked to work on their research independently.

1) Irradiation embrittlement of reactor pressure vessels
2) Irradiation degradation of PWR biological shielding wall
3) Degradation of BWR pedestal concrete during severe accident
4) Probabilistic assessment for emergency preparedness with earthquake and nuclear accidents
5) Development of high entropy alloys for nuclear

[Nuclear Engineering, Multiscale Physics, Safety Management]

[integrated risk-informed decision making, *in-situ* observation, irradiation design, safety, materials]

Yukie NAGAI (Associate Professor) (Research into Artifacts, Center for Engineering)

Shape modeling for empowering applications of X-ray CT measurements

Industrial X-ray CT scanning has been introduced primarily in the manufacturing industry as a non-destructive internal measurement technology. The applications of CT measurement are expanding beyond the mere acquisition of object geometry, as exemplified by the digital twin. This shows that CT scanning has value more than just shape measurement. However, measurement data is subject to various disturbances, thus it is necessary to improve its accuracy and image quality to make the best use of it.

We believe that algorithms to improve the quality and use of measurement data can enhance the value of the measurement data, and we have been developing geometry processing algorithms for data obtained from substantial objects by measurement technologies such as X-ray CT scanning. In addition, to elucidate the influence of objects on human sensation and perception, we aim to develop sensory modeling technologies by linking measurement data with quantitative sensory data.

Our specific research topics include X-ray projection image improvement, high-quality CT reconstruction, accurate shape extraction, visualization, shape analysis, and shape generation. During the course, students develop algorithms, implement them, and verify their performance. Our algorithms are based on various fields such as the principles of X-ray CT scanning, shape modeling, computational geometry, differential geometry, and optimization.

Our mission is to provide valuable technologies and people for the betterment of society. We are willing to work with students who share this idea of contributing to society and are curious to explore new research fields.

[Scanned data processing, Shape modeling, Computational geometry, Programming]

Koji OKAMOTO (Professor)

Note: No new student will be accepted.

Severe Accident, Nuclear Safety and Visualization

In the Severe Accident of Nuclear Power Plant, melted fuel relocates to lower plenum with dissolving the SUS and Zircaloy structures. The phenomena are multi-physics, multi-phase, multi-dimensions, multi-chemistry, that is, huge non-linear mechanisms. For example, the accident at Fukushima-Daiichi NPP has lots of unknowns and unresolved issues. In order to operate the nuclear plant safely, the non-linear severe accident phenomena have to be known. In our laboratory, the thermal-hydraulic phenomena related to the Severe Accident had been studied with experiment and numerical simulation. These results had been applied to international collaborative research, R&D for next generation nuclear reactor and decommissioning activity of Fukushima Daiichi.

"Visualization" is the key technology on 21 century. The huge amount of data will be visualized to understand the complex phenomena and/or to resolve the core mechanism of the complex systems. The laser and high-speed camera will resolve the invisible world with quantitative information. We are the world top class laboratory for quantitative visualization.

In the Nuclear Safety, Visualization and Severe Accidents are the key system. The complex huge system, e.g. Nuclear Power Plant, will be resolved using the visualization technology. The Nuclear Energy will be a promising source of energy to help the world, especially developing countries. However, public understandings will be needed, especially in Japan. Using the visualization technology, we will provide an open access of the Nuclear Energy.

We really need a trailblazer for the complex future.

[Visualization, Nuclear safety, Severe accident]

Takumi SAITO (Professor)

Nuclear Waste Management: A Key for Sustainable Use of Nuclear Energy

It is the duty of our generation to settle the issue of nuclear waste disposal. This is so in particular when we achieve so-called carbon neutral society with nuclear, for which its own sustainability is required. Geological disposal is the only feasible option for high-level wastes or spent fuels, where various basic research and R&D are still needed. In my group, we tackle this problem by understanding and modeling the chemistry of radionuclides that governs their migration in subsurface environments (“natural barrier”) and the behaviors of various engineered barriers, using sophisticated spectroscopy, chromatographic techniques, and computer simulation. In addition, we perform various research on transport of radionuclides through heterogeneous host rocks. Knowledge obtained through the research has been applied to the modeling of chemodynamics of radionuclides released from the accident of the Fukushima Daiichi nuclear power plant in soils. Any students who have interests in nuclear waste managemen, or relevant processes, ranging from molecular-scale reactions to macroscopic transport, and aim to tackle together this difficult issue of nuclear waste disposal, which arise at the interface of the use of nuclear energy and the environments, are highly welcomed, no matter what academic backgrounds they have.

[Nuclear waste disposal, Radionuclide transport, Geochemistry, Actinide chemistry]

Mikio SAKAI (Professor)

Development of state-of-the-art multi-physics simulation technologies towards construction of a physics-based digital twin

By integrating our world-leading multi-physics simulator with artificial intelligence, we are conducting research across a variety of fields, including nuclear engineering, environmental and energy engineering, materials processing, and food and pharmaceutical engineering. We also carry out studies on data science for powder systems, the verification and validation of computer simulation results, and the realistic visualization of multi-physics simulations using computer graphics. Ultimately, we aim to integrate these fundamental technologies to develop a highly versatile digital twin. In the nuclear engineering field, we are working on developing detailed physical models to elucidate the phenomena involved in severe accidents, as well as creating reduced-order models using proper orthogonal decomposition. I welcome ambitious, energetic students to join my group. When you look back on your student days after graduation, I hope you will be able to say, “I did some great research!”

[Multiphysics simulation, digital twin, discrete element method, data science]

Kazuyuki SAKAUE (Associate Professor)

Light/Quantum beam science and applications

Light/quantum beam is widely used in society. Lasers as light are probably installed in the PC or smartphone you are looking at on your screen right now, while radiation as quantum beams supports social activities such as medical care and infrastructure diagnosis, and synchrotron radiation obtained from quantum beams is used to develop various new products. Light and quantum beams may seem to be two different fields, but in semiconductor manufacturing, for example, the wavelength of exposure light is becoming shorter, and EUV (extreme ultraviolet light: wavelength of 13.5 nm) is beginning to be used. This is an area that can already be called radiation. The two fields is expected to get closer. To develop this new combined field, we will expand the application by pioneering new light and quantum beam sources through lasers, accelerators, their fusion, and by miniaturizing accelerators. Recently, we have also been working on applications to laser processing.

Our laboratory has just started up, and we will design and build research devices using lasers and accelerators. You can learn a wide range of fields such as accelerator science/optical science/vacuum technology/materials science/optical and quantum beam applications. Let us enjoy this chance to build systems filled with your own ideas together.

[Light/Quantum beam、Accelerator、Laser、Quantum beam application、Laser processing]

Takeshi SATO (Associate Professor)

Theory and simulations of light-matter interaction

Our laboratory conducts theories and simulations of the interaction between light and matter. We are a world-leading laboratory in the field of attosecond science, which aims at directly measuring and controlling the electron motion in materials with ultrashort pulses and high intensity lasers. My research themes can be classified into three: theory, implementation, and applications. First, we are developing original theories for accurately solving the time-dependent Schrodinger equation to describe light-matter interactions. With theory, you can make a breakthrough using papers and pencils only. Second, you will be trained for both new and old computer skills including C++, Fortran, and python in our group. With computer implementation, you can connect theory with reality. Appealing in the third topic, applications, is that you can use original theory and codes to predict real-world experiments. We are also developing new theories and methods for simulating quantum dynamics on a quantum computer. Please join us if you like math, physics, chemistry, programming, or simulations, or if you are interested in the theory of light-matter interactions, quantum mechanics, or quantum computer, or if you want to challenge the fusion of physics and machine learning.

[Light-matter interaction, Quantum Chemistry, Solid-state Physics, Quantum Computer, Machine Learning]

Kenji SHIMAZOE (Associate Professor)

Quantum Sensing and Instrumentation for Radiation Science

We develop novel quantum sensing and instrumentation for medical physics, environmental applications and nuclear science, which visualizes unknown physical phenomenon and information.

X-ray low-dose photon counting CT, next generation PET (positron emission tomography) and Compton imaging, radio-theranostics technology with new radioisotopes, X-ray and neutron imaging and analysis, radiation detectors for decommissioning and monitoring, research on atomic nucleus and radiation generation, new measurement method based on quantum entanglement, photon-radiation integrated technology with nanoparticles (quantum dot) are one of our research topics. We build new radiation science and medical diagnosis and therapy utilizing atom and atomic nucleus. We welcome ambitious students interested in those fields to work together.

[Quantum Imaging, Quantum measurement, Quantum sensor, Radiation Detection and Measurement, X-ray and Neutron Imaging, Medical Diagnosis and Therapy]

Hiroyuki TAKAHASHI (Professor)

Note: No new student will be accepted.

Radiation measurements and instrumentation

Radiation measurements are very important in many science and technology areas. We develop quantum radiation detectors for various applications in many areas such as medical imaging, industrial imaging, basic science, etc. Microfabrication techniques, microelectronics and computer hardware techniques, and simulation calculations are effectively used in our research.

[Radiation measurements, Gamma-ray imaging, Environmental radiation, Neutron detectors, Signal processing]

Takashi TAKATA (Professor)

Deepening of Risk and Utilizing of Risk on Decision Making in Engineering Issue

We have no engineering system with absolute safety. Accordingly, A qualitative and quantitative understanding of risk on the system will be one of the most key issues to discuss its safety and to make a decision concerning with an application of the system.

Since a nuclear power plant is a huge and complex engineering system, intrinsic risks in the plant include large uncertainties and numerous scenarios. Hence, a ratiocinative methodology will be of importance to clarify the risks. We have been developing the methodology based on experimental approaches as well as numerical simulation technology.

So as to utilize an engineering technology efficiently, one needs two-sided characteristics of; one's credible expertise and a sense of overall balance. Accordingly, we have also investigated a qualitative characteristic of the information concerning with the risk, which is obtained in the risk assessment, and its elemental role on decision making.

[Risk assessment, Thermal-hydraulics, Numerical simulation, Uncertainty, Decision making, Nuclear safety]

Shinichi YAMASHITA (Associate Professor)

What is induced by ionizing radiations? Revealing “individuality” to utilize advantages and to overcome disadvantages.

The advantages and disadvantages of ionizing radiation are two sides of the same coin based on underlying common features, which can be regarded as their " individuality.” By understanding their “individuality” and managing them adequately, we can utilize ionizing radiation in many practical fields, such as cancer therapy and material development. Therefore, understanding the phenomena brought about by radiation energy is essential.

Ionizing radiations deposit their energies instantly, causing various changes to be suddenly and locally induced. We have been investigating fast phenomena occurring within a microsecond (0.000001 s) in correlation with stable changes manifested after a long time (final products). We have also started some trials to produce beneficial compounds and to develop novel functional materials.

More specific research topics are, for example, as follows:

- Development of experimental systems for observation of the fast phenomena (construction of hardware and graphical programming with LabVIEW)
- Initial process of radiation damage to DNA and its inhibition by additives
- Utilization of radiation energy in the production of ammonia (contribution to green sustainable chemistry)
- Influences of seawater or metal oxide nanoparticles on water radiolysis
- Atomic-oxygen-induced microstructural change on the surface of polymeric material used in spacecraft
- Radiation signal processing using luminescent materials (Radiation detection)
- Development of nanomaterials for radiation energy conversion and utilization

Other research topics are also set up to take into account the students' interests as much as possible.

[Radiation effect (physicochemistry, chemistry, and biochemistry), water chemistry in nuclear reactors, cancer therapy, industrial application of radiation, interface, radiation detection, nanoparticles]

Notice for Examination
~The 2026 Master's / Doctoral Program Graduate School of Engineering, the University of Tokyo~

1. Examination Dates

Examinations will be held from August 25 (Monday) through August 29 (Friday), 2025.
(For details on times and location of the examination subjects, refer to the "Guide to Entrance Examination" of the department you are applying for.)

2. Examination Location

Refer to the "Campus Map for the Examination" [see the attached paper].
(1) The actual place of the examination subjects for applicants will be posted on the School of Engineering website and each department website by 10:00 a.m. on August 22 (Friday), 2025.
Confirm the specified place for the examination subjects beforehand.
(2) Applicants should arrive at the specified place for the examination subjects 20 minutes prior to the scheduled examination time.
For the examination of specialized subjects (専門科目(専門学術)), also refer to notifications from the department you are applying for.
(3) Confirm that the number on your desk is the same as your examinee number and take your seat at that desk.
(4) If you are late for the examination, you will still be allowed to take the examination if it is less than 30 minutes after the start of the examination.

3. Items to Bring

(1) Examination admission card. (*If you forget to bring it on the examination day, go to the examination venue and tell the supervisor about it.)
(2) Black pencils (or black mechanical pencils), an eraser, a pencil sharpener (a desktop type is not allowed), mechanical pencil leads, a watch (watches with functions other than time measurement are not allowed).
*The bringing of ballpoint pens is not permitted.
(3) For other items to bring for the examination of specialized subjects (専門科目(専門学術)), refer to notifications from the department you are applying for.
(4) Other items as instructed at the time the Examination admission card is issued.

4. Notice during Examination of Regular Education Subjects (一般教育科目(一般学術))

(1) Follow the instructions from the proctor during the examination.
(2) You cannot leave the examination room throughout the examination.
(3) The Examination admission card must be kept on your desk at all times during the examination.
(4) Applicants cannot take home the answer sheets or the problem booklets after the examination.
(5) Do not leave the room until instructed to do so by the proctor.

5. The Secondary Examination for Applicants to the Doctoral Program

The secondary examination will be held between mid-January and early February 2026.
Applicants will be advised of Examination dates and locations regarding secondary examinations for the department they are applying for later.