*This document is an English translation of the 2020 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.

2020 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

Tel: +81-3-5841-6015, Fax: +81-3-5841-8713
Tel: +81-3-5841-2900 (English speaking staff)
Email: nyushijimu@n.t.u-tokyo.ac.jp
Website: http://www.n.t.u-tokyo.ac.jp

1. Department of Nuclear Engineering and Management

This entrance examination guide 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 2020 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.

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 five.

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.

Location: School of Engineering, the University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, 113-8656,Tokyo

1) Tuesday, May 14, 2019, from 17:00 @ Engineering Building 3, 2nd floor, Lecture room 32 (Guidance) & from 17:30 @ Engineering Building 2, Exhibition Room (Poster Session by Laboratories)
2) Saturday, June 8, 2019, from 15:00 @ Engineering Building 3, 2nd floor, Lecture room 32 (Guidance) & from 15:30 @ Engineering Building 2, Exhibition Room (Poster Session by Laboratories)

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.

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

For further detailed information about research activities of respective laboratories, or if you wish to take any professor’s advice, please contact the office of the Department of Nuclear Engineering.

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 is from Tuesday, July 2 to Thursday, July 11.

2. Master's Program

2-1. Examination subjects

Written examination

(1) General subjects: Foreign language - English

Applicants who are able to submit an official TOEFL score - TOEFL-PBT, TOEFL-iBT- at the time of application may use the scores in lieu of English examinations. Regarding foreign-language examinations, please refer to "Notice regarding Foreign-language (English) Examinations in 2019 Graduate School of Engineering, The University of Tokyo Entrance Examinations."

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

Since the entrance examination for the 2017 Master's program, the examination format for the specialized subjects has been changed. The problems prepared for mathematics of the regular education subject by the School of Engineering are used as a part of the problems. The problems of the regular education subject in the past examination are found in the following website.

http://www.t.u-tokyo.ac.jp/soee/admission/general_past.html

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. Examination schedule

Subject			Date & time	Location	Items to Bring
Written examination	English (examination based on TOEFL-ITP)		August 26 (Mon), 09:00 to 11:30	It will be indicated on the exam admission card which will be sent after you have applied.	Exam admission card, Writing tools
	Specialized	Mathematical problems designed to test ability to think logically	August 26 (Mon), 13:00 to 15:30	Same as above	Exam admission card, Writing tools, Watch * You cannot bring a calculator or a watch with a calculator.
		Reading comprehension examination	August 26 (Mon), 16:30 to 18:00	Same as above	Exam admission card, Writing tools
Survey of preferred research group			August 26 (Mon) 18:10 to 18:30	Same as above	Writing tools
Oral examination			August 27 (Tue) or August 28 (Wed)	Noticed beforehand	Exam admission card

Please visit our website (http://www.n.t.u-tokyo.ac.jp) or check the notice board of the Department of Nuclear Engineering and Management located on the second floor of the Engineering Building No.3 before the examination. Examination dates, times, or locations might be changed.

2-3. Others

(1) September enrollment:
The successful applicants can enroll the Master's Program from September 2019, if they can meet the requirements. If you wish to start from September 2019, you have to contact the department office before you apply.

(2) Consultations with faculty:
If you need to ask about research fields of the Master's Program, you can ask faculty in advance. If you wish to do so, please contact via the office of Department of Nuclear Engineering and Management.

(3) Research group affiliation:
After being accepted, students will be affiliated with one of the research groups according to their entrance examination scores.

(4) Past written examination:

Mathematical problems designed to test ability to think logically: You can find them on the website at http://www.n.t.u-tokyo.ac.jp

Mathematical problems in the regular education subject of the School of Engineering: You can find them website at http://www.t.u-tokyo.ac.jp/soee/admission/general_past.html

Reading comprehension examination: You can come to the department office to get it, or we'll send it to you if you order to nyushijimu@n.t.u-tokyo.ac.jp

A copy of past written examination is included among the documents distributed at the guidance.

(5) Scholarships:
There are several scholarship programs and international study programs available at the School of Engineering. If necessary, please contact the office of the Department of Nuclear Engineering and Management. 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.

3. Doctoral Program (Application Schedule A)

3-1. Examination subjects
Primary examination

Written examination

(1) General subjects: 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 the examination of General subjects.
The other applicants should take this English examination. But, if you are able to submit an official TOEFL score - TOEFL-PBT, TOEFL-iBT- at the time of application, you may use the scores in lieu of English examinations. Regarding foreign-language examinations, please refer to "Notice regarding Foreign-language (English) Examinations in 2020 Graduate School of Engineering, The University of Tokyo Entrance Examinations."

(2) Specialized subjects: Mathematical problems designed to test ability to think logically and a reading comprehension 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 the examination of specialized subjects.

Since the entrance examination for the 2017 Doctoral program, the examination format for the specialized subjects has been changed. The problems prepared for mathematics of the regular education subject by the School of Engineering are used as a part of the problems. The problems of the regular education subject in the past examination are found in the following website.
http://www.t.u-tokyo.ac.jp/soee/admission/general_past.html

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 2019, 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 rowspan="3">Written examination</td><td colspan="2">English
(examination based on TOEFL-ITP)</td><td>August 26 (Mon),
09:00 to 11:30</td><td>It will be indicated on the exam admission card which will be sent after you have applied.</td><td>Exam admission card,
Writing tools,
a watch
* You cannot bring a calculator or a watch with a calculator.</td></tr>
<tr><td rowspan="2">Specialized</td><td>Mathematical problems designed to test ability to think logically</td><td>August 26 (Mon),
13:00 to 15:30</td><td>Same as above</td><td>Same as above</td></tr>
<tr><td>Reading comprehension examination</td><td>August 26 (Mon),
16:30 to 18:00</td><td>Same as above</td><td>Same as above</td></tr>
<tr><td colspan="3">Oral examination</td><td>August 27 (Tue)
or August 28 (Wed)</td><td>Noticed beforehand</td><td>Exam admission card
*See Note</td></tr>
</table>

Please visit our website (http://www.n.t.u-tokyo.ac.jp) or pay attention to the information on the notice board of the Department of Nuclear Engineering and Management located on the second floor of the Building No.3 before the examination. Examination dates, times, or locations might be changed.

*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, 2020, should present a summary of a midterm report of your research progress.

2) Applicants who will take the extended oral examination which is counted 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. These documents will be returned later.

You have to submit or send the document (a) and document (b) (only for those who need to do) by mail to arrive no later than ***August 19 (Mon)***, to the office of Department of Nuclear Engineering and Management.

For the presentation, you can use a PC projector. If you do not use the projector, you can also

use another material for your presentation. In that case, please let us know at the department office by ***August 19 (Mon)***

The necessary information such as format will be notified to the applicants by mail in July from the department office, which you have to follow when you prepare the document.

If you have any further questions regarding the above, please contact the office of the Department of Nuclear Engineering and Management.

Secondary examination

Secondary examination is only for those who have passed the primary examination, and it is scheduled for January 2020. The detailed information will be informed to the applicants later.

3-3. Others

(1) September enrollment:
The successful applicants can enroll the Doctoral Program from September 2019, if they can meet the requirements. If you wish to start from September 2019, you have to contact the department office before you apply.

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

(3) Admitting students with full-time jobs:
Full-time employees of educational, academic research institutions or companies can enroll in the Doctoral Program with keeping your current employee's status. Please contact the department office for the details.

(4) 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). For more information, please contact the office of the Department of Nuclear Engineering and Management. 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

(5) Past written examination:

English: Nondisclosure because past TOEFL examinations are not disclosed.

Mathematical problems designed to test ability to think logically: You can find them on the website at http://www.n.t.u-tokyo.ac.jp

Mathematical problems in the regular education subject of the School of Engineering: You can find them website at http://www.t.u-tokyo.ac.jp/soee/admission/general_past.html

Reading comprehension examination: You can come to the department office to get it, or we'll send it to you if you order to nyushijimu@n.t.u-tokyo.ac.jp

A copy of past written examination is included among the documents distributed at the guidance.

(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.

4. Introduction of the faculty 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

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

Dongyue CHEN（ Project Lecturer ）
Ageing Management and Performance of Nuclear Materials

Ageing degradation of nuclear materials is one of the key issues for the safe operation of nuclear power plants. As an important step to achieve reliable and proactive ageing management of nuclear materials, we combine both experimental and modeling measures to study their ageing mechanisms at multiple scales. Our interests focus on the key materials in reactors, for example core structural materials, reactor pressure vessel steels and fuel cladding materials. State-of-the-art techniques, such as in-situ TEM (Transmission Electron Microscopy) and APT (Atom Probe Tomography), are utilized to observe the evolution of irradiation defects. First-principal modeling is preformed for the comparison with experimental results, and the algorithms for the quantitative analysis of experimental data are also investigated.
[Ageing management, Nuclear materials, Irradiation defects]

Kazuyuki DEMACHI（ Associate Professor ）
Abnormal sign detection for nuclear security, maintenance, radiation therapy

We are researching and developing technologies for "prediction detection of abnormalities" by applying Deep Learning for nuclear security and maintenance of nuclear power plants and medical imaging.
1) Technology to detect malicious or dangerous behaviors leading to sabotage, accident or injury by analyzing surveillance camera image in real-time.
2) Technology to detect the failure of dynamic equipment such as pumps and turbines before abnormalities appear prominently on the monitoring signal.
3) Technology to predict the sudden motion of tumor, in order to prevent normal tissues from unexpected exposure by sudden outing from irradiation range.
[Deep learning, anomaly sign detection, nuclear security, nuclear maintenance, medical imaging]

NEJDET ERKAN（ Project Associate Professor ）
Experimental and Numerical Nuclear Thermal-Hydraulics for Nuclear Safety and Severe Accidents

Experimental methods and the instruments have reached to very advanced levels recently. In parallel, the computational methods gained tremendous capacity and have become capable of simulating more complicated systems than before by employing sophisticated modeling techniques that are widely employed for the nuclear reactor technologies. For a robust modeling, validation of the digital world against high-quality experimental data (diverse, multi-dimensional, high-resolution, and accurate) is extremely needed. To enhance the nuclear safety and the understanding of the nuclear accidents, we perform experiments and numerical simulations related to nuclear thermal-hydraulics. We use and develop advanced visualization and measurement techniques for fluid flow and heat flow (PIV, PIV/TSP, Shadowgraphy etc.) diagnostics to acquire high-quality data. The computational tools such as OpenFOAM (Open-source computational fluid dynamics tool) and RELAP/SCDAP and their models validated with experiments to enhance our understandings of the thermal-hydraulics mechanisms prevalent in the nuclear power plant systems. Why don't you challenge the computational and real worlds with state-of-art techniques?
[Nuclear Thermal-Hydraulics, Nuclear Safety, Severe Accident, Particle Image Velocimetry (PIV), OpenFOAM]

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)
Applied Laser engineering for controlling atomic systems

We are interested in developing a novel advanced system utilizing single atom control technologies, which are based on atomic, molecular and optical physics. Atoms efficiently absorb photons with energies corresponding to electronic transitions. Difference of the number of neutrons changes the energies of the transitions, which is called isotope shifts. Laser isotope separation is one of the examples making use of such technologies. Photon has also momentum, which can control motion of atoms. Recent progress of the technique, laser cooling, visualizes single atoms. Laser cooling leads atomic ions forming Coulomb crystal of ions. These laser techniques can expand the possibilities of handling nucleus of atoms and molecules. Combinations of Lasers and Isotopes are applicable to not only nuclear engineering, but also medicine, tracer technique, forensic science, and more. We also construct experimental apparatus by ourselves. Let us enjoy Lab life with us!

[Laser spectroscopy, Laser analysis, Laser cooling, Isotope separation, Isotope analysis, Nuclear fuel cycle, Isotope engineering, Atomic, molecular and optical science]

Kenichi ISHIKAWA (Professor)
Laser-matter interaction from the first principles

Electrons bond atoms in molecules and trigger chemical reactions. Electrons transmit information in electronic devices and living organisms. Electrons transform light into chemical energy in photosynthesis. We study the interaction between lasers and electrons in atoms, molecules, and solids using ab-initio simulations based on quantum mechanics. We are interested in the many-electron dynamics triggered by a laser pulse and the nuclear dynamics induced by the electron dynamics. These are relevant with biological effects of radiation, control of chemical reactions, and advanced laser material processing. We actively collaborate with Vienna University of Technology, LMU Munich, FERMI free-electron laser, Imperial College London, Hungarian Academy of Science, and RIKEN.
[Laser, Photon science, Strong-field physics, Attosecond science, Ab initio simulations, Laser material processing]

Naoto KASAHARA（ Professor ）
Design by analysis for energy plants

Energy plants are complex systems related with thermal-fluid-structural mechanics. Understanding of essential mechanism of multi-physics phenomena will lead to development of systematic models on thermal load - structural response - material strength in plants. These enable superior design which can satisfy both plant safety and economics.
Most of them are joint research programs with external companies. They will give you educational chance to learn academic research organization and project management.
Through concrete research on structural design of fast breeder reactors, students can learn rational and general methodologies applicable to other fields.
[Structural analysis, High temperature strength, Reliability analysis, Nuclear structural engineering, Fast breeder reactor]

Ryoichi KOMIYAMA（ Associate 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

Accelerator Mass Spectrometry (AMS) can analyze extremely rare long-lived radio isotopes such as

^{10}Be(half life = 1.36x10^{6} yr), ^{14}C(5,730 yr), ^{26}Al(7.2x10^{5} yr), ^{36}Cl(3.01x10^{5} yr), ^{129}I(1.57x10^{7} yr). These rare isotopes form special isotope systems with their stable isotopes which have precise information about earth environment system. Most famous isotope system is the ^{14}C/^{12}C system well known to be used for dating. Our laboratory has a 5MV tandem accelerator and developed multi-nuclide AMS system of which the performance retains world's top level. While we are applying AMS to various interdisciplinary research fields from archaeological to earth environmental sciences, recently we especially focus on the ^{129}I/^{127}I system. As iodine has a close relation with organic matter and is often found with important carbon reservoir such as methane hydrates and soils, we consider ^{129}I/^{127}I system is an important clue to elucidate the total carbon dynamics.
[Ion beam, AMS, Isotope geochemistry, Radioisotope environment assessment]

Masashi OHNO（ Associate Professor ）
Innovative analysis of nuclear material using superconducting radiation sensors

Our academic objective is to realize a new innovative high-energy-resolution spectroscopy for nuclear structure investigations, radioactive or non-radioactive nuclide identifications, material analyses, and radiotherapy. For example, non-destructive analysis of nuclear materials for safeguards and nuclear forensic requires to improve accuracy and sensitivity. The precision spectroscopy of hard X-ray and gamma ray from the nuclear materials is powerful tool for the identification of the plutonium, uranium, actinide and their decay products. However it needs to resolve their X-ray or gamma ray peaks in the complex spectrum of around 100keV region, which cannot be resolved by the conventional detectors. Therefore, we have developed the superconducting radiation sensor with the ultra-high energy resolution. Now our research group has already obtained the world top energy resolution in high-energy gamma-ray region and also, tried to measure gamma-rays from fission products with this superconducting detector.
[Superconductivity, Nanotechnology, Gamma-ray spectroscopy, Charge particle therapy]

Koji OKAMOTO（ Professor ）
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（ Associate Professor ）
Chemistry for nuclear waste disposal and environmental behaviors of radionuclides

It is the duty of our generation to settle the issue of nuclear waste disposal. Geological disposal is the only feasible option for high-level wastes or spent fuels, where various basic research and R&D are still needed. Chemistry of radionuclides is a key foundation to realize a well-accepted disposal project. Thus, we are pursuing understanding and modeling of the chemistry that governs the migration of relevant radionuclides in subsurface environments, which is often called “natural barrier”, using sophisticated spectroscopy, chromatographic techniques, and computer simulation. 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 has an interest in the issue of nuclear waste disposal are welcomed, no matter what academic backgrounds they have.
[Nuclear waste disposal, Geochemistry, Environmental chemistry, Actinide chemistry]

Mikio SAKAI（ Associate Professor ）
Advanced modeling for granular and multi-phase flows

My group develops world-leading multiphysics models for computational granular dynamics, namely, innovative models for solid-fluid and solid particle-elastic body interaction problems. We encounter these problems in various fields including nuclear engineering, chemical engineering, etc. Numerical studies on the problems are challenging since these were hardly simulated because of the complicated phenomena and excessive calculation cost. In nuclear engineering, we perform a simulation of nuclear vitrification process and core relocation in severe accident. In chemical and mechanical engineering, new industrial application models are developed to simulate a complex multi-phase flow. Thus, our research topics become wide ranging. At present, we develop new models to perform the simulations by using Lagrangian-Lagrangian or Eulerian-Lagrangian approaches. Our original technologies become important in engineering and science.
[Computational granular dynamics, Discrete element method, Multiphysics modeling]

Takeshi SATO（ Associate Professor ）
Multielectron dynamics in intense laser fields

High field physics and attosecond science are rapidly progressing, in which dynamics of electrons in matters are directly measured and even controlled, using ultra-short high-intensity laser pulses. We are developing state-of-the-art theoretical and computational methods to solve time-dependent Schrödinger equation of multielectron systems interacting with intense laser fields, aiming at *ab initio* study of nonlinearly nonperturbative phenomena such as tunneling ionization, high harmonic generation, and nonsequential multiple ionization.
[High field physics, Attosecond science, Wave function theory, Density functional theory, Quantum chemistry]

Naoto SEKIMURA（ Professor ）
Safety and resilience of complex systems, Nuclear materials engineering, Codes and standards for nuclear safety, Ageing management of light water reactors, Maintenance engineering of complex systems, Multi-scale simulation of radiation damage in nuclear materials, Systems engineering for nuclear fuels, Knowledge-base for international nuclear community

Safety of nuclear power plant systems has become most important topic of research both from hardware integrity and management of complex systems. Multi-scale simulation and experimental

studies on microscopic and macroscopic behaviors of nuclear materials under very severe conditions including energetic neutron irradiation are also the major research topics. I have been leading national projects for ageing management of nuclear reactors components and materials with other universities, national laboratories and industries. Our group is also working on international projects on safe long term operation of nuclear systems and seismic safety through intensive collaboration with IAEA and OECD/NEA.
[Safety and knowledge management for nuclear systems, Multiscale modeling of materials]

Kenji SHIMAZOE（ Project Lecturer ）
Novel quantum imaging and application to environmental, nuclear and medical science

State-of-the-art technology of quantum detection and quantum imaging are strongly required in the field of environmental, space, nuclear and medical science. In nuclear medicine, PET (Positron Emission Tomography) is now widely used to detect early-stage cancer, which utilizes two gamma quanta emitted after positron-electron interaction. In our laboratory, the novel quantum detection method and application to medical and environmental science are investigated based on physics of interactions between quanta and materials. Novel biological/medical imaging method is one of our research topics based on sophisticated quantum imaging technology. Collaborative researches with university hospital, NIRS, KEK, AIST, UCB, TUM etc. are ongoing.
[Quantum Detection, Radiation Detection and Measurement, Medical Imaging, Quantum Imaging, Molecular Imaging]

Shunichi SUZUKI（ Project Professor ）
Decommissioning of Fukushima Dai-ichi NPP and project management

In order to complete the decommissioning of Fukushima Dai-ichi NPP, we need to challenge and overcome the difficulties which no one has ever experienced. The key technology for decommissioning of the accident plants is how to solve the unsteady state problems caused by remarkable changes of environment, circumstances and the states of the plant condition with the lapse of time.
Main theme of this course is finding the tasks and their solutions for decommissioning through evaluation of phenomena which may occur in the future and also though making the scenario with experiments such as material and thermal-hydraulic tests.
This course will not only deepen your skill & knowledge on decommissioning, but also give you an opportunity to understand the importance of the project management and the way of System Thinking for a complex world which you will face in the future.
[Decommissioning, System dynamics, Risk assessment, Resilience engineering]

Hiroyuki TAKAHASHI（ Professor ）
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 （ Project 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]

Takayuki TERAI （ Professor ）
Materials science and elemental technology for advanced energy and environment systems

Note: No new student will be accepted.

We study material science and chemical engineering for advanced energy systems including the next-generation fission reactor, fusion reactor and nuclear fuel reprocessing systems. Elemental technology for hydrogen energy system including fuel cell, hydrogen storage, etc. are also investigated. In addition, material processing with high-energy particles such as neutrons, ions, electrons and plasma particles for advanced material preparation and property modification are our research targets.
[Reactor materials, Hydrogen energy, High-energy particles]

Mitsuru UESAKA （ Professor ）
Development and application of advanced and compact accelerators/lasers for Nuclear Engineering and Medical Physics

We are developing advanced and compact accelerators/lasers such as S-band photocathode RF electron gun and linear accelerator (linac), portable 950 keV/3.95 MeV X-band (9.3GHz) linac X-ray source for on-site inspection of social and industrial infrastructures, 3.95 MeV linac-based neutron source for water inspection in bridge and on-site Fukushima nuclear fuel debris analysis. 35 MeV linac gamma-ray source for medical radioisotope production are under design. We have developed 6 MeV X-band linac for dynamic tracking X-ray pinpoint cancer therapy, and fiber laser accelerators for dynamic observation of radiation-induced DNA damage/repair process is under development. Further, we are performing research on advanced and precise radiation treatment planning. RI (Radio Isotope) imaging, R&D based medical physics are performed. Students can join the International collaboration with IAEA (International Atomic Energy Agency) on research and education.
[Compact accelerator and laser, RI (Radio Isotope) imaging, R&D based medical physics, Industrial/societal infrastructure on-site inspection, On-site Fukushima Nuclear Fuel Debris Analysis]

Akira YAMAGUCHI （ Professor ）

Trans-science and nuclear risk

Science and technology (S&T) give us a promising future and the society and public receive the full benefit of the S&T; presently, we have found they are things of the past. The true value of S&T is appreciated only by the way of how they interrelate to the society. Context of S&T includes notions of uncertainty, imagination and unknowns.
It is required for contemporary S&T to go into how they are accepted by the society and how they can serve for society. Our research topics are: 1) to simulate the S&T (to know phenomena); 2) to clarify the positive and negative features (to assess risks); 3) to establish reasonable and logical criteria for utilizing the S&T for public welfare (to make good decisions). Underlying baselines are academic field that deals with lack of knowledge and unknown phenomena (i.e., uncertainty).
Thermal-hydraulic simulations, for example, tell us what would actually happen. Statistical science provides us of a methodology for decision-making under uncertain situations if enough information is appropriately obtained. Risk assessment works as a bridge of the simulation and the decision-making, and is a tool to understand the core of the system safety. Risk assessment and related issues are promising research field and exactly where researchers and engineers are really needed.
[Risk assessment, Simulation, Decision-making problem, Nuclear safety]

Shinichi YAMASHITA (Associate Professor)
What are induced by ionizing radiations? Utilization of advantages and overcome of disadvantages.

Many problems in nuclear engineering cannot be treated without considering ionizing radiations. On the other hand, ionizing radiations are utilized as efficient tools in practical fields such as cancer treatment in medical field, material processing in industrial field, and so on. It is essential to understand their features to enhance their advantages as well as to minimize their disadvantages. We are interested in physicochemical, chemical, and biochemical events sequentially occurring from pico- to microsecond (one trillionth to one millionth second) induced by ionizing radiations.
We are studying “radiation protection/enhancement caused by tiny additives”, “decomposition of water induced by therapeutic high-energy heavy-ion beams”, “radiation chemistry in gel matrix (polymer gel dosimeter)”, “chemical structure change of seawater constituents (halide ions) by ionizing radiations”, “contribution of boiling to gas evolutions from water under ionizing radiation”, and so on. Especially, phenomena induced by ionizing radiations at interfaces such as water-DNA/ ceramics/water vapor have not been clarified yet. Join us to make breakthroughs in the frontier.
[Radiation effect (physicochemistry, chemistry, and biochemistry), water chemistry in nuclear reactors, cancer therapy, industrial application of radiation, interface]

-This document is a translation from the authoritative Japanese version.-

Notice for Examination
~The 2020 Master's / Doctoral Program Graduate School of Engineering the University of Tokyo~

1. Examination Dates

Examinations will be held over five days, from August 26 (Monday) through 30 (Friday), 2019.
(For details on times and location of the examination subjects, refer to "Guide to Entrance Examination" of the department you are applying to.)

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 bulletin board for School of Engineering and each department at 10:00 a.m. on August 23 (Friday), 2019.
Confirm the specified place for the examination subjects beforehand. In addition, confirm the bulletin board for the department you are applying to.
Applicants registered for the examination of TOEFL ITP must refer to the "Guide for Applicants Taking the Examination of TOEFL ITP" [see the attached paper]. Note that the examination room of TOEFL ITP, Regular education subjects(一般教育科目(一般学術)), and specialized subjects(専門科目(専門学術)) may differ.
(2) Applicants should arrive at the specified place for the examination subjects 15 minutes prior to the scheduled examination time.
For the examination of specialized subjects(専門科目(専門学術)), also refer to notice by the department you are applying to.

3. Items to Bring

(1) Examination admission card
(2) Black pencils (or black mechanical pencils), an eraser, a pencil sharpener (a desktop type is not allowed) and a watch (only with a time measurement function is allowed).
(3) **Use of electronic devices such as cell phones is strictly prohibited throughout the examination, even if you only use it as a watch. Make sure to completely deactivate the alarm setting, turn off the phone power, and put it in your bag before you enter the examination room. Do not take it out in the examination room.**
(4) For the item to bring for the examination of specialized subjects(専門科目(専門学術)), refer to notice by the department you are applying to.

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

(1) Applicants can not leave the examination room after the start of the examination.
(2) The Examination admission card must be kept on your desk at all times during the examination.
(3) For the examination of regular education subjects(一般教育科目(一般学術)), applicants must write his/her examinee number on each answer sheet, not his/her name. Applicants must use one answer sheet for each problem. Applicants can use the reverse side if necessary. At the end of the examination, follow your proctor's instructions and carefully tear off the designated places.
(4) Applicants can not take away the answer sheets and the problem booklets after the examination.

5. The Secondary Examination for Applicants to the Doctoral Program

The secondary examination will be held between late January and mid-February, 2020.
Applicants will be advised of Examination dates and location regarding secondary examinations for the department you are applying to later.

6. Miscellaneous

(1) The Examinee Numbers of successful applicants will be posted on the School of Engineering bulletin board at 4:00 p.m. on September 5 (Thursday), 2019.

The Examinee Numbers of successful applicants will be posted on the web site of the School of Engineering by September 6 (Friday), 2019, as well. It will be next from the post time to the bulletin board mentioned above. (The page will be linked from http://www.t.u-tokyo.ac.jp/soe/index.html).
(2) Successful applicants will be notified of authorization for admission by mail from the day following the announcement of successful applicants. The School will not accept telephone calls, fax, e-mail, and other inquiries regarding the results of the examinations.
(3) After the application process is complete, applicants must report immediately in case of change of current address or contact.
(4) For inquiries, contact: Graduate School Team, Administrative Division, School of Engineering, the University of Tokyo (03-5841-6038,7747)

試験場案内(東京大学本郷キャンパス)
Campus Map for the Examination
(Hongo campus, the University of Tokyo)

地下鉄利用　Subway
・本郷三丁目駅(地下鉄丸の内線) 徒歩20分
Hongo-sanchome Station (Subway Marunouchi Line) 20min.walk
・本郷三丁目駅(地下鉄大江戸線) 徒歩20分
Hongo-sanchome Station (Subway Oedo Line) 20min.walk
・根津駅(地下鉄千代田線) 徒歩15分
Nezu Station (Subway Chiyoda Line) 15min.walk
・東大前駅(地下鉄南北線) 徒歩10分
Todaimae Station (Subway Namboku Line) 10min.walk

その他のアクセスについては次を参照のこと
Refer to the following for other accesses
http://www.u-tokyo.ac.jp/campusmap/map01_02_j.html